UNIVERSITÉ DU BURUNDI
GRENIER DU SAVOIR DU BURUNDI
Dépôt institutionnel officiel
https://repository.ub.edu.bi

Statistic Modeling for Understanding the Origin of the Random Effects in the Tax Revenues Panel Data System in DR-Congo : Case of North-Kivu Province

Byamungu, Wanguwabo David; Nahayo, Fulgence; Fono, Louis Aimé; Et al.

2021

Mathematical and Statistical Economics

https://repository.ub.edu.bi/handle/123456789/1290

Document téléchargé depuis le **Grenier du Savoir du Burundi** — https://repository.ub.edu.bi

Mathematical and Statistical Economics, Vol. 3, 2021, no. 1, 1 - 17
HIKARI Ltd, www.m-hikari.com
https://doi.org/10.12988/mse.2021.987

Statistic Modeling for Understanding the Origin of the Random Effects in the Tax Revenues Panel Data System in DR-Congo: Case of North-Kivu Province

Wanguwabo David Byamungu

Laboratoire Universitaire de Recherche en Modélisation et en Ingénierie de la Statistique appliquée "LURMISTA"-ISTA/University of Burundi in Doctoral School of University of Burundi, Burundi

Fulgence Nahayo

Laboratoire Universitaire de Recherche en Modélisation et en Ingénierie de la Statistique appliquée "LURMISTA"-ISTA/University of Burundi in Doctoral School of University of Burundi, Burundi

Louis Aimé Fono

Laboratoire de mathématiques-Equipe de Recherche en Mathématiques appliquées aux Sciences Sociales-EMASS, University of Douala, Cameroon

Moses M. Manene

Research Center in Applied Mathematics, University of Nairobi, Kenya

This article is distributed under the Creative Commons by-nc-nd Attribution License.
Copyright © 2021 Hikari Ltd.

Abstract

Forecasting tax revenues, particularly in Democratic Republic of the Congo economy, is an uphill task. Recent past of the country has been dominated by economic uncertainty, precisely in mining and in agriculture sectors. This factor, alone, has greatly contributed to high volatility of tax revenues collected by

customs officers. The fuzzy characteristic of tax revenues has made it quite impossible for researchers to detect or distinguish from randomness the three well known components of a classical time series, precisely trends, seasonality, and cyclical phenomena .What are the factors which explain the random effects in the tax revenues panel in DRC? Our purpose is to detect and understand the origin of the random effects in the tax revenues panel data in DR-Congo through statistics about citizen's perceptions around tax operation. A quantitative questionnaire with scaled values, open and closed questions, consisting in collecting various perceptions of different economic operators in the import-export sector has been administered to 170 taxpayers randomly selected. Through Analysis of variance, t-test analysis and Pearson Chi-square results show that dissatisfaction of taxpayers, lack of legitimacy in political institutions and government policies, highest tax rate, non-compliance with tax rate for all taxpayers, low level of knowledge in tax matters and corruption, fraud and tax evasion perpetuated by customs officers are the most factors which explain the random effects in DRC's tax revenues panel data. Marital status is not a source influencing taxation. Mind of counterpart of the taxes in terms of achievements for improving social conditions which is not visible involves broken contract between taxpayers and tax authorities for several reasons sources of random effects above developed.

Keywords: Origin of Random effects, statistic modeling, tax revenues, panel data system, DRC, North-Kivu Province

1. Introduction

The factor of economic uncertainty existing in DRC has contributed to the high volatility of tax revenues collected by the customs officers during the recent past and involves an uphill task in forecasting. The fuzzy characteristics of tax revenues has made it quite impossible for researchers to detect or distinguish from randomness the three well known components of a classical time series, precisely trends, seasonality, and cyclical phenomena [2]. Classical forecasting methods or smoothing methods as discussed in most time series textbooks, see for instance [1, 4], may lead to the results that are not reliable and reasonable economically. The increasing uncertainty that characterizes each annual tax revenue time series makes tax revenues panel data to escape the three well known components of time series. What is the origin of the factors which explain random 'effects in DRC's taxes?

