Review Article

INVESTIGATION OF NONLINEAR AND DYNAMIC RELATIONSHIP OF TAX REVENUE, ECONOMIC WELFARE, AND DEMOCRACY USING GMM

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Abstract
This article aimed to investigate the relationship between tax revenue, welfare, and democracy level in democratic and undemocratic countries. This investigation was performed by analyzing data from 77 countries for the period 2000-2015. The results obtained by dynamic panel data modeling based on the generalized method of moments (GMM) showed that there is a negative U-shaped relationship between the share of tax revenue in GDP and democracy, indicating that as political participation increases, nations tend to favor minimal states, but as we move from democracy toward authoritarianism, the share of tax revenue increases. Also, a positive relationship was observed between economic welfare and the share of tax revenues, which indicates that the share of government tax revenue increases with the improvement of economic welfare.
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INTRODUCTION
For many years, there has been a debate among scholars on the question that what structural factors determine the role and size of the economic and social activities of an efficient state. One of the most important factors that determine whether a state can carry out its duties effectively and efficiently is the presence of an effective taxing system tailored to the social needs of the governed society. It is never easy to establish and maintain such a system and this is even more difficult and somewhat impossible in countries with weak political structures and low welfare levels (Profeta et al., 2009). In democratic states, the concentration and delegation of power are based on the will of the people. In countries with democratic states, people expect the state to do what they demand in the context of public choice. In the framework of classical minimal state theory, the provision of goods and social services should be based on the expressed desire and demands of the society and should not be influenced by the personal inclination and interests of the rulers (Musgrave & Musgrave, 1993).

In the theoretical framework of public economics, the state uses tax revenue as a means to carry out the three classical tasks of allocation, distribution and maintaining economic stability. In this regard, the maximization of social welfare by using the power to tax is an important subject of discussion. According to Brennan and Buchanan (2006), essentially, the power to tax is the ability of the state to levy and collect taxes and then allocate it to the social goods needed by taxpayers. Research has shown that economic welfare and the type of political regime (in the democracy-authoritarianism spectrum) play a major role in a state's ability to tax. Therefore, many hypotheses have been developed to explain this relationship. According to Vanhanen (2003), democracy means the presence of free and fair elections for filling the positions of power. Welzel (2007) defines democracy as the political structure in which the power of the state is limited by the constitution and controlled by the people. Autocracy can be defined as the opposite of democracy, that is, the political structure in which one person has unlimited and uncontrolled power over others. According to Moore (1999) and Mosley

(2015), middle-income countries expand their tax revenues more rapidly than lower-income countries, which tend to struggle with low and almost static tax revenues. In the present study, the goal was to examine the relationship between economic welfare, political structure, and the share of tax revenues in the national economy. To achieve this goal, a nonlinear model developed by the dynamic panel data method based on the generalized method of moments (GMM) was used to examine this relationship in countries with different political structures ranging from democratic to autocratic.

LITERATURE REVIEW
There has been no empirical study in Iran on the relationship between tax revenues, economic welfare, and democracy. According to Musgrave and Musgrave, as nations industrialize, the public sector's share of the national economy tends to increase (Ighodaro & Oriakhi, 2010). In the model proposed by Musgrave and Rostow, the growth of public expenditure and subsequent tax revenues is linked to patterns of economic growth in societies. According to this model, in the early stages of economic growth, the public sector investment as a percentage of total investment in the economy will increase because, as argued in the public economics, the provision of infrastructures such as roads, transportation systems, laws, health, education and other investment in human capital, which belong to the domain of social goods, falls in the state's area of responsibly. In this regard, Wagner outlines three main reasons for the increase in the share of tax revenues and state expenditure: (a) as a society grows and becomes more complex, it tends to need more sophisticated public support and regulatory activities. Urbanization, specialization of labor, and industrialization require higher expenditure from tax revenues to enforce laws and contracts and ensure sound economic performance. (b) Real income growth increases the relative elasticity of welfare and cultural expenditure. (c) To enable economic development and technological progress, the state has to manage natural monopolies to enhance economic efficiency. Also, the investment required in some areas (such as

railroads) is so enormous that the private sector is unable to finance these initiatives (Durevall & Henrekson, 2011).

