THE IMPACT OF PERSONAL INCOME TAX PROGRESIVITY ON SEVERAL MACROECONOMIC INDICATORS AT EU27 LEVEL FOR 2000 - 2022 PERIOD

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Abstract:

In the context of recent macroeconomic developments and the increasing need for financial support from the state, at the level of the European Union countries, it arise the question of a revision or even reform of public policies. Therefore, using panel data at the EU27 level, the article aims to analyze the impact of personal income tax progressivity, measured by several methods, on macroeconomic indicators such as: Taxes on individual or household income, Inflation, consumer prices, GDP growth and Investment share of GDP by institutional sectors, Unemployment rate and Annual net earnings. The results, more or less in line with expectations and economic theory, can also be particularized on specific groups of countries (e.g. countries that still have the single quota) to be able to motivate the reintroduction of progressive taxation.

Keywords: *taxation, fiscal efficiency, fiscal progressivity, macroeconomic implications*

JEL classification: *H24, H21, E24*

Introduction

Tax as an instrument of fiscal policy can have a positive or negative effect on economic growth. An increase in taxes can lead to a decrease in the income of individuals and can affect the purchasing power and can be reflected in the reduction of aggregate demand and decrease in production and can lead finally to the decrease in economic growth. But the pursuit of fiscal

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progressivity does not necessarily mean the increase of taxation, but rather the more correct placement of taxation on various social categories, so a balanced and socially fair placement of the tax burden. The increase in fiscal progressivity may suggest an increase in the restrictive character of the fiscal policy, thus shortcomings in the sphere of supporting economic growth and tempering unemployment, but it could reduce also the deficit of the balance of payments and inflation.

Therefore, it is interesting to analyze whether fiscal progressivity, focusing only on progressivity at the level of personal income, measured by a series of methods, contributes or not to the improvement of some macroeconomic parameters or vice versa.

Description of the Problem and Literature Review

Some studies support the positive effects of fiscal progressivity, others, on the contrary, present serious reservations regarding its ability to support the economy. Thus, the work of Weller and Rao (2008) tests, for the period 1981-2002, several sources of macroeconomic data to see the connection between fiscal progressivity and economic stability, economic growth, inequality and fiscal policy, noting that taxation progressive gives the decision-makers the ability to conduct anti-cyclical fiscal policies, which contribute to economic stability, at the same time there is no evidence that the progressiveness of taxes leads to the reduction of economic growth (an idea also supported by the studies of Roed and Storm, 2002; Li and Sartre, 2004).

Conversely, according to the authors Weller and Rao (2008), the level of government spending and capital mobility can have a negative effect on progressivity. At the same time, progressivity can suggest the decrease of social inequality (Hassan and Bogetic, 1999 – study on fiscal progressivity in Bulgaria, before the introduction of the single quota) and bringing additional revenues to the budget since those who earn more will contribute more to the increase of revenues (Schmitt, 2003). Equally, progressive taxation can improve the automatic stabilization function of the tax system. More exactly, progressiveness can act similarly, as strongly in effect, as the demand mechanism (Auerbach and Feenberg, 2000), while demonstrating strong correlations between tax revenues and output gap (Swanepol and Schoeman, 2002), thus the progressive structure of taxes leading directly to the stabilization of production.

On the negative side, less progressive personal income taxation may be associated with higher capital flows and even lower long-term top marginal tax rates (Weller and Rao, 2008). At the same time, the reduction of marginal tax rates is extremely well correlated with the decrease in the unemployment rate, and as the levels of tax rates decrease, investment and/or consumption increase, also the real growth rate of wages (Gentry and Hubbard, 2002; Vermeer, 2022 etc.).

Methodology and Data

The article aims to analyze the correlations and the results of a regression equation that will clarify the connection between a series of macroeconomic indicators (Taxes on individual or household income, Inflation, consumer prices (annual %), GDP growth (annual %), Investment share of GDP by institutional sectors, Unemployment, total (modelled ILO estimate), Annual net earnings - Single person without children earning 50% of the average earning) show in table 1 also the tax progressivity related to the personal income tax. Progressivity is measured by four methods. At the same time, the number of income tranches/thresholds taken into account and its possible influence is added to the analysis. The analyzed period is 2000-2022; the data sources are Eurostat, World Development Indicators or DG Taxes and Customs, the method of investigation is panel data base.