The quality of governance and the seriosity of those in power could be a major factor that motivates or demotivates citizens to pay taxes or levies. That is why adequacy between fiscal function and public achievements is presented as a contract seen as mobilizing factor and legitimizing taxation in the state, and the relationship of the taxpayer to the tax system is first and foremost of citizens' legitimacy problem in the government.

Regarding the situation of informal economy in DR-Congo, being the same in other countries like Burundi, Kenya, Uganda, Rwanda, Tanzania, Zambia, etc.;

the degree of development and governance is a key-parameter of differentiation, and explains the unfavorable behaviour of the Congolese citizens vis-à-vis the collection of taxes by the state. More explanations in [22] and [16] are given. There is one broad answer to the question of degree of governance that appears in literature, in such context, which is justified by the remodel of taxation sector in a new public management moving of tax collection out the ministry of finance into a separate entity. In this perspective, we note Zambia Revenue Autority [25], Rwanda Revenue Authority [23], Uganda Revenue Authority[12], Tanzania Revenue Authority[25], Kenya Revenue Authority [23]), and Revenue office of Burundi which are governance arrangements of tax collection under contract with mission of protecting the tax collection process from the corrosive routine political interests of the head of the State. Furthermore, Congolese citizens behaviour is always reinforced by the endemic phenomenon of corruption, in particular, within the tax administration. It is a whole system, fueled in particular by the culture of impunity. This fact is confirmed by [13], [8] and [9] in their literature. We must also evoke the practice of tax evasion to describe the problem of taxation in the context of the DR Congo. On one hand, should we think about the disappointment of taxpayers in the inefficient use of state resources? Does not fraud come from the weight of taxation or from the ignorance of taxpayers, on the other hand? The first situation is justified by the fact that the state is not concerned with improving the living conditions and the well-being of citizens, and the second, the taxpayer considers that the tax is no longer a contribution in the common charges of the state but rather a sacrifice imposed on him unilaterally by the decent public power that he is obliged to bow. This fact is confirmed in [16, 7]. Indeed, a large Congolese opinion considers taxation as a form of predation of the people by the political power. From this perspective, state tax collectors are generally perceived as "stalkers", "thieves", as we understand them in the ordinary language of the average Congolese citizen and [11] qualifies tax or levy as racketeering, a means for an unjust enrichment for the benefit of the ruling class.
These received ideas or negative stereotypes about collection of taxes and levies constitute the main argument of the general conviction that Congolese people have no tax culture. It is also very usual to speak of “tax fraud” and “corruption” to describe the situation in DR-Congo. However, considered as a variable, this fiscal incivism on the behalf of the Congolese would partly explain the low rate of revenue mobilization by the services committed for this purpose.
Thus, our main objective is to detect and understand the origin of the random effects in tax revenues panel data in DR-Congo through statistics on citizen’ perceptions around tax practice.

2. Research methodology

The present sub-point data collected as well as the methodology used to collect data on the field. Data collected on the field are from all traders’ categories such as construction materials traders, cosmetics traders, agricultural exporters, manufacturing traders. This will help the generalization of the results in the whole

province. This phase was followed by data collection of the field carried through the questionnaire to detect and understand the origin of the random effects through the taxpayer, social representations around tax system. Quantitative research was used to conduct the survey carried out with taxpayers.

2.1. Geographical area of study and target of the population

2.1.1. Geographical area of the study

Due to financial constraints, North-Kivu province was first divided into three areas corresponding to three customs posts for collecting import-export taxes where we have to meet traders for collecting through the questionnaire their perceptions on the Congolese taxation system.

2.1.2. Target population

The target population consists of traders who import or export goods.

2.2. Sampling technique

The objective is to conceive a sample that can give reliable statistic estimations. It is necessary to note that for the indicators measure needs, it is necessary to have a size of sample assuring representativeness, attitudes, understanding of the perception, ie a sample that can provide statistically reliable estimates. It should be noted that to measure indicators (perceptions), the sample size should be representative, as understanding of the attitudes, perceptions and behaviour can be discovered through the questionnaire and can explain the origin of fluctuations in tax revenues.