In empirical studies, the relationship between the tax level and democracy level has not received much attention (Darcy, 2012). From a theoretical perspective, there are three different views on the relationship between the tax level, economic welfare, and democracy level:

(A) Many scholars believe that there is a positive relationship between the share of tax revenue in GDP and democracy. In this view, the tax-to-GDP ratio is interpreted as a function of state-society relations. Since the level of democracy has a strong impact on state-society relations, the tax revenues of a country can be expected to be a function of the level of democracy in that country. Thus, it can be hypothesized that the level of democracy affects the level of tax revenues. Darcy (2012) argues that changing the state-society relations by promoting democracy, opening up the political arena, ensuring freedom of expression, creating accountability mechanisms, and providing means of public control over state decision-making will have a positive impact on the share of tax revenue in GDP. De Schweinitz (1964) also supports the idea that taxation and the level of democracy are strongly correlated. In his view, democracy is inevitably associated with a high level of taxation as it relieves the pressure to provide citizens with all public goods and services directly, which means people will pay taxes to get some social goods from the government. In a study by Boix (2001) on the relationship of government size with the type of political regime, it was reported that government budget (tax collected) tends to grow faster under democratic rule than under authoritarianism. However, the investigations of this study were for countries with incomes higher than a certain threshold. In an empirical study by Thies (2004) on developing countries, it was reported that the expansion of democracy in these countries has increased government tax revenues. The studies conducted by Fjeldstad (2004), Cummings et al. (2005), and Ross (2004) have also reported similar findings.

(B) Some scholars believe that the relationship between the share of tax revenue in GDP and democracy is negative. For example, Downs (1960) showed that democratic governments tend to decrease the budget, as they attempt to optimize resource allocation. McGuire and Olson (2003) showed that high levels of taxation can also be observed in authoritarian regimes. They argued that in these countries, the obtained resources will be spent on the government's preferences rather than people. Niskanen (2003) reported that authoritarian regimes are more likely to raise taxes and spend the revenues arbitrarily. An empirical study by Tonizzo (2008) also showed that countries with high levels of democracy have smaller governments and therefore lower tax revenue share in GDP.

(C) The third group of scholars believes that there is no evidence of a relationship between taxation and democracy. For example, a study by Meltzer and Richard (1981) showed that it is impossible to determine whether democracy is negatively correlated with the government size (tax revenue share) or whether the expansion of democracy is associated with better distribution. Using cross-sectional regression, Cheibub (1998) showed that authoritarian states are not superior to democratic states in terms of tax revenues and that authoritarianism is not necessarily associated with high levels of tax revenue. Similarly, Profeta et al. (2009) found no significant association between democracy and corporate tax revenues, indirect tax, and social security assistance.

DATA AND MODEL SPECIFICATION

Data
Following the approach of empirical studies carried out by Darcy (2012), Thies (2004), Fjeldstad (2004), Cummings et al. (2005), and Ross (2004), the relationship between tax level and democracy was investigated based on the assumption that tax variables are a function of tax revenue, which is affected by the government composition (democracy index) and GDP per capita. The dataset consisted of information provided in the World Bank database for 77 countries for the period 2000-2015. The countries were chosen based on a variety of criteria, including economic development, socio-economic structure, culture, and the type of political government.

Model Specification
The main hypothesis of this study was that there is a significant relationship between the level of democracy and the tax level. This relationship can be expressed by the following general equation:

$$\tau = f(d) \qquad (1)$$

In this equation, τ is the tax revenue as a percentage of GDP and d is the democracy index.
To estimate the model, first, the scatter plot of Equation (1) for the studied countries was examined (Chart (1)). As the plot shows, the relationship between the plotted variables is not linear but rather U-shaped. The plot also shows that the highest tax rates are in the two ends of the spectrum, which are related to highly democratic and highly authoritarian states. In this paper, we attempted to examine this observation in the framework of a hypothesis using econometric methods.
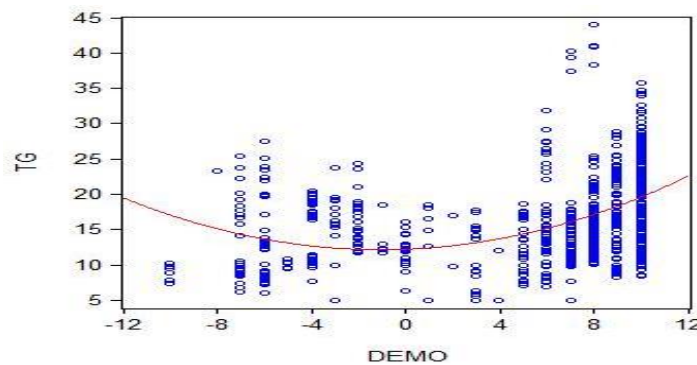

