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Effect of Dollar Exchange Rate and Gold Price on GRAPE Production in Turkey: an Ardl Bound Testing Approach

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ABSTRACT

This study investigates relationship among grape production and dollar exchange rate and gold price for Turkey over the period 1950-2015. As grape production and dollar exchange rate and gold price variables used in analysis was different order of integration (I(0) and I(1)) it was employed bound test approach. Grape production series is stationary in level. Dollar exchange rate and gold price series are stationary in first difference. It is found negative relationship between the grape production and dollar exchange rate variables. It is found positive relationship between the grape production and gold price rate variables.

KEYWORDS ARDL tests, grape production.

INTRODUCTION

In spite of, in theory, nominal depreciation or appreciation of exchange rate is assumed to change the real exchange rate and thus has a direct effect on the trade balance (Himarios, 1989; Bahmani-Oskooee, 2001). Various studies have made regarding the ARDL Bound test (Vita and Abbott, 2004; Khalil and Dombrecht, 2011; Singh, 2013; Goh and Wong 2014; Davidescu, 2015).

According to FAO data (2013), China ranks first with 11 650 024 tons, Italy is the second with 8 010 364 million tons, and USA (United States of America) is the third with 7 744 997 tons of production in the world. According to FAO data (2013), Turkey ranks 6th with grape production 4 011 409 among the world's countries. In Turkey, grape production amount has reached the highest amount of 4 264 720 tons in 2009. Grape production has amounted to 4 175 356 tons in 2014, and 3 650 000 tons in 2015 (TSI, 2015).

This research target to use the Autoregressive Distributed Lag (ARDL) approach to error correction models (ECM) to determine whether there is existence of relationship among grape production, dollar exchange rate and gold price, in long run and short run in regard of Turkey data.

MARETIAL AND METHOD

All series examined in this research grape production, dollar exchange rate and gold price are collected from the *TUIK Statistics.*

The agricultural data on the amount of grape production and gold price from the period 1950 to 2013 evaluated in the study were supplied from "Statistical Indicators" book published by TSI 2014. The grape production amount (2014 and 2015 years) data are taken from TSI's web site (https://biruni.tuik.gov.tr/bitkiselapp/bitkisel.zul). Dollar exchange rate value and published by the Republic of Turkey Central Bank (TCMB) have been used (TCMB, 2016). The data is annual the time period 1950 to 2015. All variables are expressed in logarithm. In terms of method, the research adopts the developed autoregressive distributed lag (ARDL) framework by Pesaran *et al.* (1996) and Pesaran (1997) to establish the direction of causation between variables.

Briefly, the ARDL approach to cointegration (Pesaran et al., 2001) involves estimating the conditional error correction (ECM) version of the ARDL model for trade balance and its determinants:

$$\log(GP)_t = \alpha_0 + \sum_{i=1}^{p} \phi_i \Delta \log(GP)_{t-i} + \sum_{i=1}^{p} \theta_i \Delta \log(DL)_{t-i} + \sum_{i=1}^{p} \lambda_i \Delta \log(GL)_{t-i}$$

$$+\delta_1 \log(GP)_{t-1} + \delta_2 \log(DL)_{t-1} + \delta_3 \log(GL)_{t-1} + \varepsilon_t \quad (1)$$

where log(GP), log(DL) and, log(GL) are grape production, dollar exchange rate and gold price values in logarithm, respectively, Δ is first-difference operator and *p* is the optimal lag length.

The *F* test is used for testing the existence of long-run relationship. When long-run relationship exist, *F* test indicates which variable should be normalized.

If there is evidence of long-run relationship of the variables, long-run model is estimated in Equation 2.

$$\log(GP)_t = \alpha_1 + \sum_{i=1}^{p} \phi_{1i} \log(GP)_{t-i} + \sum_{i=1}^{p} \beta_{1i} \log(DL)_{t-i} + \sum_{i=1}^{p} \theta_{1i} \log(GL)_{t-i} + \gamma_t \quad (2)$$

The orders of the lags in the ARDL model are selected by either the Akaike Information criterion (AIC) or the Schwarz Bayesian criterion (SBC), before the selected model is estimated by ordinary least squares.

The ARDL specification of the short-run dynamics can be derived by constructing an error correction model (ECM) of the following form:

$$\Delta \log(GP)_t = \alpha_2 + \sum_{i=1}^{p} \phi_{2i} \Delta \log(GP)_{t-i} + \sum_{i=0}^{p} \theta_{2i} \Delta \log(DL)_{t-i} + \sum_{i=0}^{p} \lambda_{2i} \Delta \log(GL)_{t-i} + \psi ECM_{t-1} + v_t \quad (3)$$

where ECM_{t-1} is the error correction term, defined as

$$ECM_t = \log(GP)_t - \alpha_1 - \quad (4)$$

$$\sum_{i=1}^{p} \phi_{1i} \log(GP)_{t-i} - \sum_{i=0}^{p} \beta_{1i} \log(DL)_{t-i} - \sum_{i=0}^{p} \theta_{1i} \log(GL)_{t-i}$$

All coefficients of short-run equation are coefficients relating to the short run dynamics of the model's convergence to equilibrium.

RESULTS

Before the testing of cointegration, it was conducted a test of order of integration for each variable using Augmented Dickey-Fuller (ADF) (Table 1). Although the ARDL frame work does not require pre-testing variables to be done, the unit root test could convince us whether or not the ARDL model should be application. As shown in Table 1 GP series stable level, while the first difference DL and GL series. So GP Series is I (0), DL and GL series I (1).