The first method takes into account Musgrave and Thin's (1948) approach to measuring progressivity. The method of Musgrave and Thin (1948) shows a measure of progressivity through an index of distributional fiscal progressivity (M, M=(1-Ga)/(1-Gb)) which takes into account the evolution of the Gini coefficient before and after taxation. The Gini coefficients, before and after taxation, are also presented in table 1.

The second method takes into account progressivity measured by the gap between the divisions by categories of persons (e.g. single people without children who earn 50% and 167% of the average income) subject to taxation according to the share of income obtained from the average income.

The third method puts the implicit tax rate on labour at the centre of the analysis, so progressivity is taken into account through the evolution of implicit taxation on labour. The first three methods were also used in previous studies, in a different context of analysis, but also as a capitalization of the project "Progressive taxation - theoretical and empirical analyzes at the level of EU27 member countries", developed within the Victor Slavescu Centre for Financial and Monetary Research (coord. Ailinca, 2023).

The fourth method refers to the difference between the highest (top) and the lowest marginal personal income tax rate. The main indicators used are shown in the table below (see Table 1).

Table 1

The initial indicators selection and description

Indicators' notation	Indicators Description	Measurement unit	Source
TIHIpGDP	Taxes on individual or household income	Percentage of gross domestic product (GDP)	Eurostat[GOV_10A_TAXAG__custom_6850410]
Gcoef	Gini coefficient of equivalised disposable income	Coefficient (scale from 0 to 100)	Eurostat, EU-SILC survey [ILC_DI12__custom_7037173]
Gcoefbst	Gini coefficient of equivalised disposable income before social transfers (pensions included in social transfers)	Coefficient (scale from 0 to 100)	Eurostat [ILC_DI12B__custom_7037129]
TRsp50	Tax rate, Single person without children earning 50% of the average earning	%	Eurostat, [EARN_NT_TAXRATE__custom_6850679]
TRsp167	Tax rate, Single person without children earning 167% of the average earning	%	Eurostat [EARN_NT_TAXRATE__custom_6850727]
Itrlabour	Implicit Tax rate on labour	%	DG taxation and customs union, TAXUD
Tspitr	Top statutory personal income tax rates (including surcharges), 2000-2023	%	DG taxation and customs union
ICP	Inflation, consumer prices (annual %)	%	World Development Indicators
GDPG	GDP growth (annual %)	%	World Development Indicators
InvGDP	Investment share of GDP by institutional sectors	%	Eurostat
Ur	Unemployment, total (modelled ILO estimate)	% of total labour force	World Development Indicators
ANE	Annual net earnings (Single person without children earning 50% of the average earning)	euro	Eurostat

Source: Author's selection

Results

In order to analyze the interrelationship between fiscal progressivity (studied by the four methods) and the macroeconomic variables presented in the methodology, we first study the statistical properties of the variables, such as the average value, standard deviation, skewness, and kurtosis (see Table 2).

The standard deviation, with some exceptions, shows in most cases close to the average, being below the average for the targeted explanatory variables, suggesting a lower spread than the average and a grouping around the average. Also, the mean and median are close in value for all the predictive variables studied, suggesting a relatively symmetrical distribution.

We notice that the independent variables Met 1 and NTR are above the value of 1, which indicates that they are substantially and positively skewed, while for the methods - Met2, Met3 and Met4 there is an adverse Skewness. Thus, data are roughly skewed for Met2 and Met3 and moderately skewed for Met4. For Met 1 and NTR the kurtosis is above 3, which indicates that the distribution is leptokurtic, producing more values than a normal distribution, while for Met2, Met3 and Met4 the Kurtosis is below 3, suggesting that, in relation to the normal distribution, it produces fewer and less extreme values.

