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FINANCIAL DEVELOPMENT AND TAX REVENUES IN TURKEY: A NON-LINEAR COINTEGRATION ANALYSIS

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Abstract:
In this study, we investigated the interaction between tax revenue and major indicators of financial development including banking sector development and stock market development in Turkey using monthly data during the period January 2006 – January 2016 by employing the asymmetric ARDL cointegration method by Shin, Yu and Greenwood-Nimmo (2014). Our findings suggested that development levels of both stock market and banking sector affected total tax revenues positively when nonlinearities were considered. However, we found that there was no relationship between financial development indicators and tax revenue when nonlinearities were ignored. So, our findings demonstrated that the appropriate modelling method considering the characteristics of the dataset is important to get the right results.

Keywords:
stock market development,
banking sector development,
tax revenue,
non-linear cointegration.

INTRODUCTION

The main income sources of the public sector are the taxes obtained from corporations and individuals and the income of public economic enterprises. But the share of the public sector in the overall economy has decreased in most countries due to privatization in recent years. So tax revenues have become a crucial financial instrument of the governments. Turkey has belatedly followed the same privatization trend in the world and privatized most of the public economic enterprises since 2001. As a result of privatization, tax revenues have also become very important for the government to implement the main public services.

In this regard, predicting tax revenues and determining major determinants of tax revenues have become a very important issue in the economic policy planning and are very critical for the policy-makers to plan the economic policies more effectively. In this regard, most countries have begun to implement various policies in order to reduce the share of the shadow economy and in turn raise their total tax revenues. In this context, improvements in the financial sector have a potential to affect the

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tax collection positively by affecting the economic activity positively (See Shahbaz *et al.*, 2015; Caporale *et al.*, 2015; and Peia and Roszbach, 2015) and decreasing the shadow economy. In this paper, we investigated the impact of improvements in both the banking sector and stock market on tax revenues.

The main objective of the paper was to research the short term and long term interaction between total tax revenues, banking sector and stock market in Turkey based on monthly data during 2006–2016 period employing asymmetric cointegration. The rest of the paper is formed as follows: the next section overviews the limited empirical literature about the relationship between total tax revenue, banking sector development and stock market development, while Section 3 introduces data and econometric method. Section 4 presents the results of the empirical analysis and the paper ends with Section 5.

LITERATURE REVIEW

There have been few empirical studies about the interaction between tax revenues and the financial sector development. The limited number of empirical studies have generally performed the panel data analysis and revealed that financial development affected indirect and direct tax revenues positively (see Ilievski, 2012; Petrescu, 2013; Capasso and Jappelli, 2013; Taha *et al.*, 2013; Bittencourt *et al.*, 2014; Akçay *et al.*, 2016). In one of the early studies, Ilievski (2012) investigated the impact of the banking sector, stock market and financial liberalization on tax revenues in more than 100 countries during 1990-2008 period using the panel data analysis. He found that both the banking sector and stock market had positive impact on tax revenue and the impact of the banking sector development on tax collection was higher relative to the one of the stock market. Moreover, he also found that financial openness had positive impact on tax revenue and the effect of financial openness on tax revenue increased in the countries with higher development level of the banking sector. In another study, Blackburn *et al.* (2012) investigated the interaction between financial development and the shadow economy in the model including banking intermediation and tax evasion and found that the tax evasion level and shadow economy rose, as long as the financial sector development reduced.

On the other hand, Petrescu (2013) examined the influence of the financial sector development on diverse taxes in 72 countries during 1990-2003 period employing panel regression and discovered that financial sector development had a positive impact on the total income tax revenue, but had no significant impact on the sales taxes, property taxes and gift taxes. Capasso and Jappelli (2013) also investigated the interaction between the shadow economy and financial development theoretically and empirically. Their theoretical model showed that financial development decreased the tax evasion level and shadow economy. However, they also conducted an empirical study by using Italian microeconomic data set and found that financial development decreased the size of the shadow economy.