2.2.1. Calculation of the quantitative size sample

The size of the required quantitative sample to assure data representativeness is calculated using the following formula from [6]:

$n = (z^2) (r) (1-r) (f) (k) / (E2)$ Where:

-n is the sample size that means the number of respondents (traders for import-export);

-z is the statistics which defines the required level of confidence. Registered value is z=1.96, for a confidence degree of 95 %;

- r is an estimate of one of the key indicators to be measured during research. When the research includes more than one key metric, they consider the weakest metric that leads to the larger sample size. In this study, the weakest indicator is non-payment of taxes (70%),

-f is the effect of opinion poll attributable to the conception of the sample. Here, we consider that it is equal to 1.02;

-k is the multiplier aiming at taking into account the rate of non-answer. We will keep 5 % for non-answers (k=1.012); E for the margin of error. This value should not exceed 15 %. We fix it to 10 % of r; therefore, E= 0.1r. Considering these factors, the sample size is 170 from a total of 3096 traders registered in three customs posts throughout the province.

2.3. Data collection preliminary phase

2.3. 1. Conception of data collection tools

The tools used for this study were already conceived and are consistent with those of other citizen 'perceptions about the taxes which can be the source of random effects. Therefore, it was necessary to adapt to DRC taxpayers' context. In fact, it

was the quantitative questionnaire which consisted of collecting various perceptions of different economic operators in the import-export sector. The perceptions will be collected in isolation questionnaire, where answers are presented as scaled measures.

2.3.2. Recruitment and training of the field agents.

The team in charge of data collection was of investigators and supervisors identified among the teachers of Faculty of Sciences and Applied Studies and National School of Statistics. Their theoretical training on how to fill the questionnaire and a practical training through role-plays so as to simulate the discussions which occurred two days ago.

2.3.3. Preparation for data collection on the field

The personnel in charge of data collection was made up of three teams of four persons each, operating in three areas customs posts of the province. These teams were monitored by a technical coordinator who was also on the field during the time of data collection. A day was enough to cover the entire area because they met taxpayers at the boarder claiming their goods. Then, all the three teams moved for five days to meet every category of taxpayers sand a strict monitoring of data collection and an efficient control through daily meetings on data collection evaluation were performed.

2.4. Data analysis

2.4.1. Data capture: The stage of data capture is very important as far as it helps to enter data into a language that the computer can read and compute. IBM SPSS 23 software (Statistical Package for Social Sciences IBM 23) was used to enter data on a model beforehand. This stage mobilized six data capture agents and two inspectors during four days. A two days training for data capture agents and three days for the inspectors had been organized for the agents before the beginning of data capture.

2.4.2. Data analysis and drafting

To ensure that the objectives were achieved and to harmonize the results'presentation format, a framework was defined, including the list of taxpayers'social representations and figures and tables to be produced, which were used as guide in the data analysis. Basing on this tapestry work the pictures / graphs of perceptions were produced through SPSS software.

3. Main results analysis

In this part, we present the results of the field survey on "social representations or perceptions around tax practice in North-Kivu" in detecting the origin of random effects in tax revenues using analysis of variance or student t-test on the one hand to detect if there is statistical difference between Dependent variables (marital status, type of trader activity, school or academic stream, interest or not in paying tax, registered and unregistered traders) and Factors: X_1(the tax rate applied to goods), X_2 (the deadline granted by DGDA for tax payment), X_3 (the efficiency of the recovery method when declaring goods), X_4 the level of constraint of the recovery mode used by DGDA), X_5(the point of view with regard to the current

tax rate in DRC), X_6 The approach of DGDA agents to taxpayers in collecting taxes), X_7(the degree of satisfaction of taxpayers with the government's use of taxes collected), X_8 (the means used in case of non-declaration of goods), X_9 (the degree of taxapayers' knowledge in tax matters in DRC), X_{10} (the assessment of import rate of revenues on import-export goods in DRC), X_{11}(The mode used for the passage through customs of their goods) and Chi-Pearson which allows us to determine related variables which can mutually influence and then be a source of random effects.