Table 2

The statistical description of the variables

Observations: 621	TIHIPGDP	ICP	GDPG	INVGDP	UR	ANE	MET 1	MET 2	MET 3	MET 4	NTR
Mean	7.480	2.850	2.541	22.700	8.401	9839.237	1.373	13.038	34.362	39.801	4.252
Median	6.110	2.184	2.574	22.260	7.360	8786.070	1.349	13.930	34.400	43.000	4.000
Maximum	29.000	45.667	24.370	54.300	27.470	29319.280	1.775	28.520	46.600	62.280	23.000
Minimum	2.000	-4.478	-14.839	10.690	1.810	879.980	1.120	-0.100	20.400	10.000	1.000
Std. Dev.	4.757	3.691	3.780	4.377	4.276	6290.500	0.110	6.721	5.877	13.542	3.407
Skewness	2.066	4.804	-0.319	0.958	1.511	0.492	1.056	-0.118	-0.369	-0.634	2.741
Kurtosis	8.194	43.113	7.621	8.096	5.711	2.236	4.331	2.395	2.375	2.338	13.458
Jarque-Bera	1139.898	44023.100	563.151	766.722	426.631	40.176	161.339	10.912	24.187	52.978	3612.243
Probability	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.004	0.000	0.000	0.000
Sum.	4645.1	1770.2	1578.1	14096.9	5217.1	6110166	852.4	8096.6	21339.1	24716.2	2640.2
Sum Sq.Dev.	14027.3	8448.5	8858.9	11876.1	11333.6	2.45 E +10	7.5	28005.8	21413.5	113694.4	7196.8

Source: Author's calculations, EViews12 processing

Based on the above information, it can be constructed an Augmented Dickey-Fuller (ADF) unit root test and present the descriptive statistics of the models. The Table 3 demonstrates that all of the variables utilized in this investigation are stable at order 0.

Table four shows the correlation matrix between the dependent variables: Taxes on individual or household income (TIHIpGDP), Inflation, consumer prices (ICP), GDP growth (GDPG), Investment share of GDP by institutional sectors (InvGDP) and Unemployment, total (Ur), Annual net earnings (Single person without children earning 50% of the average earning) (ANE) and the proposed methods for fiscal progressivity.

We thus observe that all methods show positive correlations with Taxes on individual or household income, and Method 4 has the most significant positive correlation, while ICP, GDGG with all methods have insignificant negative correlations.

Table 3

Augmented Dickey-Fuller unit root test for selected variables

Variables tested for ADF	T-statistic	Mackinnon critical value at 5%	P-value	Order of integration	Observation
TIHIpGDP	-3.6784	3.4171	0.0245	I(0)	Stationary
ICP	-13.2502	-3.4171	0.0000	I(0)	Stationary
GDPG	-19.4795	-3.4171	0.0000	I(0)	Stationary
InvGDP	-7.4145	-3.4171	0.0000	I(0)	Stationary
Ur	-7.6990	-3.4171	0.0000	I(0)	Stationary
ANE	-4.4809	-3.4171	0.0017	I(0)	Stationary
Met 1	-6.1103	-3.4171	0.0000	I(0)	Stationary
Met 2	-4.9008	-3.4171	0.0003	I(0)	Stationary
Met 3	-4.5600	-3.4171	0.0013	I(0)	Stationary
Met 4	-4.2153	-3.4171	0.0045	I(0)	Stationary
ntr	-4.5102	-3.4171	0.0015	I(0)	Stationary

Source: Author's calculations, EViews12 processing

Table 4

The correlation matrix of the variables

	TIHIpGDP	ICP	GDPG	InvGDP	Ur	ANE	Met 1	Met 2	Met3	Met 4	NTR
TIHIpGDP	1										
ICP	-0.175	1									
GDPG	-0.132	0.163	1								
InvGDP	-0.073	0.212	0.248	1							
Ur	-0.188	-0.134	-0.138	-0.288	1						
ANE	0.615	-0.237	-0.134	-0.157	-0.280	1					

Met 1	0.375	-0.065	-0.065	-0.192	0.116	0.289	1				
Met 2	0.389	-0.218	-0.132	-0.152	-0.056	0.709	0.215	1			
Met 3	0.410	-0.051	-0.110	0.092	0.058	0.200	0.418	0.236	1		
Met 4	0.632	-0.176	-0.133	-0.246	0.008	0.650	0.404	0.690	0.342	1	
NTR	0.107	-0.067	-0.052	-0.266	-0.139	0.495	0.014	0.424	-0.094	0.380	1

Source: Author's calculations, EViews12 processing

Also, the unemployment rate (Ur) highlights that only Met2 and the number of trances (NTR) show negative correlations with the methods that highlight fiscal progressivity. INVGDP shows a single positive but insignificant correlation with Met3. Same as TIHIpGDP, ANE is positively correlated with all methods and highly significant with the methods Met2 and Met4. In order to be able to reveal more information, we proceed to develop a series of regression equations.