Chart (1) - scatter plot of tax revenue (as a percentage of GDP) versus the democracy index for the studied countries

According to the above, the model was assumed to be of the following general form:

$$\tau_{it} = \alpha + \beta d_{it} + \varepsilon_{it} \qquad (2)$$

Where α denotes the intercept, β the slope, i the cross-sections (the states), and t the time. After estimating this model and introducing higher orders of democracy index (d), the nonlinear (second-order) relationship between tax rate and democracy level was examined using the Ramsey Regression Equation Specification Error Test (RESET) (Table 4, Models 1 and 2) and GDP per capita was introduced to the model as a control variable. Since high-income voters are expected to be willing to accept a higher level of taxation (Loweri (1987), Berch (1995), and Dennis et al. (2011)), the tax level can be expected to have a positive relationship with income level. Accordingly, the model was modified as follows:

$$\tau_{it} = \alpha + \beta_1 d_{it} + \beta_2 d_{it}^2 + \beta_3 y_{it} + \varepsilon_{it} \qquad (3)$$

Where α is the intercept, β is the slope, i denotes the cross-sections (the states), t is the time, and other variables have the same definition as given above. In this model, the variable (t) represents the tax level as a percentage of GDP and measures the relative tax revenue available to the state to perform its three functions. The low values of this indicator signify the low level of government intervention in the economy in terms of revenue share. The variable (d) measures the level of democracy in the country or political regime. Following the method of Acemoglu, Naidu, Restpero & Robinson (2014), the democracy score of political regimes was defined in the range of [-10,+10], with +10 representing a highly democratic and -10 representing a highly authoritarian political structure. In cases where the values reported in the dataset were in the form of standardized authority codes (-66, -77, and -88), they were converted into the defined democracy score system (in the range of [-10,+10]) using the

ruleset provided by Marshall et al. (2011), which is briefly described below:

- "-66" represents a period of "interruption" which is treated as "system missing". The interruption period refers to the period that a nation needs to reestablish a new polity after the occupation by foreign powers during war and the termination of its old polity.
- "-77" represents a period of "interregnum" or anarchy between the fall of a government system and the rise of another. In this case, the equivalent democracy score is "0".
- "-88" represents a period of "transition", which is prorated over the span of the transition. For example, if a country has a POLITY score of -7 in 1957, -88 in 1958, 1959, and 1960, and +5 in 1961, the change from -7 (in 1957) to +5 (in 1961), which is +12, must be prorated over the three years of transition, resulting in the following scores: 1957: -7; 1958: -4; 1959: -1; 1960: +2; 1961: +5. For transitions (-88) that emerge after interruption (-66) or interregnum (-77), proration must be done from the value "0".

The variable (y) represents GDP per capita and measures national welfare.

MODEL ESTIMATION
Test of stationarity (Unit Root Test) for Panel Data
Since the number of observations available for model variables over the studied period varied with the country, we decided to use an unbalanced panel data model (Anderson & Hsiao, 1981; Arellano & Bond, 1991). Although it is not necessary to run a test of stationarity for an unbalanced panel data model with data for a 16-year period (Abizadeh & Tosan, 2007), we performed the Levin-Lin-Cho test (LLC), Im-Pesaran-Shin test (IPS), Augmented Dickey-Fuller test (ADF), Phillips-Perron test (PP), and the tests presented by Maddala & Wu (1999) and Choi to make sure of the reliability of the results. The results of these tests are presented in Table (3).

Table 1: Results of the stationarity tests

| PP-Fisher	ADF-Fisher	Im, Pesaran and Shin	Levin, Lin & Chu	
279.572	152.381	-0.31863	-12.3856	**TG**
(0.000)	(0.0195)	(0.3750)	(0.0000)	
82.4975	214.995	-2.70469	-10.6605	**GDP**
(1)	(0.0009)	(0.0034)	(0.0000)	
90/4333	50/8800	-48000000000	-1500000000	**DEMO**
(0.0507)	(0.9586)	(0.0000)	(0.0000)	
73.7573	40.0855	-130000000	-3900000000	**DEMO2**
(0.2395)	(0.9951)	(0.0000)	(0.0000)	

Source: research findings,
Note: The figures given in parentheses are p-value.