3.1. Analysis of Variance and t-test results

Table $N^0$1: Anova Results

Is there a statistical significant difference between Single, Married, Divorced, Widowed traders on X1, X2, X3, X4, X5, X6, AND X7?		There is no statistically significant difference between Single, Married, Divorced, Widowed traders on X1, X2, X3, X4, X5, X6, X7:					Decision
		Sum of Squares	df	Mean Square	F	Sig.	
X1	Between Groups	3.58	5	.71	.90	.48 (ns)	As p-value >.05, Ho is not rejected
	Within Groups	130.81	164	.79			
	Total	134.40	169				
X2	Between Groups	4.85	5	.97	.99	.42 (ns)	As p-value >.05, Ho is not rejected
	Within Groups	160.34	164	.97			
	Total	165.20	169				
X3	Between Groups	1.09	5	.21	.56	.72 (ns)	As p-value >.05, Ho is not rejected
	Within Groups	63.35	164	.38			
	Total	64.44	169				
X4	Between Groups	1.49	5	.29	.73	.59 (ns)	As p-value >.05, Ho is not rejected
	Within Groups	66.48	164	.40			
	Total	67.97	169				
X5	Between Groups	.66	5	.133	.10	.99 (ns)	As p-value >.05, Ho is not rejected
	Within Groups	207.31	164	1.26			
	Total	207.97	169				
X6	Between Groups	3.73	5	.74	1.28	.27 (ns)	As p-value >.05, Ho is not rejected
	Within Groups	94.85	163	.58			
	Total	98.59	168				
X7	Between Groups	6.86	5	1.37	.61	.68 (ns)	As p-value >.05, Ho is not rejected
	Within Groups	365.84	164	2.23			
	Total	372.71	169				

Anova results from table $N^0 1$ prove that there is no statistically significant difference between Single, Married, Widowed, Divorced traders on X_1, X_2, X_3, X_4, X_5, X_6, and X_7 because all p-values are greater than .05,which led to the non-rejection of null hypothesis resumed in table N°1.

Table $N^0 2$: Anova results of Dependent variable Type of commercial activity on X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8, X_9 and X_{10}.

Is there a statistically significant difference between importing, exporting or import-exporting traders on X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8, X_9 AND X_{10}?		There is no statistical significant difference between importing, exporting or import-exporting traders on x_1, x_2, x_3, x_4, x_5, x_6, x_7, x_8, x_9 and x_{10} :					Decision
		Sum of Squares	df	Mean Square	F	Sig.	
X_1	Between Groups	.24	2	.12	.14	.86 (ns)	As p-value >.05, Ho is not rejected
	Within Groups	134.16	167	.80			
	Total	134.40	169				
X_2	Between Groups	.86	2	.43	.43	.64 (ns)	As p-value >.05, Ho is not rejected
	Within Groups	164.34	167	.98			
	Total	165.20	169				
X_3	Between Groups	.12	2	.06	.15	.85 (ns)	As p-value >.05, Ho is not rejected
	Within Groups	64.32	167	.38			
	Total	64.44	169				
X_4	Between Groups	2.20	2	1.10	2.79	.06 (ns)	As p-value >.05, Ho is not rejected
	Within Groups	65.77	167	.39			
	Total	67.97	169				
X_5	Between Groups	1.07	2	.53	.43	.64 (ns)	As p-value >.05, Ho is not rejected
	Within Groups	206.89	167	1.23			
	Total	207.97	169				
X_6	Between Groups	.56	2	.28	.47	.62 (ns)	As p-value >.05, Ho is not rejected
	Within Groups	98.02	166	.59			
	Total	98.59	168				
X_7	Between Groups	.09	3	.03	.07	.97 (ns)	As p-value >.05, Ho is not rejected
	Within Groups	73.3	166	.43			
	Total	71.4	169				

Table N^{0}2 (continued): Anova results of Dependent variable Type of commercial activity on X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8, X_9 and X_{10}.