Taha *et al.* (2013) analyzed the interaction between direct tax and financial sector development in Malaysia during 1997–2008 period employing ARDL (autoregressive distributive lag) bounds testing and Granger causality test and found a long run relationship between the financial system development and tax revenue and also a one-way causality between the stock market and direct tax revenue. In another study, Bittencourt *et al.* (2014) examined the interaction between the financial development, tax evasion and inflation theoretically and empirically. Their theoretical model demonstrated that higher level of financial sector development led to lower shadow economy. They also conducted an empirical study by using a data set from 150 countries during 1980-2009 period and their empirical findings supported the predictions made in the theoretical model. Finally, Akçay *et al.* (2016) researched the interaction between tax revenues and financial development in Turkey during 2006-2014 period

applying cointegration tests of Johansen and Juselius (1990), and causality analysis and discovered a unilateral causality between financial development and tax revenues.

DATA, MODEL AND ECONOMETRIC METHODOLOGY

Data

We employed the total tax revenue as the dependent variable in the study, and we used domestic credits to the private sector, stock market capitalization and industrial production as independent variables. Tax revenue is represented by a total of direct taxes and indirect taxes. The domestic credit to the private sector is composed of the credits provided by deposit banks, development and investment banks and participation banks and this variable represents the banking sector development. On the other hand, stock market development is proxied by stock market capitalization. Since the banking sector and stock market are major parts of the financial system, these variables together represent financial development in our study. Finally, industrial production index is preferred as a proxy for the economic activity which has a deep impact on tax revenues. The data summary is presented in Table 1. Monthly data of tax revenue and domestic credit to private sector were acquired from the database of the Central Bank of the Republic of Turkey (CBRT), monthly data of stock market capitalization were obtained from Borsa Istanbul (BIST) and lastly the industrial production index was obtained from the Turkish Statistical Institute.

Variables	Symbol of variables	Source
Tax revenue	TAXREV	CBRT (2015a)
Stock market capitalization	SMC	BIST (2015)
Domestic credit to private sector	PCRD	CBRT (2015b)
Industrial production index (base year: 2010)	IND	CBRT (2015c)

Table 1. Data description

Taxes are paid in February, May, August and November in Turkey (see Law No. 5615). Therefore, a dummy variable was employed to represent the months in question. Under the Turkish Tax Law, all tax statements must be issued on 14th of the mentioned months and be paid on 17th of a particular month. Due to the nature of our dataset, impact of changes in domestic credit to private sector and stock market capitalization on tax revenues occurred during these four months. Any changes in the shareholders' wealth must be reflected in their tax statements and any changes that occur between 14th and 30th day of month are reflected in the next statement. Therefore, a maximum of four months should be a suitable lag for our model. So we used 4 as a max lag for the ECM model in the paper.

Model

Total tax revenue is the sum of direct and indirect taxes. So the total tax revenues (TAXREV) can be represented as follows:

$$TAXREV = Direct\,Taxes + Indirect\,Taxes \quad (1)$$

One of the main determinants of tax revenues is the economic activity. In our model industrial production represents the economic activity. On the other hand, the shadow economy has a significant impact on tax revenues. Higher level of shadow economy means lower tax revenues. In this context, we included the financial development indicators in Table 1 as possible determinants of tax revenues in the model, because they have a potential to affect tax revenues by reducing the shadow economy and also affecting economic activity positively. So our model can be expressed as follows:

$$TAXREV = f\left(SMC, PCRD, IND\right) \tag{2}$$

The asymmetric approach of gains and losses is a common characteristic of income tax systems. Corporations will have tax liabilities if they return profit, but generally they are not paid an equivalent refund when they experience a tax loss (Cooper & Knittel, 2010). While corporations can reduce future tax liabilities on the basis of prior losses, individual tax payers are not allowed to reduce their future tax liabilities based on their personal financial losses. Therefore, any increase in personal income must be reflected on tax statements where a decrease or loss of personal income is not refundable. Consequently, there is an obvious asymmetric behavior in the tax system and modeling without asymmetry would provide misleading estimation results.

Econometric methodology

Balke and Fomby (1997) improved threshold cointegration method that is an asymmetric and nonlinear cointegration. On the other hand, Granger and Yoon (2002) pointed out that there was possibly a hidden cointegration risk when the negative and positive components are cointegrated. Then, Schorderet (2002, 2003) improved the study of Granger and Yoon (2002) by considering a hidden cointegration asymmetric effect.