As the statistical results presented in the above table demonstrate, the LLC test showed that GDP, DEMO, DEMO2 are all I(0) at the 5% significance level, and therefore no panel cointegration test is needed for the model variables.

In cases where the model data is pooled, several tests should be performed to determine the preferable model estimation method.

Estimation of Econometric Model

Chart (2) - Estimation methods for pooled data
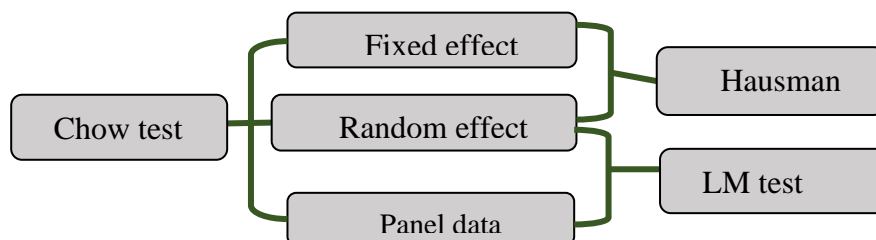
First, the Chow test should be used to determine whether data are pooled or panel. Then, if the data are indeed panel, the Hausman test should be performed to determine whether the fixed effect or the random effect approach is preferable. The LM test can then be used to determine the estimation method. (Figure 2).

The results of the Chow test are presented in Table 1.

Table 2- Results of the Chow test

F-statistic	**79.504**
Prob.	**0.000**

Source: research findings

The Chow test statistic at the 5% significance level showed that panel data is of pooled type. Therefore, it was necessary to determine whether the fixed-effect method or the random-effect method is preferable. Therefore, the Hausman test was performed (Ashrafzadeh & Mehregan 2008). The quantitative results of the Hausman test are presented in Table (2):

Table 3- Results of the Hausman test

Chi-Sq statistic	**2.2275**
Df	**3**
[prob.]	**0.5265**
fixed effect/random effect	**Random**

Source: research findings

As the results presented in the above table show, the Hausman test identified the random effect approach as the preferable model estimation method (Model 3). Although there is a very low chance of encountering colinearity in the panel data method, the variables can be introduced step by step to entirely avoid this problem. If the introduction of a new variable makes no significant change in the coefficients and sign of the parameters, it is safe to assume that there is no colinearity in the model estimation. By performing the serial autocorrelation test for the residual components, it can be determined whether the residuals are correlated in their model. In that case, the OLS estimates will not be consistent (Hsiao, Arellano, Bond, & Baltaji, 1995). To resolve this problem, the model can be developed by the use of two-stage least squares (2SLS) or generalized method of moments (GMM) (Arellano & Bond, 1991). Since Matyas and Sevestre showed that the 2SLS estimation may yield large variances for the coefficients (because of the problems in selecting instrumental variables), Arellano and Bond proposed the use of GMM to avoid this problem. In this method, the autocorrelation of the dependent variable with the lag and error terms is removed by using the lag as the instrumental variable in the GMM estimation of dynamic panel data models (Barro and Lee, 1996). The general estimation model in this method is as follows:

$$\Delta\tau_{it} = \beta_1\Delta d_{it} + \beta_2\Delta d_{it}^2 + \beta_3\Delta\tau_{i,t-1} + \beta_4\Delta y_{it} + \Delta\mu_{it} \quad (4)$$

In this study, the validity of the model was assessed by the use of J-statistic. This test has a chi-square distribution with a degree of freedom equal to the number of over-specified constraints (P-k), where K is the number of estimated coefficients and P is the instrument rank. The J-statistic obtained in this study showed that the null hypothesis that the model is valid cannot be rejected. Since it was also not rejected that the instrument rank of the estimated model is higher than the estimated parameters, it was determined that the method is fit for model estimation. Therefore, the GMM method was used to estimate the model for 77 countries. The results of this model estimation are presented in Table (3):

Table 4. Quantitative results of model estimation

Independent variables	Model (1)	Model (2)	Model (3)	Model (4)
	OLS (linear)	OLS (nonlinear)	Cross-Section random effects	GMM
Constant	14.4148 (0.000)	12.1925 (0.000)	13.2641 (0.000)	----------------
D	0.40244 (0.000)	0.10498 (0.0737)	0.0473 (0.0134)	-0.1210 (0.000)
D²	----------------	0.0433 (0.000)	0.0253 (0.000)	0.0202 (0.000)