X_8	Between Groups	.30	2	.15	.38	.67 (ns)	As p-value >.05, Ho is not rejected.
	Within Groups	65.9	167	.39			
	Total	66.21	169				
X_9	Between Groups	.22	2	.11	.23	.79 (ns)	As p-value >.05, Ho is not rejected.
	Within groups	78.73	164	.48			
	Total	78.95	166				
X_{10}	Between Groups	.72	2	.36	.25	.77 (ns)	As p-value >.05, Ho is not rejected
	Within groups	238.97	167	1.43			
	Total	239.70	169				

Through table N^{0}2, it is seen that there is no statistical significance difference between Importing, Exporting and Importing-Exporting traders on X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8, X_9 and X_{10}

Table N^{0}3: Anova Results

Is there a statistically significant difference between traders with no school or academic level, having been in management or economics domains or other scientific area on X_1, X_2, X_3, X_4, X_5, X_6, X_7 and X_8?		There is no statistically significant difference between traders with no school or academic level,with economics degree or other scientific area:					Decision
		Sum of Squares	df	Mean Square	F	Sig.	
x_1	Between Groups	2.87	2	1.43	1.82	.16	As p-value >.05, Ho is not rejected
	Within Groups	131.53	167	.78			
	Total	134.40	169				
x_2	Between Groups	3.64	2	1.82	1.88	.15	As p-value >.05, Ho is not rejected
	Within Groups	161.56	167	.96			
	Total	165.20	169				
x_3	Between Groups	1.45	2	.72	1.92	.14	As p-value >.05, Ho is not rejected
	Within Groups	62.99	167	.37			
	Total	64.44	169				
x_5	Between Groups	6.31	2	3.15	2.61	.07	As p-value >.05, Ho is not rejected
	Within Groups	201.66	167	1.20			
	Total	207.97	169				
x_6	Between Groups	.44	2	.22	.37	.68	As p-value >.05, Ho is not rejected
	Within Groups	98.14	166	.59			
	Total	98.59	168				
X_7	Between Groups	.20	2	.10	.04	.95	As p-value >.05,Ho is not rejected
	Within Groups	372.51	167	2.23			
	Total	372.71	169				
x_9	Between Groups	4.13	2	2.06	4.53	.01	As p-value <.05, Ho is rejected
	Within groups	74.83	164	.45			
	Total	78.95	166				
x_{10}	Between Groups	21.09	2	10.54	8.97	.00	As p-value <.05, Ho is rejected
	Within groups	182.20	155	1.17			
	Total	203.29	157				

In view of the results contained in table N03, we note that there is no significant statistical difference between non-intellectual traders, traders with an academic

qualification in economics and traders who have completed other scientific area respectively on X_1, X_2, X_3, X_5, X_6, X_7 and therefore the hypotheses put forward for these different variables were not rejected. Rather, a statistical significant difference between non-intellectual traders, traders with an academic qualification in economics and traders who have studied in other fields emerged in the degree of payers' knowledge on tax matters X_9 **(F (2,164) = 4.53, p <.05)** and on the assessment of the tax rate on import-export goods X_{10} **(F (2.155) = 8.97, p <.05).**Tax knowledge and awareness was found to be statistically significant in explaining tax compliance among Export Processing Zones investors in Kenya. The study findings revealed that tax knowledge & awareness has a very close relationship with taxpayers' ability to understand the laws and regulations of taxation, and their ability to comply with them [15]. In DRC, the low knowledge and awareness in tax matter have an impact in tax compliance and involves loss of tax culture and thus explain the random effects in taxes.

