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Abstract
Using a panel-model approach, this paper investigates the validity of the relationship between level of tax revenues and type of voting. The data-set covers the period 2000-2010, and includes 135 countries. The main finding points out that the assumed function is linear and the compulsory vote tends to increase the tax revenues collected by public authority. The analysis in this paper covers the "gap" in the literature in this field.

1. Introduction

The tax revenues represent the most important financing source for government. As Musgrave (1959) notes, the state collects taxes and allocates them in order to fulfil three main functions in economy: allocation, distribution, and economic stabilization. Based on the social contract, it is very clear that the tax payment represents a constitutional duty for citizens, and a right for the government. Even so, there are a lot of taxpayers who don't pay the taxes.

Several determinants are relevant in this way. Studying some papers in this area (e.g. Torgler 2005 and 2006, Martínez-Vázquez and Torgler 2005, Prieto et al. 2006, Torgler and Schneider 2007, Alm and Torgler 2006, and Cummings et al. 2007), Lago-Peñas and Lago-Peñas (2008) group the factors in four categories:

(a) Socio-demographic characteristics: gender, age, marital status, education, employment status, religiosity, and social class;

(b) Political and social attitudes: trust in courts, the legal system, politicians and democracy in general, national pride, social capital, the perceived level of corruption, and voting behaviour;

(c) Fiscal parameters: tax rates, the fine rate, audit probability, risk aversion, and personal income.

(d) Contextual determinants: differences in the extent of direct democracy, language fragmentation or the existence of regional cleavages.

In the public choice approach, the voters, as taxpayers, approve the level and structure of taxation, and accept to pay the taxes, only if they receive benefits from public goods or obtain some financial socio-economic transfers. The collective vector is a result obtained at constitutional or post-constitutional stage of decision. Regarding this vector, almost all literature in the field investigates it considering the voting as voluntary.
What happen when the voting is compulsory? Does it influence the collected tax revenues? If yes, which is the magnitude of this impact?

This paper answers at these questions, studying the impact of type of voting on the tax revenues, based on a panel-model approach. The data-set covers the period 2000-2010, and includes 135 countries. The main finding stresses that the assumed function is linear, type of voting having a significant impact on the level of collected tax revenues. The analysis in this paper covers the "gap" in the literature in this field.

Even if the literature is very poor, there are some results in this direction. Some authors suggest that there is a strong connection between collected tax revenues and type of voting (Lomasky and Brennen, 2000; Hill, 2002; Briggs and Celis, 2008; and Holder, 2010), while other researchers don't find any correlation in this way (Brooki, 2008; Level, 2009 and Usher; 2011).

The rest of the paper is structured as follows: Section 2 contains the literature review. Section 3 presents the methodology and the empirical results. Section 4 concludes.

2. Literature Review

Which is the best type of voting: voluntary of compulsory? Even if the voluntary voting is predominant in the world, there are 32 countries or sub-states entities which have compulsory voting. The choosing of voting type system is a very debatable issue in the socio-political spectrum. Jakee and Sun (2006) emphasise that the normative debate over compulsory voting "typically asks whether voting should be viewed" as a civic duty, or as a right. If the civil duty implies compulsory voting, the civil right implies voluntary voting.
As the payment of taxes is a duty, the taxpayers are likely to become more responsible of taxation aspects if the voting is compulsory. In this context, the tax evasion and avoidance are minimal, while the collection of tax revenues increases. The relationship between collected tax revenues and type of voting was less investigated in the literature. However, there are authors that claim the existence of this connection, but with different directions, while others stress that there is no significant correlation.

Regarding the first group of researchers, Lomasky and Brennen (2000) promote the idea that, having the same direction, the tax revenues are strongly connected with the type of voting.
They argue that the failing to vote is morally indifferent: "one does not morally better to vote than, say, spend the time playing golf instead". For the authors, this type of reasoning is valid in

respect to voluntary systems than it does in mandatory system. Thus, there would be no strong duty to pay taxes in a voluntary tax system. As a consequence, the compulsory voting can increase the tax revenues collected by government than in the case of voluntary system.

Hill (2002) analyses what happen when the voter avoids the tax payment under a voluntary system. In this situation, as the voting is voluntary, the taxpayers don't see any importance of state's functions. In the opposite side, as the author notes, the compulsory voting under collective action make taxpayers to appreciate the system utility of taxation, and encourages them to pay the taxes, improving in this way the collection of government tax revenues.

The same conclusion finds Holder (2010). He models compulsory voting, stressing that this type of vote increases the total government spending and taxes. Moreover, the effect on public goods provision is ambiguous.

Other researchers defend the existence of the connection, but with a contrary sign. Briggs and Celis (2008) investigate the impact of compulsory voting upon differential turnout rates in Britain and Belgium. Showing that "taxpayers who do vote could see a small percentage reduction in the amount of taxation that they are eligible to pay", the authors reveal there is a significant correlation between voting action and tax revenues, but by opposite direction.