Generically, the equations are represented as:

$Y=\alpha+\beta1x1+\beta2x2+\beta3x3+\beta4x4+\beta5x5+\varepsilon$

Where: Y= the dependent variables chosen successively as: Taxes on individual or household income (TIHIpPIB), Inflation, consumer prices (ICP), GDP growth (GDPG), Investment share of GDP by institutional sectors (InvGDP) and Unemployment, total (Ur), Annual net earnings (Single person without children earning 50% of the average earning) (ANE)

α= Constant; β1-6=Slope or x1-X5 coefficients;

x1-x5= the coefficients of the regression or the independent variables, or M1-M4 method and NTR –number of income tranches; ε= error term.

Table 5 shows, in a centralized way, the connection between the predictor variables and the response variable. Thus we observe that:

- For the dependent variable TIHIpGDP only the Met3, Met4 and NTR methods are significant because they have a p-value below 0.05,
- For the variable ICP only the method Met2 is adequate,
- For the dependent variable GDPG none of the progressivity methods are adequate,
- For the variable InvGDP only the methods Met1, Met3, Met4 and NTR have a suitable p-value,
- For Ur only the methods Met1 and NTR are ok,
- For the ANE only the independent variables Met1, Met2, Met4 and NTR are suitable.

It can be considered as appropriate the R-squared of 0.455253, respectively of 0.5955 presented only for the equations what explains the dependent variables TIHIpGDP and respectively ANE.

Thus, we can consider that progressivity, calculated by certain methods presented above, cannot explain to a large extent the evolution of inflation, economic growth and unemployment, but it can influence to some extent the evolution of investments. Despite these shortcomings, fiscal progressivity can significantly influence and explain the evolution of income from the personal income tax and especially of net annual personal earnings.

Table 5

The Regression equation results for TIHIpGDP, ICP, GDPG, INVGDP, Ur, ANE

Method: Least Squares and 621 included observations				Coefficient	t-Statistic	Prob.
Dependent Variable	TIHIpGDP	Independent Variable	C	-8.8847867	-4.80748	0.0000
R-squared	0.455253		Met 1	2.781976	1.861819	0.0631
Adjusted R-squared	0.450824		Met 2	-0.039082	-1.29521	0.1957
F-statistic	102.7927		Met 3	0.143196	5.134338	0.0000
Prob(F-statistic)	0.0000		Met 4	0.21659	13.53636	0.0000
Durbin-Watson stat	0.1334		NTR	-0.122771	-2.550592	0.0110
Dependent Variable	ICP	Independent Variable	C	4.5910	2.4345	0.0152
R-squared	0.0504		Met 1	-0.2827	-0.1846	0.8536
Adjusted R-squared	0.0427		Met 2	-0.1097	-3.5487	0.0004
F-statistic	6.5308		Met 3	0.0151	0.5286	0.5973
Prob(F-statistic)	0.0000		Met 4	-0.0160	-0.9760	0.3295
Durbin-Watson stat	0.9077		NTR	0.0461	0.9337	0.3508
Dependent Variable	GDPG	Independent Variable	C	5.1518	2.6336	0.0087
R-squared	0.025565		Met 1	0.1876	0.1181	0.9060
Adjusted R-squared	0.017643		Met 2	-0.0421	-1.3127	0.1898
F-statistic	3.227044		Met 3	-0.0487	-1.6432	0.1009
Prob(F-statistic)	0.006942		Met 4	-0.0155	-0.9114	0.3624
Durbin-Watson stat	1.56432		NTR	-0.0067	-0.1313	0.8956
Dependent Variable	InvGDP	Independent Variable	C	31.7284	15.0232	0.0000
R-squared	0.1527		Met 1	-8.3111	-4.8471	0.0000
Adjusted R-squared	0.1458		Met 2	0.0452	1.3045	0.1926
F-statistic	22.1724		Met 3	0.1615	5.0471	0.0000
Prob(F-statistic)	0.0000		Met 4	-0.0681	-3.7073	0.0002
Durbin-Watson stat	0.3856		NTR	-0.2471	-4.4744	0.0000
Dependent Variable	Ur	Independent Variable	C	3.2805	1.4903	0.1367
R-squared	0.0355		Met 1	4.2116	2.3566	0.0188
Adjusted R-squared	0.0277		Met 2	-0.0398	-1.1015	0.2711
F-statistic	4.5330		Met 3	-0.0056	-0.1664	0.8679
Prob(F-statistic)	0.0005		Met 4	0.0199	1.0381	0.2996
Durbin-Watson stat	0.1929		NTR	-0.1745	-3.0302	0.0025
Dependent Variable	ANE	Independent Variable	C	-9371.4980	-4.4683	0.0000
R-squared	0.5955		Met 1	5874.0470	3.4497	0.0006
Adjusted R-squared	0.5922		Met 2	413.9070	12.0372	0.0000
F-statistic	181.0941		Met 3	-1.0101	-0.0318	0.9747
Prob(F-statistic)	0.0000		Met 4	101.4419	5.5633	0.0000
Durbin-Watson stat	0.2291		NTR	411.3624	7.4994	0.0000