Despite the well-known fact that macroeconomic variables exhibit nonlinear and asymmetric characteristics, extensive studies only regard the linearity and symmetrics. However, the nonlinearity characteristics of many economic variables have indicated that nonlinearity and asymmetry are frequent features of the social sciences (Shin *et al*., 2014). Moreover, many researchers proposed nonlinear models (see Kahneman and Tversky, 1979; Shiller, 1993, 2005). Therefore, in this paper a non-linear autoregressive distributed lag (NARDL) model is employed to research the asymmetrical relations in the long term. Shin *et al.* (2014) derived the NARDL estimator from ARDL model of Pesaran *et al.* (2001).

The asymmetric ARDL model demonstrates nonlinear long term relationship and nonlinear error correction through partial sum decompositions and asymmetric long term relationship can be expressed as follows:

$$y_t = \beta^+ x_t^+ + \beta^- x_t^- + u_t \tag{3}$$

Where x_t is a k×1 vector of regressors and separated as $\mathbf{x}_t = \mathbf{x}_0 + \mathbf{x}_t^+ + \mathbf{x}_t^-$. and in this formulation $\mathbf{x}^+$ and $\mathbf{x}^-$ are partial sums of positive and negative changes in $\mathbf{x}_t$.

In this paper, we assume that tax revenue has a long term relationship with the variables representing development of the banking sector and stock market, and economic activity:

$$\mathrm{TAXREV}_t = \alpha_0 + \alpha_1 \mathrm{SMC}_t + \alpha_2 \mathrm{PCRD}_t + \alpha_3 \mathrm{IND}_t + \varepsilon_t \tag{4}$$

Error correction model (ECM) is represented as follows:

$$\Delta TAXREV_t = \beta_0 + \sum_{j=1}^{p} \beta_{1j} \Delta TAXREV_{t-j} + \sum_{j=0}^{q} \beta_{2j} \Delta SMC_{t-j} + \sum_{j=0}^{m} \beta_{3j} \Delta PCRD_{t-j} + \sum_{j=0}^{n} \beta_{4j} \Delta IND_{t-j} + \gamma_1 DUM_t + \theta \epsilon_{t-1} + u_t \quad (5)$$

In this formulation, Δ indicates the first differenced values of the variables and ε is an error-correction term that is the OLS residuals from long-term cointegrating regression in Equation (4). Finally, DUM represents a seasonal dummy variable.

We will estimate the linear relationship among the variables by the following ECM considering Shin *et al.* (2014):

$$\Delta TAXREV_t = \psi + \eta_0 TAXREV_{t-1} + \eta_1 SMC_{t-1} + \eta_2 PCRD_{t-1} + \eta_3 IND_{t-1} + \sum_{j=1}^{p} \beta_{1j} \Delta TAXREV_{t-j} + \sum_{j=0}^{q} \beta_{2j} \Delta SMC_{t-j} + \sum_{j=0}^{m} \beta_{3j} \Delta PCRD_{t-j} + \sum_{j=0}^{n} \beta_{4j} \Delta IND_{t-j} + \gamma_1 DUM_t + e_t \quad (6)$$

Here $\psi = \beta_0 - \theta\alpha_0$, $\eta_0 = \theta$, $\eta_1 = -\theta\alpha_1$, $\eta_2 = -\theta\alpha_2$, $\eta_3 = -\theta\alpha_3$. On the other hand η_0 , $-\frac{\eta_1}{\theta}$, $-\frac{\eta_2}{\theta}$, $-\frac{\eta_3}{\theta}$ are co-integrating coefficients of TAXREV, SMC, PCRD and IND variables respectively, while $\beta_1, \beta_2, \beta_3, \beta_4$ are short term coefficients.