Finally, the last opinions promote the idea that there is no evidence regarding the relationship between collection of tax revenues and type of voting. Brooki (2008) studies the connection between tax revenues as percent in GDP and type of voting system, using 9 variables for a sample size of 109 countries. The main finding shows that the most important independent variable, compulsory voting law, is not significant. The second result illustrates that compulsory voting law is not correlated with government spending.

Level (2009) focuses on the justification of compulsory voting. The author considers that the duty to pay taxes is applied whether or not one is a citizen. This thing depends by "ability to pay, proportionality, and even redistributive justice that are absent from the case for compulsory voting". Usher (2011) analyses the duty to vote. The authors emphasise that the voluntary voting becomes preferable to compulsory voting. In this context, the outcome of elections is not affected by a tax or fee on voting if the tax is appropriately redistributed.

Based on these theoretical foundations, we find some new evidence regarding the relationship between the collected tax revenues and type of voting, using a panel-model approach, with 135 countries, for the period 2000-2010.

3. Methodology and Results

In order to investigate the relationship between collected tax revenues and type of voting, we consider two variables: the tax revenues, as a dependent variable, and the type of voting, as independent variable. The data-set includes 135 countries, covering the period 2000-2010 (Table 1, in Appendix). The level of economic development, form of socio-economic system, culture, geographic position, and type of political regime are the main criterions for selection of the considered countries.

The variables are as follow:

(a) The tax revenues (r) illustrate the amount of tax revenues collected by general government in U.S. dollars. The data has been taken from the International Monetary Fund online data-base.
(b) Type of voting (v) is a dummy variable. It is 1 if the country has mandatory voting and 0 if the country has voluntary voting.
The main hypothesis of this analysis is that the type of voting (voluntary or compulsory) determines the level of collected tax revenues, based on a function with this shape:

$$r = f(v), \tag{1}$$

where r - the amount of tax revenues in U.S. dollars, and v - the voting type. These two variables are exogenous variables, as Lewis-Beck and Nadeau (2011) note.

For investigate this function, we consider a panel-data model, using several scenarios (models 1-8, Table 2, in Appendix).
The basic OLS naïv model 1, using natural logarithmic transformation of variable r, is as follows:

$$\ln(r_{it}) = \alpha + \beta\, v_{it} + \varepsilon_{it}, \tag{2}$$

where α - intercept, β - slop, i - country, t - time and remainder, and ε_{it} - the error term, which varies over both country, and time.

In the case of model 1, the results of Ramsey's Reset Tests, assuming square and cube, cube only, and square only, suggest a linear relationship between natural logarithm of tax revenues and type of voting.
In order to find a good specification, we have tested three control variables: GDP, fiscal balance and adult literacy index (only GDP and adult literacy rate are treated as elasticity, the fiscal balance having negative values). GDP and fiscal balance are variables with major impact on tax revenues, while adult literacy index is a cultural proxy variable for tax conformation.
(c) GDP (gdp) represents the GDP in U.S. dollars. The source of the data is World Bank online data-base.
(d) Fiscal balance (b) reflects the amount of fiscal balance as percent in GDP. The data has been taken from the International Monetary Fund online data-base.
(e) Adult literacy index (l) is a measure used to determine how many adults can read and write in a certain area or nation as percent in total adult population. The source of the data is United Nations Development Programme online data-base.
The extended linear model becomes:

$$\ln(r_{it}) = \alpha + \beta_1 v_{it} + \beta_2 \ln(gdp_{it}) + \beta_3(b_{it}) + \beta_4 \ln(l_{it}) + \varepsilon_{it}, \tag{3}$$

where α - intercept, β - slope, i - country, t - time and remainder, and ε_{it} - the error term, which varies over both country and time.

Based on Akaike, Schwarz and Hannan-Quinn criterions, Table 2 shows that the OLS model 8 can be considered representative to describe the connection between tax revenues and type of voting.

In relation (2), the error term ε_{it} can be $\varepsilon_{it} = \lambda_i + \mu_{it}$, with λ_i - constant across individuals, and μ_{it} - normally distributed error or, in other words, $\mu_{it} \approx N(0, \sigma_\mu^2)$.

Thus, other two types of panel models can be performed in this case:

(a) Fixed-effects models, with this shape:

$$\ln(r_{it}) = (\alpha + \lambda_i) + \beta_1 v_{it} + \beta_2 \ln(gdp_{it}) + \beta_3 (b_{it}) + \beta_4 (\ln l_{it}) + \mu_{it}, \tag{4}$$

where λ_i is part of a constant, but varies by individual, and

(b) Random-effects models, which can be specified as follows:

$$\ln(r_{it}) = \alpha + \beta_1 v_{it} + \beta_2 \ln(gdp_{it}) + \beta_3 (b_{it}) + \beta_4 \ln(l_{it}) + (\lambda_i + \mu_{it}), \tag{5}$$

where λ_i is part of an error term (error variances varying across groups and/or times).