Source: Author's calculations, EViews12 processing

Thus, the result for the most appropriate methods for personal income tax collections as a percentage of GDP and for annual net personal incomes (ANE) is shown in table 6. It is thus

observed that the number of tranches and the methods of calculating the progressivity, complement each other between them very well, and method 4, which is based on the difference between the highest and the lowest marginal rates, supports very well the idea of progressiveness in relation to the expected effect in the economy.

Table 6

The final Regression equation results only for TIHIpGDP and ANE

Method: Least Squares and 621 included observations				Coefficient	t-Statistic	Prob.
Dependent Variable	TIHIpPIB	Independent Variable	C	-5.732476	-6.507139	0.0000
R-squared	0.450311		Met 3	0.156277	5.873286	0.0000
Adjusted R-squared	0.447639		Met 4	0.212659	17.1079	0.0000
F-statistic	168.4845		NTR	-0.146183	-3.134465	0.0018
Prob(F-statistic)	0.0000					
Durbin-Watson stat	0.1266					
Dependent Variable	ANE	Independent Variable				
R-squared	0.5955		C	-9380.2130	-4.5149	0.0000
Adjusted R-squared	0.5929		Met 1	5857.7220	3.6111	0.0003
F-statistic	226.7351		Met 2	413.8105	12.0914	0.0000
Prob(F-statistic)	0.0000		Met 4	101.3400	5.6503	0.0000
Durbin-Watson stat	0.2291		NTR	411.7686	7.7255	0.0000

Source: Author's calculations, EViews12 processing

In the annex, the results of heteroscedasticity and multicollinearity are presented only for two more significant equations, more precisely for TIHIpGDP and ANE, shown in Table 6.

Based on the details above, we can also perform a Granger causality test. Thus, eliminating the connection of the dependent variables between themselves and the independent variables between themselves, and taking into account only the connection between the dependent and independent variables with a p-value below 5%, we observe the following situations presented in table 7.

Thus, although the GDP is not explained well enough above the idea of fiscal progressivity of the personal income tax, nevertheless Met2 and Met4 seem to build an explanation for the GDP from the perspective of Granger causality. At the same time, for unemployment and net annual personal income, an adequate Granger causality seems to be provided by the Met1 method - based on the Gini coefficient, before and after taxation.

Table 7

The Granger Causality Test Results for selected variables

Pairwise Granger Causality Tests		
Date:09/11/23		
Sample:1621		
Lags 2 Obs. 619		
Null Hypothesis:	**F-Statistic**	**Prob.**
Met 2 does not Granger Cause GDPG	3.43299	0.0329
Met 4 does not Granger Cause GDPG	3.87236	0.0213
Met 1 does not Granger Cause UR	5.83879	0.0031
Met 1 does not Granger Cause ANE	15.5704	3. E - 07

Source: Author's calculations, EViews12 processing; only results with a probability below 0.05, and only the conditioning of the methods on the selected macroeconomic indicators are presented above.

Conclusions

The increasing need for budget revenues as well as the need to establish society on the most correct and equitable basis reveals, at least for the countries of Central and Eastern Europe where the single tax rate is still kept, the importance of achieving a significant fiscal reform.