Table 1: ADF Unit Root Test

Variables	Level	First difference
Grape Production (log(GP))	-4.099 ***	---
Dollar exchange rate log((DL))	-0.058	-5.223 ***
Gold price log((GL))	0.642	-4.862 ***
The level of significance	Critical values	Critical values
1%	-3.544	-3.537
5%	-2.911	-2.908
10%	-2.593	-2.591

The next step is where equation 1 is predicted to determine the long-run relationships among the variables.

In order to specify the optimal lag (p), Log*L*, LR, FPE, AIC, SC, LM, and HQ information criterion values are displayed in Table 2. When Table 2 is examined, it is seen that the model with the lag number "4" according to FPE and AIC values should be selected. Lag length was suggested by Narayan (2004). For the observations are annual, it is choosed 4 as the maximum order of lags in the ARDL and estimate for the period of 1950-2015.

Table 2. Statistics for selecting the lag order of the equation

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-206.3962	NA	0.215725	6.979872	7.084589	7.020832
1	72.27037	520.1775	2.69e-05	-2.009012	-1.590143*	-1.845170*
2	84.59334	21.77058	2.42e-05	-2.119778	-1.386757	-1.833053
3	95.33156	17.89703*	2.30e-05	-2.177719	-1.130546	-1.768112
4	105.0431	15.21479	2.27e-05*	-2.201438*	-0.840114	-1.668949
5	112.9490	11.59530	2.40e-05	-2.164967	-0.489492	-1.509597
6	118.4319	7.493317	2.77e-05	-2.047731	-0.058104	-1.259173

* indicates lag order selected by the criterion

LR: sequential modified LR test statistic (each test at 5% level), FPE: Final prediction error, AIC: Akaike information criterion, SC: Schwarz information criterion, HQ: Hannan-Quinn information criterion

The equations (2)–(4) are estimated by OLS regression. The results of the short-run coefficients associated with the long-run relationships obtained from the equation (3) are presented in Table 3. The lagged error term (ECT_{t-1}) in results is negative and significant at 1% level. ECM value is estimated to -0.365 which implies that the speed of adjustment to equilibrium after a shock is high. Approximately 36.5% of disequilibria from the previous year's shock converge back to the long-run equilibrium in the current year. In the short run, GP, DL and GL are significant and has an important impact on GP. DL has a negative impact and significant but GL has a positive impact and significant on GP. Durbin-Watson statistics is 1.804 and autocorrelation is no problem (Table 3).

Table 3. Results of equation (3), ARDL (2,4,4) selected based on AIC

Dependent Variable: D(log(GP))				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.002843	0.021753	-0.130705	0.8965
D(log(GP(-1)))	-0.548447	0.143588	-3.819578	0.0004
D(log(GP(-2)))	-0.217198	0.114686	-1.893841	0.0637
D(log(DL(-3)))	-0.115669	0.038724	-2.987004	0.0043
D(log(DL(-4)))	-0.106263	0.044647	-2.380063	0.0209
D(log(GL(-2)))	0.100132	0.040672	2.461958	0.0171
D(log(GL(-4)))	0.100900	0.047318	2.132388	0.0376
ECM(-1)	-0.364953	0.136451	-2.674603	0.0099
R-squared	0.534750			
Durbin-Watson statistics	1.804248			
Sum squared residual	0.320112			
F-statistic	8.702479			0.001

The regression for the estimating ARDL equation (3) fits well and the model is significant. It also passes all the diagnostic tests against Breusch-Godfrey serial correlation LM test and White Heteroskedasticity Test. The results of these tests are given in Table 4.

Table 4. Results of diagnostic tests

	Test statistics	Probability
White Heteroskedasticity test	1.187	0.326
Breusch-Godfrey Serial Correlation LM Test	1.166	0.337

Once the ECM model given by equation (3) has been estimated, the sum of recursive residuals (CUSUM) test is applied to assess the parameter stability. Figure 1 the results for CUSUM tests. The results show the absence of any instability of the coefficients because the graph of the CUSUM statistic fall inside the critical bands of the 5% confidence interval of parameter stability.

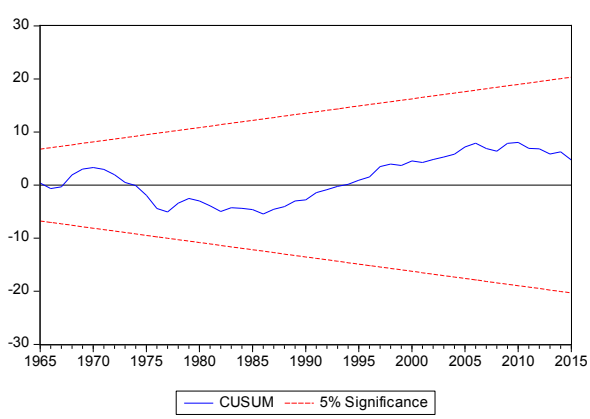

Figure 1. Graph of CUSUM Test

CONCLUSION

The research examines the dynamic causal relationship among the series of grape production, dollar exchange rate and gold price for Turkey for the period of 1950-2015. It implements

ARDL model to cointegration to investigate the existence of a long run relation among the above noted series. The results show that there is cointegration among the variables specified in the model when grape production is the dependent variable. The results obtained in that report using the corresponding vector error correction estimation are broadly confirmed by the estimation of an ARDL (2, 4, 4) model.

Results of the bounds test for co-integration reveal that a long-run equilibrium relationship was confirmed between grape production, dollar exchange rate and gold price in the case of Turkey economy by using the ARDL modeling approach.

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