As the panel-data model may have heterogeneity in the data, we analyze this propriety in both cases of fixed and random effects panel-models types (Table 3). First, we perform the hypothesis tests to choose between pooled model and fixed-effects model (cross-section), respectively random-effects model. Second, we study the hypothesis tests to choose between fixed-effects model and random-effects model.

The null hypothesis of no cross-sectional heterogeneity is rejected with F-statistic F(132,1297) = 62.4523 (p-value=0.00). F-test illustrates that cross-sectional fixed model 9 is preferred to the pooled model 8.

The Breusch-Pagan test for the random-effects has the Chi-square= 5049.36, with p-value=0.00, so the null hypothesis of no cross-sectional heterogeneity is rejected. The random model (10) is preferred to the pooled model 8.

Finally, for the random-effects model 10, the Hausman test, with a Chi-square= 26.3163 (p-value=0.00), suggests that the fixed-effects model 9 is preferred to random-effects model 10.

As the model 9 has an estimation problem in respect to variables v, we fix this think performing a new model 11, with robust standard errors.

Therefore, the last model 11 can be considered representative and stable to describe the relationship between tax revenues and type of voting. The empirical results, in the case of 135 investigated countries, reveal that all considered determinants have significant impact on tax revenues.

This means that the level of collected tax revenues depends upon type of voting (as it is compulsory or voluntary), having the same direction in respect to dummy variable v, under positive impact of GDP, sold of fiscal balance and adult literacy index. In other words, a compulsory vote tends to increase the tax revenues collected by public authority.

4. Conclusions

The citizens have a different behaviour in respect to vote, as it is viewed as civil duty or civil right. If the vote is compulsory, they can be more responsible regarding the tax payment. In this way, the empirical results point out a strong relationship between type of voting and collected tax revenues, under significant and positive influence of GDP, sold of fiscal balance and adult literacy rate. As the two main investigated variables have the same sign, collected tax revenues tends to increase only if the vote is viewed as a civil duty. In the other words, the compulsory voting improves the collection of tax revenues.

The transmission channel has a motivational reason. On the one hand, if the voting is voluntary (civil right), the taxpayers don't realize the entirely importance of taxes. Thus, the taxes become "voluntary" trough the evasion and avoidance phenomena. On the other hand, if the voting is compulsory (civil duty), the taxpayers view the taxation as a very important "duty". In this case, they reject almost all possibilities of tax evasion and tax avoidance.
In the context of tax-policy implications, the study suggests that a significant increase of collected tax revenues, without a major negative reaction of taxpayers, can be easily obtained by public authority if the voting is compulsory. Concerning taxation, as the main government financing source, there is no doubt that compulsory voting gains the battle over voluntary voting.

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Appendix

Table 1: List of analyzed countries

Countries				
Afghanistan, I.R. of	China,P.R.:Hong Kong	Hungary	Malaysia	Rwanda
Albania	Colombia	Iceland	Mali	Samoa
Algeria	Congo, Dem. Rep. of	India	Malta	Saudi Arabia
Argentina	Congo, Republic of	Indonesia	Mauritius	Senegal
Armenia	Costa Rica	Iran, I.R. of	Mexico	Slovak Republic
Australia	Côte d'Ivoire	Ireland	Moldova	Slovenia
Austria	Croatia	Israel	Mongolia	Spain
Azerbaijan, Rep. of	Cyprus	Italy	Morocco	Sudan
Bahrain, Kingdom of	Czech Republic	Jamaica	Mozambique	Swaziland
Bangladesh	Denmark	Japan	Nepal	Sweden
Belarus	Djibouti	Jordan	Netherlands	Switzerland
Belgium	Dominican Republic	Kazakhstan	New Zealand	Tajikistan
Benin	Ecuador	Kenya	Nicaragua	Togo
Bolivia	Egypt	Korea, Republic of	Niger	Tonga
Botswana	El Salvador	Kuwait	Nigeria	Trinidad and Tobago
Brazil	Estonia	Kyrgyz Republic	Norway	Tunisia
Brunei Darussalam	Ethiopia	Lao People's Dem.Rep	Oman	Turkey
Bulgaria	Fiji	Latvia	Pakistan	Uganda
Burkina Faso	Finland	Lebanon	Panama	Ukraine
Burundi	France	Lesotho	Paraguay	United Arab Emirates
Cambodia	Georgia	Liberia	Peru	United Kingdom
Cameroon	Germany	Libya	Philippines	United States
Canada	Ghana	Lithuania	Poland	Uruguay
Central African Rep.	Greece	Luxembourg	Portugal	Uzbekistan
Chad	Guatemala	Macedonia, FYR	Qatar	Venezuela, Rep. Bol.
Chile	Guyana	Madagascar	Romania	Vietnam
China,P.R.: Mainland	Honduras	Malawi	Russian Federation	Zambia