We employed the approach suggested by Schorderet (2002, 2003) and Shin *et al.* (2014) to see asymmetric pass-through of PCRD and SMC on tax revenue. SMC and PCRD variables are separated to positive and negative shocks according to the approach. So SMC + and SMC- are partial sums of positive and negative changes in SMC variable. The same is also valid for PCRD variable. They are calculated as follows:

$$SMC_t^+ = \sum_{i=1}^{t} \Delta SMC_i^+ = \sum_{i=1}^{t} \max\left(\Delta SMC_i, 0\right); \quad SMC_t^- = \sum_{i=1}^{t} \Delta SMC_i^- = \sum_{i=1}^{t} \min\left(\Delta SMC_i, 0\right) \quad (7)$$

$$PCRD_t^+ = \sum_{i=1}^{t} \Delta PCRD_i^+ = \sum_{i=1}^{t} \max\left(PCRD_i, 0\right); \quad PCRD_t^- = \sum_{i=1}^{t} \Delta PCRD_i^- = \sum_{i=1}^{t} \min\left(\Delta PCRD_i, 0\right) \quad (8)$$

Equation (4) can be expressed as follows by regarding equations (7) and (8)

$$TAXREV_t = \alpha_0 + \alpha_1^+ SMC_t^+ + \alpha_1^- SMC_t^- + \alpha_2^+ PCRD_t^+ + \alpha_2^- PCRD_t^- + \alpha_3 IND_t + \epsilon_t \quad (9)$$

Also equation (6) can be rewritten as follows by distinguishing long and short run asymmetric relationships:

$$\Delta TAXREV_t = \psi + \eta_0 TAXREV_{t-1} + \eta_1^+ SMC_{t-1}^+ + \eta_1^- SMC_{t-1}^- + \eta_2^+ PCRD_{t-1}^+ + \eta_2^- PCRD_{t-1}^- + \eta_3 IND_{t-1}$$
$$+ \sum_{j=1}^{p} \beta_{1j} \Delta TAXREV_{t-j} + \sum_{j=0}^{q} \left(\beta_{2j}^- \Delta SMC_{t-j}^- + \beta_{2j}^+ \Delta SMC_{t-j}^+ \right) + \sum_{j=0}^{m} \left(\beta_{3j}^- \Delta PCRD_{t-j}^- + \beta_{3j}^+ \Delta PCRD_{t-j}^+ \right) \quad (10)$$
$$+ \sum_{j=0}^{n} \beta_{4j} \Delta IND_{t-j} + \gamma_1 DUM_t + e_t$$

Where $\psi = \beta_0 - \theta\alpha_0$, $\eta_0 = \theta$, $\eta_1^+ = -\theta\alpha_1^+$, $\eta_1^- = -\theta\alpha_1^-$, $\eta_2^+ = -\theta\alpha_2^+$, $\eta_2^- = -\theta\alpha_2^-$, $\eta_3 = -\theta\alpha_3$ and $\psi_1^+ = -\frac{\eta_1^+}{\theta}$, $\psi_1^- = -\frac{\eta_1^-}{\theta}$, $\psi_2^+ = -\frac{\eta_2^+}{\theta}$, $\psi_2^- = -\frac{\eta_2^-}{\theta}$ are positive and negative long term coefficients of SMC and PCRD respectively, while $-\frac{\eta_3}{\theta}$ is a long term cointegrating coefficient of IND.

We can express equation (10) in terms of long asymmetry and short run symmetry or long-run symmetry and short-run asymmetry by employing Shin *et al.* (2014) as follows:

If the asymmetries exist only in the long term:

$$\Delta TAXREV_t = \psi + \eta_0 TAXREV_{t-1} + \eta_1^+ SMC_{t-1}^+ + \eta_1^- SMC_{t-1}^- + \eta_2^+ PCRD_{t-1}^+ + \eta_2^- PCRD_{t-1}^- + \eta_3 IND_{t-1}$$
$$+ \sum_{j=1}^{p} \beta_{1j} \Delta TAXREV_{t-j} + \sum_{j=0}^{q} \beta_{2j} \Delta SMC_{t-j} + \sum_{j=0}^{m} \beta_{3j} \Delta PCRD_{t-j} + \sum_{j=0}^{n} \beta_{4j} \Delta IND_{t-j} + \gamma_1 DUM_t + e_t \quad (11)$$