Tax(-1)	----------------	---------------	---------------	0.4530 (0.000)
Y	----------------	0.00013 (0.000)	0.00019 (0.002)	0.00045 (0.000)
Model Summary				
R-Squared	0.104	0.1921	0.040	----------------
F-statistic	90.762 (0.000)	61.2689 (0.000)	10.7534 (0.000)	----------------
Akaike Criterion	6.5404	6.4430	----------------	----------------
Schwarz Criterion	6.5524	6.4669	----------------	----------------
Hannan-Quinn	6.5450	6.4522	----------------	----------------
Ramsey RESET Test	44.4341	----------------	----------------	----------------
F-statistic Ramsey Test	(0.000)	---------------	---------------	----------------
J-Statistic				56.1257
Instrumental rank				55

Source: research findings
The figures given in parentheses are p-value.

As the results presented in Table (3) illustrate, the coefficient of the lagged tax revenue was found to be positive and significant. This shows that the tax revenue has a dynamic behavior over time, as the imbalance in tax revenues decreases by 45% a year. The effect of GDP per capita as a measure of economic welfare on the tax revenue was also positive, which is consistent with the hypothesis. The model showed a positive rate of change relative to the democracy index:

$$f^{''}(\Delta d_{it}) = (\Delta d_{it})^{''} = 2\beta_2 > 0 \qquad (5)$$

Therefore, it can be concluded that there is a non-linear U-shaped relationship between democracy and tax revenues. On this basis, it can be stated that as the level of democracy increases (assuming other conditions remain constant), government tax revenues decrease. Hence, at the highest level of democracy, the share of tax revenues in GDP and the role of the state in the economy will be minimized. On the contrary, as the level of democracy decreases and the country moves toward authoritarianism, the share of tax revenues in GDP and the role of the state in the economy increases.

CONCLUSION
This study aimed to investigate the relationship between democracy, welfare and tax levels in 77 countries using a nonlinear model developed by the dynamic panel data method based on GMM. For this purpose, the empirical data were used for nonlinear dynamic modeling in the software Eviews to examine the relationship between the share of tax revenue in GDP, the level of economic welfare, and the level of democracy in the studied countries from 2000 to 2015. The results of econometric tests showed a negative relationship between the share of tax revenues in GDP, welfare and democracy in the framework of the developed nonlinear model. This relationship indicates that nations with high political participation are willing to pay taxes for their social goods and support a minimal state. But as the democracy level decreases and the country moves towards authoritarianism, low regard for people's opinions leads to a higher share of tax revenues. The results also showed a positive relationship between economic welfare and the share of tax revenues. Therefore, it can be argued that as economic welfare increases, the increasing complexity of social relations and the increasing number of economic and social disputes lead to the expansion of the role of the state and the share of government tax revenues.

REFERENCES
1. Abizadeh. S., Tosun. M.S. (2007). "Open Trade and Skilled and Unskilled Labor Productivity In Developing Countries: A Panel Data Analysis", the Journal of International Trade and Economic Development, vol. 16, 383-399.
2. Acemoglu, D., Naidu, S., Restrepo, P., & Robinson, J. A. (2014). "Democracy does
3. Cause growth", National Bureau of Economic Research.
4. Anderson. T. W., Hsiao. C. (1981). "Estimation of Dynamic Models with Error Component", Journal of the American Statistical Association, 76.
5. Arellano. M., Bond. S.R. (1991). "Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations", Review of Economic Studies, 58 (2), 277–297.
6. Ashraf Zadeh, H. R. Mehregan. N. (2008). "Panel Data Econometrics", Tehran: Tehran University Cooperative Research Institute.
7. Berch. N. (1995). "Explaining changes in the tax incidence in the states", Political Research Quarterly, 48 (3), 629–641.
8. Boix, C. (2001). "Democracy, development and the public sector", American Journal of Political Science, 45 (1), 1–17.
9. Brennan. G., Buchanan. J. (2006). "The power to tax: Analytic foundations of a fiscal constitution", New York: Cambridge University Press.
10. Cheibub, J.A. (1998). "Political regimes and the extractive capacity of governments: taxation in democracies and dictatorships", World Politics, 50 (3), 349–376.
11. Cummings, R.G, Martinez-Vazquez, M. McKee & Torgler. B. (2005). "Effects of Tax Moral on Tax Compliance: Experimental and Survey Evidence", International Studies Program Working Paper (05-16). Atlanta: Andrew Young School of Policy Studies, Georgia State University.
12. Darcy, M. (2012). "Taxation, Democracy and State-Building: how does sequencing matter?". Working Paper (05-16), the Quality OF Government Institute (QOG) Department of Political Science University of Gothenburg, 4-7.
13. De Schweinitz. K. (1964). "Industrialization and democracy", New York: Free Press.
14. Dennis. C., Medoff. M. Stephens. K. (2011). "The impact of tax rates, partisanship and economic variables on the distribution of state and local tax burdens", The Social Science Journal, 48 (2), 305–313.
15. Downs, A. (1960). "Why the government budget is too small in a democracy", World Politics, 12 (4), 541–563.
16. Durevall, D., Henrekson, M. (2011). "The Futile Quest for a Grand Explanation of Long-run Government Expenditure", Journal of Public Economics 95: 708 –722.

