Tax Revenue and Main Macroeconomic Indicators in Turkey

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Abstract

This study is about the behavior of main macroeconomic indiactors and their interaction with tax revenue with annual data over 1980-2013 in Turkey. The main purpose is to study the causality between tax revenue and a broad list of indicators over the stated period. First we present descriptive statistics and then test for the stationarity of the variables after which we test for the existence and direction of Granger causality between pairs of indicators proven to be stationary. In the last part of the study we search for the permanent long-run relationship via the existense of cointegration among variables after which we establish the error correction mechanism. We have intentionally selected the time span since Turkey has experienced several shocks before being addressed in the list of G-20 and a typical emerging market economy. Besides. the so-called great recession is included in the period and is still prevailing with perplexing attitutes of managing the crisis. Our results document that there is unidirectional causality from total tax revenue to foreign direct investment and external debt stock. In addition we report a cointegrating relation among tax revenue, GDP and external debt stock.

Keywords: *Tax Revenue, Macroeconomic Indicators, Stationarity, ADF, Granger Causality, Cointegration, Error Correction*

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Introduction

The role of government in alleviating the negative effects of the global financial crisis on economies has become more influential. The governments have basically two channels to manipulate their intervention to the economies the more effective of which is the fiscal policy. This situation has directed the fiscal tools of the states to the forefront of economic analysis especially due to the stimulus packages. The main inflow to the government budgets is the tax revenue, direct of indirect. The packages are basically meant to increase government purchases. On the other hand, the tax revenue has to be increased. The effort to challenge the negative impacts of the global financial crisis has to be in addition to the basic duties of the government that can never be induced below national security and justice. There are many other functions to be fulfilled by the governments and the situation is serious in that insufficient fiscal revenue does not help states provide public services adequately and meet the basic needs of the citizens ranging from health, education and security to infrastructure construction. Glomm and Ravikumar (1998) report that when the government reduces the capital income taxes, it will reduce the spending on education and the long-run growth.

The sustainability of increased government budget is the big concern since there seems to be no permanent solution to the problem (Conley and Dupor 2010). Dadayan and Boyd (2009) for instance report shocking declines in tax revenues of the USA and describe historically difficult budgeting conditions. If the same conditions will prevail the country will be confronted to more severe budgeting challenges beyond the official end of the national recession and the challenges will be more acute in case of a sluggish labor market recovery and renewed banking sector stress persistently retard sales and income tax receipts. Indeed, although Blanchard (2006) indicates that government effort to stabilisation is insufficient, the government budget responds to the business cycles closely. As Sobel and Wagner (2003) state en route to the boom the government experience budgetary relief as tax revenues grow. The higher rates together with broader bases generate significant increases in tax revenues. To the contrary, when the economy trapped into recession, the budget deficits once again challenge state officials to find new revenue sources and cut expenditures. The main point is the diagnosis of which point of the cycle we are in. The moral and economic concerns consider the inevitable principles of equity, efficiency, and economic development, but the compulsory aim of balanced budget suppresses almost all goals. One key point in working out the problem of tax rev-

enue raising and help governments balance their budgets is to analyze the basic relations between this revenue and some crucial variables. One key categorize these variables into economic, political and others including sociological, psychological and demographic variables.

There is no well established model to study the impact of taxes and government expenditures on macroeconomic variables (Barro and Redlick 2009). For many economies the indirect taxes, taxes on goods and services, help governments raise revenue substantailly (Ebrill et al 2001). The existing literature on the interaction between tax revenue and macroeconomic variables include studies based on specific countries over time with time series estimation techniques or panel data of country sets over time analysed with panel data estimation techniques. Gordon and Li (2005), for instance, report that in countries with weak financial sectors, tax revenue as a share of GDP is low, the tax base is narrow and optimal tax structure puts more weight on capital taxes. Christina and David (2007) documented that a tax increase by 1% leads to reduced 2% to 3% of GDP in the United States in the study they conducted on the level of taxation on economic growth in the post-World War II period. In another study Holcombe and Lacombe (2004) explore the negative impact of state income taxes on state economic growth.