If the asymmetries exist only in the short term:

$$\Delta TAXREV_t = \psi + \eta_0 TAXREV_{t-1} + \eta_1 SMC_{t-1} + \eta_2 PCRD_{t-1} + \eta_3 IND_{t-1} + \sum_{j=1}^{p} \beta_{1j} \Delta TAXREV_{t-j}$$
$$+ \sum_{j=0}^{q} \left(\beta_{2j}^- \Delta SMC_{t-j}^- + \beta_{2j}^+ \Delta SMC_{t-j}^+ \right) + \sum_{j=0}^{m} \left(\beta_{3j}^- \Delta PCRD_{t-j}^- + \beta_{3j}^+ \Delta PCRD_{t-j}^+ \right) \quad (12)$$
$$+ \sum_{j=0}^{n} \beta_{4j} \Delta IND_{t-j} + \gamma_1 DUM_t + e_t$$

(10), (11) and (12) numbered equations present the cointegrating relationship between tax revenues and negative and positive components of the variables SMC, PCRD and symmetric components of IND.

Shin *et al.* (2014) used a similar bounds test of linear ARDL approach by Pesaran *et al.* (2001) to determine the asymmetric cointegrating relationship. The cointegrating relationship can be tested by t-statistics of Banerjee *et al.* (1998) and F-statistics of Pesaran *et al.* (2001). The null hypothesis can be defined as $\eta_0=0$ against alternative hypothesis $\eta_0<0$ in the use of t-statistics approach. On the other hand null hypothesis can be defined as $\eta_0 = \eta_1 = \eta_2 = \eta_3 = 0$ against alternative hypothesis $\eta_0 \neq 0$ or $\eta_1 \neq 0$ or $\eta_2 \neq 0$ or $\eta_3 \neq 0$ in the use of F statistics approach. If there is a long term asymmetry, null hypothesis would be $\eta_0 = \eta_1^+ = \eta_1^- = \eta_2^- = \eta_2^+ = \eta_3 = 0$. Finally, calculated F values must be compared with the tabulated F values of Pesaran *et al.* (2001).

The presence of a long term symmetry is investigated by the Wald test (H_0: $\alpha_1^+ = \alpha_1^-$ also $\alpha_2^+ = \alpha_2^-$). The null hypothesis of $\sum_{i=0}^{q} \beta_{2i}^+ = \sum_{i=0}^{q} \beta_{2i}^-$ and $\sum_{i=0}^{m} \beta_{3i}^+ = \sum_{i=0}^{m} \beta_{3i}^-$ should be used in tests of short-run asymmetry. The model allows for an asymmetric effect, if the null hypothesis of symmetry is rejected. Asymmetric dynamic multiplier of change of *TAXREV*$^+$ and *TAXREV*$^-$ could be found respectively with rejection of the null hypothesis of symmetry:

$$m_h^+ = \sum_{i=0}^{h} \frac{\partial \text{TAXREV}_{t+i}}{\partial \text{SMC}_t^+}; \quad m_h^- = \sum_{i=0}^{h} \frac{\partial \text{TAXREV}_{t+i}}{\partial \text{SMC}_t^-} \tag{13}$$

$$n_h^+ = \sum_{i=0}^{h} \frac{\partial \text{TAXREV}_{t+i}}{\partial \text{PCRD}_t^+}; \quad n_h^- = \sum_{i=0}^{h} \frac{\partial \text{TAXREV}_{t+i}}{\partial \text{PCRD}_t^-} \tag{14}$$

Note that as h → ∞ then $m_h^+ \to \psi_1^+, m_h^- \to \psi_1^-, n_h^+ \to \psi_2^+, n_h^- \to \psi_2^-$. In this formulation $\psi_1^+, \psi_1^-, \psi_2^+$ and ψ_2^- are the asymmetric cointegrating coefficients. The dynamic multipliers could capture the positive and negative shocks of stock market capitalization and domestic credit on the tax revenues from an initial equilibrium to the new equilibrium (Shin *et al.*, 2014).