17. Fjeldstad, O. H. (2004). "What's Trust Got to do with it? Non-Payment of Service Charges in Local Authorities in South Africa", Journal of Modern African Studies, 39(2), 289-306.
18. Ighodaro, C., Oriakhi, D. (2010). "Does The Relationship between Government Expenditure and Economic Growth Follow Wagner's Law in Nigeria?". Annals of the University of Petroşani, Economics 10(2):185-198.
19. IM k, S., Pesaran M. H., Shin Y. (1997). "Testing for Unit Roots in Heterogeneous Panel", Department of Applied Economics, University of Cambridge, UK.
20. Lowery, D. (1987). "The distribution of tax burdens in the American states", Western Political Quarterly, 40 (1), 137–158. Musgrave
21. Marshall, M., Gurr. T., Jaggers. K., (2010). "Polity IV project, Political regime characteristics and transitions, 1800-2009", Center for Systemic Peace, Manual and Online database.
22. McGuire, M., Olson. M. (1996). "The economics of autocracy and majority rule", Journal of Economic Literature, 34 (1), 72–96.
23. Meltzer, A., Richard. S., (1981). "A rational theory of the size of government", Journal of Political Economy, 89 (5), 914–927.
24. Moore, M. (1999). "Death without taxes: democracy, state capacity and aid dependence in the Fourth World", Oxford: Oxford University Press.
25. Mosley, Paul (2015). "Fiscal composition and aid-effectiveness: a political economy model", World Development, 69 (May), 106-115.
26. Musgrave, R. A. And Musgrave. P. B. (1372). "Public Finance in Theory and Practice (1910)", Translated by Massoud Mohammadi and Yadollah Ebrahimi Far. Planning and Budget Organization, Tehran, Iran.
27. Niskanen, W. (2003). "Autocratic, democratic, and optimal government: Fiscal choices and economic outcome", Cheltenham: Edward Elgar Publishing.
28. Profeta, P., Puglisi. R., Scabrosetti. S. (2009). "Does democracy affect taxation? Evidence from developing countries", Public Choice Political Economy, Pavia, 24–25September.
29. Ross, M. L. (2004). "Does Taxation Lead to Representation?", British Journal of Political Science, 34, 229-249.
30. Thies, C., (2004). "State Building, Interstate and Intrastate Rivalry: A Study of Post-Colonial Developing Country Extractive Efforts, 1975–2000". International Studies Quarterly, 48, 53–72.
31. Tonizzo, M. (2008). "Political institution, size of government and redistribution: an empirical investigation", Development Destin Studies Institute, Working Paper, No. 8-89.
32. Vanhanen, T. (2003). "Democratization: a comparative analysis of 170 countries", London: Routledge.
33. Welzel. C. (2007). "Are levels of democracy affected by mass attitudes? Testing attainment and sustainment effects on democracy", International Political Science Review, 28 (4), 397–424.
34. World Bank, (2017). World Bank online database.
35. Kuni Zu'aimah Barikah. "Traditional and Novel Methods for Cocrystal Formation: A Mini Review." Systematic Reviews in Pharmacy 9.1 (2018), 79-82. Print. doi:10.5530/srp.2018.1.15