Beck et al (2004) include variables to represent financial intermediary and economic growth, total factor productivity growth, physical capital accumulation and private saving rates. Levine (1991) establishes an endogeneous growth model and suggests that stock market and tax policy jointly affect economic growth. A couple of studies including Barro, and Sala-I-Martin (1992), Futagami et al (1993), and Karran (1985) claim to prove the relation between tax and economic growth.

In another study, Treisman (1999) considers macroeconomic indicators like GDP/capita and inflation in the analysis of tax revenue to conclude that tax rates reductions and general macroeconomic problems common to transitional economies play an important role in the declining tax revenue. In another study on relationship between tax structure and economic indicators for the OECD countries Gober and Burns (1997) document that total tax revenue is negatively correlated with saving and investment and personal income tax, corporate income tax, sales tax (consumption tax) and other taxes are highly significant. In one of the leading studies Musgrave (1969) investigated the relation between tax reveue and GDP and stated that this relation is law in developing countries. Unfortunately the literature focusing

on total tax revenue and main macroeconomic indicators is short for Turkey. Çulha (2012) makes use of causality analysis to study the direction and the magnitude of the effects of the business cycles on tax revenues in Turkey. Cyclical properties of tax revenues with respect to real GDP have been analyzed to document that tax revenues in Turkey are procyclical and they are affected from business cycles to a great extent. Furthermore, the volatility of tax revenues with respect to the real GDP is higher and there exists correlation between tax revenues and the real GDP. Arıkan and Yalçın (2013) examine the relationship between tax revenues and GDP for Turkey over 2004 to 2012 using quarterly data. The impact of tax components on GDP is investigated with the help of Johansen and Juselius (1990) cointegration and Granger Causality test to prove that the main categories of taxes are cointegrated with GDP but the sub categories are not. Açıkgöz (2012) similarly analyze the tax revenue growth relation with emphasis on capital/GDP and domestic savings/GDP ratios. She uses Granger Causality and impulse response analysis to document that growth Granger causes both ratios. In another study Temiz (2008) focuses on the relation between economic growth and tax revenue with cointegration and error correction analysis. She concludes that the two variables are cointegrated.

Empirical Methodology and Data

Main prominent macroeconomic indicators are included in order to figure out the interaction of total tax revenue with these indicators. Theory on public finance emhasizes the dependence of tax revenue to the GDP crucially, besides according to Okun's Law unemployment and GDP growth are closely related. The growth rate of output over the population growth is proven to decrease unemployment level. Although macroeconomic theory has conditioned the nature of the relationship between such macroeconomic variables the interaction among other variables are not this clearcut.

This section focuses on the data and analytical methodology adopted to analyse the relation between the stated variables. The data set consists of annual observations over 1980 to 2012. The duration of the study includes at least three shocks to the Turkish economy which makes the conclusions of the analysis more interesting. All data but the total tax revenue is downloaded from the official website of the World Bank. The total tax revenue data, as a collection of direct tax and indirect tax revenues, is obtained from General Directorate of Budget and Fiscal Control (BUMKO).

The variables and their abbreviations we used in econometric analysis are listed in Table 1. For the empirical part of the study Eviews software is used.

Table 1: Definitions of variables

Variable	Definition
TRE	Total tax revenue (current US$)
EDS	External debt stocks, total (DOD, current US$) in billions
STD	Short-term debt (% of total reserves)
TRS	Total reserves (includes gold, current US$) in billion
INF	Inflation, consumer prices (annual %)
DCR	Domestic credit provided by banking sector (% of GDP)
EXP	Exports of goods and services (current US$) in billions
IMP	Imports of goods and services (current US$) in billions
TRD	Trade (% of GDP)
GDP	GDP (constant 2005 US$) in billions
RER	Official exchange rate (LCU per US$, period average) x 10^3
M2	Money and quasi money (M2) (current LCU) in billions
POP	Population (Total) in millions
FDI	Foreign direct investment, (BoP, current US$) in millions