Table N^{0}4: t-test results

Is there a statistically significant difference between merchants interested in paying taxes and merchants not interested in paying taxes on X5, X6, X7, X9 and X10?		There is no statistically significant difference between merchants interested in paying taxes and merchants not interested in paying taxes on (1), (2), (3), (4) and (5).					Decision
		Levene's test for Equality of variances		t-test for Equality of means			
		F	Sig.	t	df	Sig.(2-tailed)	
x_5	Equal variances assumed	1.68	.19	-1.66	168	.09	As p-value >.05, Ho is not rejected
	Equal variances not assumed			-1.6	93.3	.11	
x_6	Equal variances assumed	6.35	.01	1.19	167	.23	As p-value >.05, Ho is not rejected
	Equal variances not assumed			1.25	111.97		
x_7	Equal variances assumed	11.33	.00	3.01	168	.003	As p-value <.05, Ho is rejected
	Equal variances not assumed			3.24	124	.002	
x_9	Equal variances assumed	.03	.08	1.24	165	.21	As p-value >.05, Ho is not rejected
	Equal variances not assumed			1.23	100	.21	
x_{10}	Equal variances assumed	.11	.73	.44	168	.66	As p-value >.05, Ho is not rejected
	Equal variances not assumed			.43	99.7	.66	

From table N^{0}4, we notice that there is no statistically significant difference between the traders having the interest to pay the taxes and the traders having no interest to pay the taxes on X_5, X_6, X_9, X_{10} and it stood out in X_7 because, in fact, the satisfaction of the compensations expected by the taxpayers from the State encourages them to subscribe or not to the payment of the tax. As mentioned in

the introduction, contract rupture is among the sources of resistance for taxpayers to pay tax and it is the main source of random effects in tax revenues. So [10] argued that if the system of taxes is perceived to be unjust, tax evasion may, at least partly, be considered as an attempt by the taxpayer to adjust its terms of trade with the government. Individuals may pay taxes because they value goods provided by the government, and they recognize that their payments are necessary both to help finance goods and services and to get others to contribute [5]. Interest in paying tax is broken since most taxpayers cannot assess exact value of what they receive in return for taxes paid. It can be argued that they have general impressions and attitudes concerning their own and others' terms of trade with the government [20].

Table N^{0}5: Anova results

Different hypotheses H0 to be checked according to the different dependent variables.		There is no statistically significant difference between registered and unregistered traders on					Decision
		Sum of Squares	df	Mean Square	F	Sig.	
X_{11}	Between Groups	2.04	2	1.02	6.06	.003	As p-value <.05, Ho is rejected
	Within Groups	27.95	166	.16			
	Total	3.00	168				

The test of homogeneity of variances, based on mean with p-value=.21 >.05, has allowed us to move toward Anova analysis. Anova result shows that F (2,166) =6.06; p<.05 there is a statistical significant difference between registered and unregistered traders on the mode used to cross goods. This is the opportunity to insist on mafia mode, corruption and tax evasion maintained by traders and custom officers to allow to bring goods through the country or out of the country without paying. In short, tax system is enmeshed in tax arrangements that tend to corruption, fraud and tax evasion and having become an endemic culture and maintained in the tax system. Corruption and embezzlement of public funds by tax officials lead taxpayers to subscribe to the logic of cooperating with tax agents and / or using influential people interposed in order to pay less to the detriment of the state fund. Tax authorities' unresponsive, corrupt and unfair treatment of taxpayers foster disrespect for and resistance against tax authorities and tax laws [12, 21]. In addition to dissatisfaction, these attitudes encourage taxpayers to evade tax and push them to reach an amicable arrangement to move goods across the border. Hypotheses of corruption and tax evasion maintained by the tax administration are here confirmed and are the most factor of random effects observed in DRC taxes. This is also confirmed by [18] in its literature. Tax systems, in most poor countries, are characterized by widespread corruption and tax evasion. The inefficiency of the tax system is also the basis of tax loss and involves randomness in his components. This inefficiency is linked to several parameters, including hiring unqualified, non-credible agents who are at the same time tax agents and tax advisers to individuals subjected to tax. This is a tax administration that is involved in tax fraud. Credibility, qualification of staff

administration have an impact on taxation system and can constitute a source of volatility of taxes [17, 14].

3.2. Analysis based on related variables

This sub-point present the results of combined analysis from variables using Pearson Chi-square to detect related variables that can be the source of random effects in mutual influence. Pearson Chi-square results tests considered for all variables are presented in tables about which conclusions are dressed.

3.2.1: Link level between the public benefits and the interest in paying tax.