This reform framework should also include the transition to progressive taxation of personal income, more or less moderate - with a larger or smaller number of tax brackets. Thus, the present study econometrically explores the importance of the fiscal progressivity of the personal income tax (through 4 methods) on some macroeconomic variables. The results indicate that Taxes on individual or household income (TIHIpGDP) and Annual net earnings (ANE) are the most influenced by fiscal progressivity, and the method that stands out the best is method 4 - which takes into account the difference between the maximum and minimum personal income tax rates. At the same time, although to a lesser extent, investments can also be connected with the evolution of the fiscal progressivity of the personal income tax.

Future Directions

The study can also be extended to more limited groups of countries at the EU27 level, so as to capture the distinct characteristics of the countries (e.g. countries that always have had a progressive quota, countries which have recently switched to a progressive quota and countries which still have a single quota) from the perspective of the impact of the fiscal progressivity of the personal income tax on the main macroeconomic variables.

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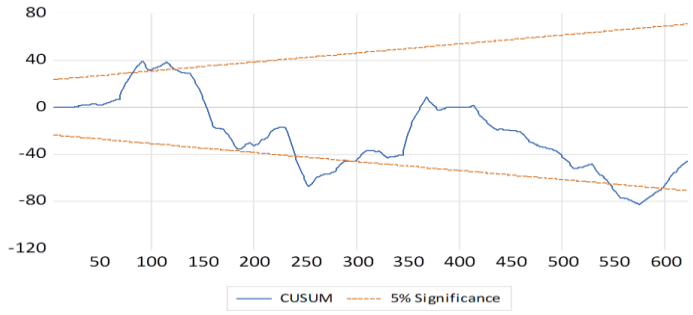
Annex

Table 1

The assessment results for explaining TIHIpGDP regression equation

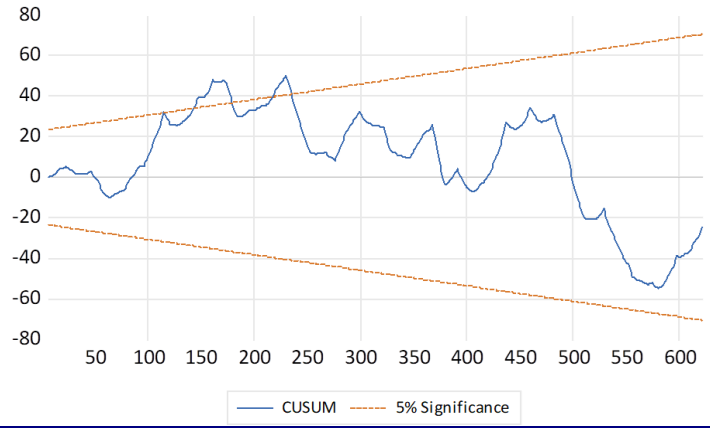
Fact-findings verifications	F - Statistics			P-value
Ramsey RESET -Stability test	166.1351			0.0000
Heteroskedasticity Test: Breusch-Pagan-Godfrey	36.24503			0.0000
LM test	2216.6440			0.0000
Multi-Collinearity test for initial equation	Coefficient variance	Centered VIF	Result analysis	Observations
MET 3	0.000708	1.213130	VIF<10	No interconnectivity of independent variables
MET 4	0.000155	1.405753	VIF<10	No interconnectivity of independent variables
NTR	0.002175	1.252570	VIF<10	No interconnectivity of independent variables

CUSUM test	

Source: Author's calculations, EViews12 processing

Table 2

The assessment results for explaining ANE regression equation

Fact-findings verifications	F - Statistics			P-value
Ramsey RESET -Stability test	48.58086			0.0000
Heteroskedasticity Test: Breusch-Pagan-Godfrey	24.10325			0.0000
LM test	1109.6090			0.0000
Multi-Collinearity test for initial equation	Coefficient variance	Centered VIF	Result analysis	Observations
MET 1	2631386	1.2332	VIF<10	No interconnectivity of independent variables
MET 2	1171.2510	2.0362	VIF<10	No interconnectivity of independent variables
MET 4	321.6747	2.2703	VIF<10	No interconnectivity of independent variables
NTR	2840.9130	1.2692	VIF<10	No interconnectivity of independent variables
CUSUM test				

Source: Author's calculations, EViews12 processing