EMPIRICAL ANALYSIS

Unit Root Test

All the variables in the ARDL model should be I(0) or I(1) for the use of the cointegration model (Pesaran *et al.*, 2001). Therefore, the stationarity of the variables should be checked before estimating the ARDL model. At the first stage, the stationarity of the variables were analyzed with the Augmented Dickey Fuller (1981) (ADF) and Phillips and Perron (1988) (PP) test and the results were presented in Table 2. We also performed a unit root analysis with the seasonal adjusted data due to the existence of the seasonality. Consequently, we discovered that none of the variables were integrated with I(2) or greater.

Because ADF test and PP tests yielded very conflicting results for IND variable, the stationarity of the variables were also analyzed with the unit root test of Zivot and Andrews (1992) (ZA) considering a structural break. The test revealed a structural break in 2008 and IND variable was I(1). Furthermore, the stationarity of the remaining variables was also analyzed with ZA test and the results obtained were the same as those of PP and ADF tests.

Model Estimation

The data on tax revenue were seasonally adjusted only for the unit root tests. The original data of tax revenues were employed in the ARDL model and a dummy variable was inserted into the model as an exogenous variable in order to avoid possible seasonality in model. Finally, (6), (11), and (12) numbered equations were estimated and the results were given in Table 3. The results in the first column showed that the null hypothesis (there was no cointegration) for symmetric model could not be rejected. This can be derived from the possible nonlinearities among the variables. Therefore, we also made an estimate using nonlinear model in equation (11) and the results were presented in the second column of Table 3. Finally, the estimation results of the model in equation (12) were presented in the third column of Table 3 and verified that there was a long run asymmetric relationship between the variables.

Variable	Model	ADF (1981)		PP (1988)	
		t-Statistic	Prob.	Adj. t-Stat	Prob.
TAXREV	Const.	2.037016	0.999900	-2.665157***	0.083300
ΔTAXREV	Const.	-6.358433*	0.000000	-65.18686*	0.000100
TAXREV	Const.+Trend	-1.417076	0.850300	-11.32008*	0.000000
ΔTAXREV	Const.+Trend	-6.940846*	0.000000	-64.71191*	0.000100
SMC	Const.	-0.783021	0.819800	-0.722744	0.835900
ΔSMC	Const.	-10.4345*	0.000000	-10.44619*	0.000000
SMC	Const.+Trend	-2.850168	0.182900	-2.924555	0.158900
ΔSMC	Const.+Trend	-10.40337*	0.000000	-10.41523*	0.000000
PCRD	Const.	-2.416755	0.139500	-6.603355*	0.000000
ΔPCRD	Const.	-8.752788*	0.000000	-58.7093*	0.000100
PCRD	Const.+Trend	-8.366494*	0.000000	-8.492976*	0.000000
ΔPCRD	Const.+Trend	-8.778447*	0.000000	-61.73798*	0.000100
IND	Const.	-0.539415	0.877800	-3.657225*	0.006100
ΔIND	Const.	-2.121721	0.236700	-44.48591*	0.000100
IND	Const.+Trend	-1.90561	0.644200	-6.805703*	0.000000
ΔIND	Const.+Trend	-2.140849	0.516600	-42.35916*	0.000100

*- stationary at 1% , **-stationary at 5% , ***-stationary at 10%

Table 2. Results of ADF and PP unit root tests

We applied the Wald test for both long-run (W_{LR}) and short-run (W_{SR}) symmetries and determined that there was a long run relation between the variables. We can reject the asymmetric model if the long term symmetry hypothesis (H_{01}: $\alpha_1^+ = \alpha_1^-$ and H_{02}: $\alpha_2^+ = \alpha_2^-$) is accepted. On the other hand, null hypotheses of short-run asymmetry are $\sum_{i=0}^{q} \beta_{2i}^+ = \sum_{i=0}^{q} \beta_{2i}^-$ and $\sum_{i=0}^{m} \beta_{3i}^+ = \sum_{i=0}^{m} \beta_{3i}^-$.