Descriptive Statistics

Descriptive statistics of the variables used in the empirical analysis of this study are reported in Table 2. Sample size for each data is 33 and no missing value in the data set. Also each of the variables has meaningful minimum and maximum values which are corresponded with means and standart deviations. The skewness and the kurtosis also have associated standart errors. The values of the skewness and the values of the kurtosis should be zero or very approximated to the zero. Positive values of the skewness indicate a pile-up of variables values on the left of the distribution, which most of the variables, except Trade and Population, are distributed likewise. Negative values of the skewness, as Population and Trade, shows a pile-up of their values on the right of the distribution. Total tax revenue's kurtosis is vey close to zero that likely normal distribution. On the other hand, while Foreign direct investment, Short-term debt, Total reserves, Domestic credit, Exports, Imports, and Money and quasi money (M2) have pointy and heavy tailed distributions, External debt stocks, Inflation, Trade, GDP, Official exchange rate, and Population have a flat

and light tailed distribution.

Table 2: Descriptive Statistics

	N	Minimum	Maximum	Mean	Std.	Skewness	Kurtosis
TRE	33	6,47	155,21	47,7947	47,29235	1,179	0,010
FDI	33	18,00	22047,00	4169,4242	6643,96020	1,719	1,691
EDS	33	19,13	337,49	115,7516	98,22831	1,026	-0,216
STD	33	56,41	236,20	110,4434	49,24743	1,259	0,704
TRS	33	2,32	119,18	28,6674	31,91899	1,305	0,735
INF	33	6,25	110,17	46,8007	30,87100	0,261	-0,909
DCR	33	19,47	71,89	38,8698	14,35992	0,911	0,154
EXP	33	3,55	208,68	60,9272	59,74086	1,141	0,122
IMP	33	8,20	252,94	71,4027	73,47295	1,318	0,588
TRD	33	17,09	58,00	40,7060	10,47852	-0,323	-0,708
GDP	33	162,49	628,43	352,9536	136,69003	0,470	-0,827
RER	33	0,08	1796,00	581,9429	695,50651	0,566	-1,599
M2	33	0,00	784,39	145,1242	230,33918	1,612	1,522
POP	33	43,91	74,00	59,3472	8,99464	-0,057	-1,167

Turkish tax system has undergone many changes over the time until recent years. With the liberalization of Turkey's economy in the 1980s, the Value Added Tax (KDV) and the Fuel Tax were the important alterations of tax system in 1985. Beside this, from time to time according to economic fluctuations also new taxes were implemented on occasion. In this sense, the crisis in 1994, 1999 and 2002 were the important dates that changed the number of taxes in Turkey. Special Communication Tax after the 1999 earthquake, and in 2002 the Special Consumption Tax was enacted. In 2006, a fundamental change had been made at corporate tax system. Corporate tax revenue as a significant portion of direct tax revenues, its tax rate was reduced to 20 percent from 30 percent. All these historical developments in the Turkish tax system, led the country's tax revenues to shift from direct taxes to indirect taxes.

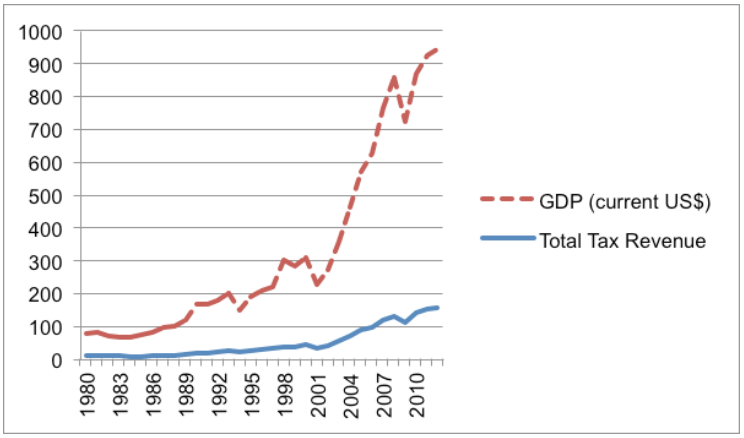

Figure 1: Total Tax Revenue and GDP (Billion US$)

In Figures 1 and 2 we have plotted the Tax Revenue with GDP, Exports and Imports to demonstrate the coordinated behavior of these indicators. Figure 1 illustrates that the Total Tax Revenue is increasing and the escalation is considerable especially after 2001 due to the remarkable performance of the Turkish economy after the 2001 crisis. The decline in 2008 is because of the global financial crisis reflection on the Turkish economy. On the other hand, the ascent in the GDP is striking especially after 2001 with the mentioned boom of the Turkish economy. Furthermore, both Imports and Exports behavior is similar to the Total Tax Revenue where Imports are much larger than exports causing the most persistent and important problems of the Turkish economy, trade deficit and current account deficit.