Table 2: OLS regressions results

Dependent variable: ln(r) (ln tax revenues in $)								
Independent variables	Model 1 (naïve)	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
Constant	9.01018*** [132.7] (0.0000)	-1.93462*** [-38.00] (0.0000)	9.05598*** [133] (0.0000)	9.67504*** [131.1] (0.0000)	-1.95227*** [-40.89] (0.0000)	-1.49740*** [-29.46] (0.0000)	9.73553*** [132.1] (0.0000)	-1.51987*** [-31.95] (0.0000)
v	0.768301*** [5.107] (0.0000)	-0.17265*** [-6.648] (0.0000)	0.804591*** [5.348] (0.0000)	0.423312*** [3.038] (0.0024)	-0.130814*** [-5.433] (0.0000)	-0.21653*** [-9.293] (0.0000)	0.429668*** [3.094] (0.0020)	-0.176228*** [-8.218] (0.0000)
ln(gdp)		1.06652*** [220.7] (0.0000)			1.06959*** [236.6] (0.0000)	1.03704*** [226.5] (0.0000)		1.04012*** [243.6] (0.0000)
b			0.0320391*** [3.415] (0.0007)		0.0228215*** [15.40] (0.0000)		0.0242495*** [6.823] (0.0047)	0.0215964*** [16.44] (0.0000)
ln(l)				2.99668*** [16.74] (0.0000)		0.607055*** [19.25] (0.0000)	3.04090*** [17.11] (0.0000)	0.577412*** [19.85] (0.0000)

Model summary								
R-squared	0.017609	0.971534	0.024668	0.176328	0.97571	0.977319	0.190351	0.980962
F-statistic	26.08041 (0.000000)	24812.60 (0.000000)	18.09630 (0.000000)	19147.67 (0.000000)	155.6331 (0.000000)	20869.69 (0.000000)	112.0656 (0.000000)	18407.73 (0.000000)
Akaike criterion	6580.816	1423.152	6448.384	6326.067	1155.008	1094.175	6183.407	807.6804
Schwarz criterion	6591.384	1439.004	6464.189	6341.92	1176.081	1115.312	6204.48	834.0215
Hannan-Quinn criterion	6584.759	1429.066	6454.285	6331.982	1162.876	1102.061	6191.275	817.5155
Ramsey RESET Test: (1) F-statistic (square and cube)	0.000000 (0.0000)							
(2) F-statistic (cube only)	0.000000 (0.0000)							
(3) F-statistic (square only)	0.000000 (0.0000)							

(a) […] denotes the t-stat, while (…) shows the attached probability;

(b) ***, **, and * denote significance at 1, 5 and 10 % level of significance, respectively.

Table 3: Fixed and random effects results

Dependent variable: $\ln(r)$ (ln tax revenues in $)			
Independent variables	Model 9	Model 10	Model 11
	FE	RE	FE with robust standard errors
Constant	-2.21411*** [-21.96] (0.0000)	-1.95282*** [-22.50] (0.0000)	-2.21411*** [-10.91] (0.0000)
v	0.0831119 [1.106] (0.2689)	-0.0914977* [-1.854] (0.0639)	0.0831119*** [9.206] (0.0000)
$\ln(gdp)$	1.09843*** [124] (0.0000)	1.07801*** [145.5] (0.0000)	1.09843*** [58.91] (0.0000)
b	0.0159952*** [21.42] (0.0000)	0.0164000*** [22.06] (0.0000)	0.0159952*** [8.447] (0.0000)
$\ln(l)$	0.452225*** [6.932] (0.0000)	0.495490*** [9.323] (0.0000)	0.452225** [2.494] (0.0127)
Model summary			
R-squared	0.997412	0.950787	0.997412
F-statistic	3675.295	6901.965	3675.295

	(0.000000)	(0.000000)	(0.0000)
Akaike criterion	-1789.886	928.8419	-1789.886
Schwarz criterion	-1068.14	955.1831	-1068.14
Hannan-Quinn criterion	-1520.404	938.6771	-1520.404
F test	62.4523 (0.0000)		62.4523 (0.0000)
Breusch-Pagan test		5049.36 (0.0000)	
Hausman test		26.3163 (0.0000)	

(a) […] denotes the t-stat, while (…) shows the attached probability;

(b) FE and RE denote cross-section fixed-effects, respectively cross-section random-effects.

(c) ***, **, and * denote significance at 1, 5 and 10 % level of significance, respectively.