The estimation results of the symmetric model including short and long run asymmetric models were presented in Table 3. Our findings suggest that a cointegrating relationship exists in all models. The estimations of asymmetric model reveal that asymmetry exists only in the long run. Therefore, absence of a long run asymmetry has been rejected and we should accept a long run asymmetry for SMC and PCRD variables. Also, we can say that negative changes of SMC did not have statistically significant effect on tax revenues, while positive changes in the variables had significant positive impact on TAXREV. But IND and positive changes of PCRD had positive long run relationship at 1% significance level, while negative changes of PCRD and positive changes of SMC were significant at 5% significance level. On the other hand, we found that the dummy variable was statistically significant and this finding verified that there was seasonality in our model. The significant ECM means that error correction model works in order to reach long run adjustment.

Finally, the estimated long run coefficients of IND, SMC-, SMC+, PCRD- and PCRD+ are 127483, -0.001, 0.006, 0.053 and 0.073 respectively. In other words, positive changes in domestic credit to private sector (PCRD) had relatively higher positive impact on the tax revenue when compared with

		Symmetric	Short run and long run Asymmetry	Only long run asymmetry
TAXREV(-1)		-0.245534*	-1.452996*	-1.467812*
IND(-1)		37451.60	190398.1*	187121.5*
SMC(-1)		0.008783**		
PCRD(-1)		0.130206*		
SMC-(-1)			-0.002479	-0.001679
SMC+(-1)			0.008250**	0.009495**
PCRD-(-1)			0.083989**	0.077938**
PCRD+(-1)			0.113023*	0.107314*
ΔTAXREV(-1)		-1.017891*	0.129598	0.108266
ΔTAXREV(-2)		-0.980779*		
ΔTAXREV(-3)		-0.816278*		
ΔTAXREV(-4)		-0.745341*		
ΔTAXREV(-5)		-0.626114*		
ΔTAXREV(-6)		-0.546558*		
ΔTAXREV(-7)		-0.554182*		
ΔTAXREV(-8)		-0.600180*		
ΔTAXREV(-9)		-0.759895*		
ΔTAXREV(-10)		-0.951280*		
ΔTAXREV(-11)		-0.938792*		
ΔTAXREV(-12)		-0.317984*		
ΔIND		25637.65	-38961.59	-55312.01**
ΔIND(-1)			-122304.4*	-149861.6*
ΔSMC		0.007255		0.002782
ΔPCRD		0.044361		0.058162**
ΔPCRD (-1)		-0.049629**		
ΔSMC-			0.005896	
ΔSMC+			-0.006631	
ΔPCRD-			0.097192**	
ΔPCRD+			0.022185	
ΔPCRD-(-1)			-0.062313***	
ΔPCRD+(-1)			0.061716	
DUM		1898940**	2986359*	3093224*
INTERSECT		-2730601	-3780531	-1578006
ECM(-1)		-0.232312*	-0.450646*	-0.405402*
F-statistic		10.75275	23.2456	22.36058
95% lower bound		3.23	2.62	2.62
95% upper bound		4.35	3.79	3.79
SMC	W_{LR}		16.30835*	14.69258*
	W_{SR}		0.379469	
PCRD	W_{LR}		9.398457*	8.748549*
	W_{SR}		0.424923	

Table 3. Results of symmetric and asymmetric ARDL tests

their negative changes. Also negative changes in the stock market capitalization (SMC) did not have significant impact on tax revenue, but the positive changes in SMC had positive impact on tax revenue.

Our findings indicated that there was a positive relationship between tax revenues (TAXREV) and stock market capitalization (SMC), domestic credit and private sector (PCRD) in the long term, while there was no statistically significant interaction between tax revenues and industrial production index (IND) in the long run. We can see the difference when the results of symmetrical and asymmetrical models are compared. In this context, SMC and PCRD variables were decomposed in terms of positive and negative shocks to estimate the model asymmetrically and in this case, different results were obtained. The increase in the SMC had positive impact on TAXREV in the long run, but this is not valid for the decrease in the SMC. Furthermore, a decrease in the SMC also had statistically insignificant positive impact on TAXREV in the long run. We found a statistically significant long run PCRD coefficient in both symmetric and asymmetric model. However, decomposition of the variable in terms of increase and decrease enables us to see the detailed results. Thus, the results of asymmetric model suggest that decrease and increase in PCRD variable had the same impact on tax revenues, but the impact of increase in the PCRD on tax revenues was found to be higher when compared to the impact of decrease in the PCRD on tax revenues.