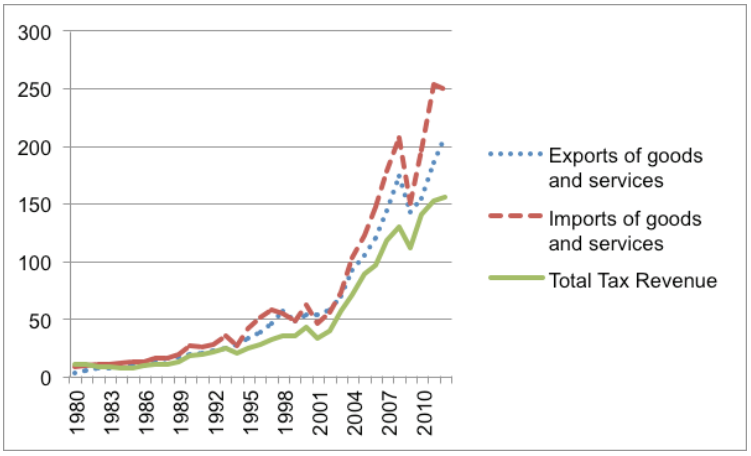

Figure 2: Total Tax Revenue, Exports and Imports (Billion US$)

Correlation Matrix

In order to explore the behavior of main macroeconomic indicators and their interaction with tax revenue with annual data over 1980-2012 in Turkey, first we generated the correlation matrix. The analysis of the correlation matrix indicates that some of the observed relationships were very strong. The total tax revenue is strongly correlated with external debts, total reserves, imports, exports, gdp and money supply. The positive correlation between total tax revenue and the other macroeconomic variables means that as X increases, so does Y. Thus an increase at these explanatory variables increases the tax revenue of the country, and vice versa. In table 3, although not using all of variables indicated above at econometric model we put all the variables in question to the correlation analysis in order to indicate the link direction and the strength of macroeconomic variables associated with total revenue tax.

Table 3: Correlation Matrix

	TRE	FDI	EDS	STD	TRS	INF	DCR	EXP	IMP	TRD	GDP	RER	M2	POP
TRE	1,00													
FDI	0,87	1,00												
EDS	0,99	0,84	1,00											
STD	-0,46	-0,43	-0,47	1,00										
TRS	0,99	0,84	0,99	-0,48	1,00									
INF	-0,70	-0,66	-0,67	0,30	-0,69	1,00								
DCR	0,87	0,67	0,87	-0,46	0,88	-0,71	1,00							
EXP	0,99	0,86	0,99	-0,47	0,99	-0,68	0,86	1,00						
IMP	0,99	0,87	0,98	-0,44	0,98	-0,68	0,85	0,99	1,00					
TRD	0,74	0,60	0,78	-0,41	0,75	-0,40	0,68	0,78	0,75	1,00				
GDP	0,95	0,81	0,97	-0,45	0,95	-0,60	0,80	0,97	0,95	0,87	1,00			
RER	0,87	0,72	0,90	-0,58	0,88	-0,72	0,87	0,88	0,85	0,77	0,89	1,00		
M2	0,97	0,80	0,96	-0,42	0,97	-0,71	0,91	0,96	0,97	0,67	0,89	0,85	1,00	
POP	0,88	0,72	0,92	-0,45	0,88	-0,53	0,75	0,90	0,87	0,90	0,98	0,89	0,81	1,00

Unit Root Tests

Since the data we handle is time series, we start with the stationarity of all series under focus. We report the results of the Augmented Dickey Fuller Test (Dickey and Fuller, 1981) with the only exogenous ''constant'' term in Table 4. This test is essential for all series since the dependent relations maybe spurious in case one works with

non-stationary series. According to the findings Total Tax Revenue is not stationary at levels but the stationarity is attained in the first differences as well as External Debt Stocks, Short-term Debt, Inflation, Domestic Credit, Trade, GDP and Official Exchange Rate. Stationarity is achieved in the second difference for Population where the original series of Foreign Direct Investment is proven to be stationary.

Table 4: Augmented Dickey Fuller Unit Root Test Results

Variable	t-statistics	Prob.	Critical value %1	Critical value %5	Critical value %10	Lag length
TRE	1.831859	0.9995	-3.752946	-2.998064	-2.638752	9
D(TRE)	-5.329353	0.0001	-3.661661	-2.960411	-2.619160	0
FDI	-6.932282	0.0000	-3.699871	-2.976263	-2.627420	5
EDS	3.163916	1.0000	-3.653730	-2.957110	-2.617434	0
D(EDS)	-3.590291	0.0119	-3.661661	-2.960411	-2.619160	0
STD	-2.151409	0.2271	-3.653730	-2.957110	-2.617434	0
D(STD)	-5.262915	0.0002	-3.689194	-2.971853	-2.625121	3
TRS	8.550354	1.0000	-3.711457	-2.981038	-2.629906	6
D(TRS)	4.155960	1.0000	-3.769597	-3.004861	-2.642242	9
INF	-2.206962	0.2078	-3.653730	-2.957110	-2.617434	0
D(INF)	-7.646557	0.0000	-3.661661	-2.960411	-2.619160	0
DCR	0.319616	0.9757	-3.653730	-2.957110	-2.617434	0
D(DCR)	-5.311907	0.0001	-3.661661	-2.960411	-2.619160	0
EXP	4.974399	1.0000	-3.752946	-2.998064	-2.638752	9
D(EXP)	6.210297	1.0000	-3.769597	-3.004861	-2.642242	9
IMP	1.804316	0.9995	-3.737853	-2.991878	-2.635542	8
D(IMP)	1.870546	0.9996	-3.737853	-2.991878	-2.635542	7
TRD	-1.834861	0.3576	-3.653730	-2.957110	-2.617434	0
D(TRD)	-5.245052	0.0002	-3.661661	-2.960411	-2.619160	0
GDP	1.217664	0.9976	-3.653730	-2.957110	-2.617434	0
D(GDP)	-5.223511	0.0002	-3.661661	-2.960411	-2.619160	0
RER	-0.161790	0.9334	-3.661661	-2.960411	-2.619160	1
D(RER)	-3.378602	0.0196	-3.661661	-2.960411	-2.619160	0
M2	11.14710	1.0000	-3.653730	-2.957110	-2.617434	0
D(M2)	1.373901	0.9984	-3.679322	-2.967767	-2.622989	0
POP	-0.360500	0.9026	-3.699871	-2.976263	-2.627420	5
D(POP)	-2.163333	0.2233	-3.699871	-2.976263	-2.627420	4
D(POP2)	-2.799687	0.0703	-3.670170	-2.963972	-2.621007	0

Granger Causality Test Results

One important concern about the tax revenue and macroeconomic indicators is the causality relationship. We follow the standard procedure of time series analysis and employ the Granger Test. The test simply lags the first variable as specified (here we have set the lag length to 3 for all cases) and regressed this variable over the other. Granger Causality is proved to be existing if at least one coefficient is proved to be else than 0. The precondition of the Granger Causality Test is the stationarity of both variables. We make use of the test results presented in Table 4 and input Eviews 4.1 the stationary series of macro indicators. There are 29 observations in each trial since we lag for 3 periods and we take the first difference to attain stationarity. We present the test results in Table 5.

Conclusions reveal that TRE and GDP are not Granger Causing each other. There is a similar case for the causality relation between TRE and DCR, STD, INF, TRD and POP where stationarity in POP is attained in the second differencing. On the other hand, there is bidirectional causality between TRE, RER and M2. Coming to the unidirectional Granger Causality, TRE Granger causes FDI and EDS, where the opposite direction of causality is rejected significantly.