On the other hand, the symmetric model suggests that industrial production did not have significant effect on tax revenue, while the asymmetric model conveyed the exact opposite. In other words, industrial production had significant positive impact on tax revenue. In this case, the results of asymmetric model are consistent with the predictions of the economic theory which suggests that there is a relationship between economic activity and tax revenue. So, the use of traditional cointegration models may be misleading us into establishing wrong relations.

The short run dynamics revealed that the lagged values of the dependent variable in the symmetric model were statistically significant, while the coefficients of the independent variables were found to be insignificant. However, the coefficients of the independent variables were also found to be significant in the short run according to the results of the model which exhibited a long run asymmetry and short run symmetry. Consequently, the use of nonlinear model will be more useful considering short run and long run dynamics.

CONCLUSIONS

We investigated the interaction between banking sector development, stock market development and tax revenues in Turkey during the period January 2006 – January 2016 by using both ARDL and the asymmetric ARDL cointegration. We found that there was no cointegrating relationship between the series in our study, when we conducted only the symmetric ARDL model. Then, we wondered whether possible nonlinearities may be misleading us and conducted the estimation with the models considering nonlinearities developed by Shin *et al*. (2013). In this regard, we simultaneously used symmetric forms of domestic credit to private sector and stock market capitalization in the model and used the dummy variable for the elimination of a possible seasonality. Furthermore, we took the symmetric form of industrial production proxy for economic activity as a control variable. We discovered that there was a cointegrating relationship between the series when NARDL model was employed. The results of the NARDL model estimation showed that negative changes in the variables of domestic credit to private sector and stock market capitalization did not have statistically significant impact on

tax revenue, while positive changes in these variables had statistically positive impact on tax revenue. Also, industrial production variable had positive impact on tax revenue.

This study verifies that the appropriate modelling method considering the characteristics of the dataset is important. We can get misleading results which may not be consistent with the theoretical expectations when the model is estimated symmetrically by a dataset with asymmetric features. In this case, we can get more realistic results with the use of asymmetric modelling which considers the nonlinearity in the economics. In this study, when we employed traditional ARDL model, we found that industrial production representing economic activity had no significant impact on tax revenues. But we saw that industrial production had positive impact on tax revenue when asymmetric modelling was used. So, we concluded that tax revenues had no linear relationship and verified the nonlinearity.

Consequently, both the banking sector development and stock market development had significant positive impact on tax revenue. Therefore, policymakers should consider policies which contribute to the financial sector development.

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FINANSIJSKI RAZVOJ I PORESKI PRIHODI U TURSKOJ: ANALIZA NELINEARNE KOINTEGRACIJE

Rezime:

U ovoj studiji smo ispitivali međusobni uticaj između poreskih prihoda i glavnih pokazatelja finansijskog razvoja, uključujući i razvoj bankarskog sektora, kao i razvoj tržišta akcija u Turskoj na osnovu mesečnih podataka u periodu od januara 2006. do januara 2016. godine uz primenu metoda asimetrične kointegracije „autoregresivno-raspoređenog zaostanka" (ARDL) koji su razvili Šin, Ju i Grinvud-Nimo (2014.). Rezultati koje smo dobili su nagovestili da stepen razvoja i tržišta akcija i bankarskog sektora imaju pozitivan uticaj na ukupne poreske prihode kada se u obzir uzmu nelinearnosti. Međutim, otkrili smo da ne postoji veza između pokazatelja finansijskog razvoja i poreskih prihoda kada se nelinearnosti zanemare. Dakle, rezultati našeg istraživanja potvrđuju da je važna primena odgovarajućeg metoda koji uzima u obzir karakteristike skupa podataka, kako bi se dobili pravi rezultati.

Ključne reči:
razvoj tržišta akcija,
razvoj bankarskog sektora,
poreski prihodi,
nelinearna kointegracija.

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