Table 5: Granger Causality Test Results

Null Hypothesis:	F-Statistic	Probability
D(GDP) does not Granger Cause D(TRE)	0.97887	0.42066
D(TRE) does not Granger Cause D(GDP)	1.47119	0.24975
FDI does not Granger Cause D(TRE)	0.14196	0.93372
D(TRE) does not Granger Cause FDI	15.6696	1.1E-05
D(DCR) does not Granger Cause D(TRE)	1.29376	0.30144
D(TRE) does not Granger Cause D(DCR)	1.18539	0.33815
D(EDS) does not Granger Cause D(TRE)	0.77108	0.52252
D(TRE) does not Granger Cause D(EDS)	6.66612	0.00227
D(STD) does not Granger Cause D(TRE)	0.55567	0.64979
D(TRE) does not Granger Cause D(STD)	0.27944	0.83963
D(INF) does not Granger Cause D(TRE)	0.45966	0.71325
D(TRE) does not Granger Cause D(INF)	0.05557	0.98231
D(TRD) does not Granger Cause D(TRE)	0.51376	0.67703
D(TRE) does not Granger Cause D(TRD)	1.34156	0.28653
D(RER) does not Granger Cause D(TRE)	3.00479	0.05220
D(TRE) does not Granger Cause D(RER)	4.28409	0.01590
D(M2) does not Granger Cause D(TRE)	4.01002	0.02032
D(TRE) does not Granger Cause D(M2)	3.94668	0.02152
D(D(POP)) does not Granger Cause D(TRE)	1.44619	0.25776
D(TRE) does not Granger Cause D(D(POP))	0.53745	0.66177

Cointegration test results

In the last part of our study we search for a cointegration relation among variables to search for a permanent common behavior in the long-run. After trying for many different combinations we proved the existence of such a cointegration with the stated values of the variables in Table 6. According to both Trace and Max_Eigenvalue tests the null hypothesis of ''No cointegrating equation'' is rejected and ''At most 1 cointegrating equation'' is not. These test results indicate the cointegration between tax revenue, GDP, and External Debt Stock.

Table 6: Cointegration Test Results

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	5 Percent Critical Value	1 Percent Critical Value	Max-Eigen Statistic	5 Percent Critical Value	1 Percent Critical Value
None **	0.688417	46.97246	29.68	35.65	36.14879	20.97	25.52
At most 1	0.273794	10.82366	15.41	20.04	9.917575	14.07	18.63
At most 2	0.028806	0.906086	3.76	6.65	0.906086	3.76	6.65

*(**) denotes rejection of the hypothesis at the 5%(1%) level

Trace test and Max-eigenvalue test indicates 1 cointegrating equation(s) at both 5% and 1% levels

Unrestricted Cointegrating Coefficients (normalized by b'*S11*b=I):

TRE	**GDP**	**EDS**
-0.001771	-0.000277	0.001149
0.000963	-8.40E-05	-0.000442
0.000419	-0.000238	0.000193

Unrestricted Adjustment Coefficients (alpha):

D(TRE)	-38.13740	-429.9472	53.95612
D(GDP)	-84.37390	-570.9792	208.6291
D(EDS)	-696.2613	-372.9422	65.85755

Cointegrating Equation(s): Log likelihood -736.4092

Normalized cointegrating coeff. (std.err. in parentheses)

TRE	GDP	EDS
1.000000	0.156636	-0.648480
	(0.02558)	(0.03472)

Adjustment coefficients (std.err. in parentheses)

D(TRE)	0.067548
	(0.30616)
D(GDP)	0.149440
	(0.57129)
D(EDS)	1.233196
	(0.32547)

Cointegrating Equation(s): Log likelihood -731.4504

Normalized cointegrating coeff. (std.err. in parentheses)

TRE	GDP	EDS
1.000000	0.000000	-0.526766
		(0.02892)
0.000000	1.000000	-0.777049
		(0.18779)

Adjustment coefficients (std.err. in parentheses)

D(TRE)	-0.346662	0.046702
	(0.30425)	(0.04374)
D(GDP)	-0.400639	0.071378
	(0.60988)	(0.08768)
D(EDS)	0.873905	0.224496
	(0.33989)	(0.04887)

Table 7: Error Correction Results

Cointegrating Eq:	CointEq1		
TRE(-1)	1.000000		
GDP(-1)	0.207467		
	(0.05996)		
	[3.46029]		
EDS(-1)	-0.638083		
	(0.08388)		
	[-7.60676]		
C	-4736.625		
Error Correction:	**D(TRE)**	**D(GDP)**	**D(EDS)**
CointEq1	0.558231	0.943911	1.022338
	(0.28640)	(0.54112)	(0.28476)
	[1.94916]	[1.74438]	[3.59022]
D(TRE(-1))	-0.538052	0.516820	-0.988164
	(0.52124)	(0.98483)	(0.51826)
	[-1.03226]	[0.52478]	[-1.90671]
D(TRE(-2))	-0.211986	-0.215739	-0.185380
	(0.59933)	(1.13238)	(0.59590)
	[-0.35370]	[-0.19052]	[-0.31109]
D(GDP(-1))	-0.098644	-0.418980	-0.159502
	(0.24005)	(0.45356)	(0.23868)
	[-0.41092]	[-0.92376]	[-0.66827]
D(GDP(-2))	-0.067483	-0.161254	0.211939
	(0.17671)	(0.33388)	(0.17570)
	[-0.38188]	[-0.48296]	[1.20623]
D(EDS(-1))	0.116411	-0.706362	0.452657
	(0.25781)	(0.48710)	(0.25633)
	[0.45154]	[-1.45014]	[1.76591]
D(EDS(-2))	-0.107696	-0.319854	-0.418908
	(0.36313)	(0.68610)	(0.36105)
	[-0.29658]	[-0.46619]	[-1.16025]
C	1061.330	3167.100	1514.547
	(462.677)	(874.182)	(460.029)
	[2.29389]	[3.62293]	[3.29229]
R-squared	0.165232	0.270225	0.594131
Adj. R-squared	-0.100376	0.038023	0.464991
Sum sq. resids	19839302	70823002	19612870
S.E. equation	949.6244	1794.221	944.1896
F-statistic	0.622089	1.163751	4.600665
Log likelihood	-243.5978	-262.6856	-243.4256
Akaike AIC	16.77319	18.04571	16.76171
Schwarz SC	17.14684	18.41936	17.13536
Mean dependent	490.6000	1506.600	1059.233
S.D. dependent	905.2765	1829.336	1290.858
Determinant Residual Covariance		2.02E+17	
Log Likelihood		-711.4169	
Log Likelihood (d.f. adjusted)		-725.3739	
Akaike Information Criteria		50.15826	
Schwarz Criteria		51.41934	

Standard errors in ( ) & t-statistics in [ ]

Error correction results

We establish the Vector Error Correction Mechanism to reveal the time it takes to attain the long-run relation after as shoch is received in the economy. The estimation results are listed in Table 7.

Concluding Remarks

We have utilized the necessary tools of time series analysis to figure out the nature of prevailing relation among total tax revenue and main macroeconomic indicators in Turkey with emphasis on the Granger causality over 1980-2012 covering the period of serious shocks to the Turkish economy.

First of all, we have computed the correlation matrix of all variables included in the study over the specified period. Our investigations have demonstrated that TRE is highly correlated GDP which is very reasonable since the majority of the tax is returned from income. Similarly, tax revenue is highly correlated with foreign direct investment, total reserves, domestic credit provided by banks, exports, imports, real exchange rate, M2 and population.

Secondly, the stationarity results executed with the Augmented Dickey-Fuller test have concluded in the rejection of the unit root at levels only for the foreign direct investment. The majority of the variables, including GDP, tax revenue, external debt stock, and trade have achieved stationarity after the first differencing. The most difficult variable to achieve stationarity is the POP for which we had to take the difference twice.

Regarding the Granger causality of total tax revenue with other macroeconomic variables, no such relation is proven for GDP, domestic credits, short term debt, inflation, trade and population whereas there is bidirectional causality for with tax revenue-real exchange rate, and tax revenue-M2 pairs. In addition, unidirectional causality from tax revenue to foreign direct investment and external debt stock.

Finally, the cointegrating relation is approved among total tax revenue, GDP and external debt stock. This finding is in line with the pertinent theory governing public finance. The error correction mechanism established is used to work out the duration of recovery in case a shock is applied to the economy.

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