Is there a link between the interest in paying state tax and the achievements or consideration given by the government? With the null hypothesis: there is no link between the interest in paying state tax and the achievements given by the government, Chi-square is the appropriate test for analyzes of non-parameterized distribution.

Table N^{0}6: Link between public benefits and interest in paying tax

		Realizations on the ground from the paid taxes		Total
		Yes	No	
Interesting in paying the state tax for the declaration of goods	Yes	48	68	116
	No	8	46	54
Total		56	114	170

Table N°7: Chi-square results

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	11.77	1	.001
Number of Valid Cases	170		

As χ^2 **= 11.77 and p = .001 <.05** then the null hypothesis according to which there is no link between the interest in paying the state tax and the achievements provided by the government on the ground is rejected. So the interest in paying tax by the taxpayers is linked to the achievements that the government provides in terms of counterpart

3.2.2: Linked level between satisfaction and public revenue from taxes

Is there a link between the satisfaction of the use by the tax authorities of the taxes collected and the achievements on the ground?

Null hypothesis: there is no link between the satisfaction of the use by the tax authorities of the taxes collected and the achievements in the field

Chi-square is the appropriate test for analyzes of non-parameterized distribution.

Table N°8: Contingence table between the two variables.

		Satisfied with the government's use of the paid tax					Total
		Not satisfied	Satisfied	Very satisfied	No idea	Moderately satisfied	
Realizations on the ground from tax	Yes	21	12	1	12	10	56
	No	72	11	3	22	6	114
Total		93	23	4	34	16	170

Table N°9: Chi-square results

	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	14.89	4	.005
Number of Valid Cases	170		

As $\chi 2 = 14.89$ and $p = .005 < .05$ then the null hypothesis according to which there is no link between the satisfaction of the use of the taxes collected by the fiscal authority and the achievements on the ground is rejected. This reveals that the satisfaction of the use of the taxes collected and the achievements on the ground are linked and this can lead to the establishment of a good tax culture, the basis of a good tax administration and the avoidance of fluctuation.

III.2.3: Linking between basic product and tax rate

Is there a link between the tax rate and the products declared by the taxpayers?

Null hypothesis: there is no link between the tax rate and the products declared by taxpayers. Then,Chi-square is the appropriate test for analyzes of non-parametric distribution.

Table N°10: Contingency results between basic product and tax rate

		Your activity is based on which product						Total
		Agricultural products	Mining products	Cosmetic products	Food products	Construction material products	Others	
The tax rate applied to goods	Lower	2	1	3	1	5	3	15
	High	9	6	16	17	25	9	82
	Fair	7	1	10	7	12	5	42
	Too high	3	0	9	6	7	6	31
Total		21	8	38	31	49	23	170

Table N°11: Chi-square Results

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	8.97	15	.87
Number of Valid Cases	170		

As $\chi^2 = 8.97$ and $p = .87 > .05$ the null hypothesis according to which there is no link between the tax rate and the products declared by the taxpayers is not rejected, i.e. the tax rate and the products declared by the taxpayers are not

related. The tax rate is determined by the tax administration and does not depend on the categories of goods that customers import or export. There is in tax administration a nomenclature to manage to tax goods.

3.2.4: Link between tax rate and marital status

Is there a link between the tax rate applied on the goods and the marital status of the trader? Through Chi-square we can test the null hypothesis that there is no link between the tax rate applied on the goods and the marital status of the trader.

Table N°12: Table of contingence between tax rate and marital status

		The level of tax rate applied to goods				Total
		Lower	High	Fair	Too high	
Marital status	Single	9	29	14	11	63
	Married	5	46	24	15	90
	Free union	0	2	1	3	6
	Divorced	1	5	3	2	11
Total		15	82	42	31	170

Table N° 13: Chi-square Result

	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	8,20	9	.51
Number of Valid Cases	170		

As χ^2=8.20 and p=.51>.05, the null hypothesis that there is no link between the tax rate applied to the declared goods and the marital status of the trader is not rejected, i.e. the tax rate and the marital status of the trader are not linked. The tax rate is not related to the marital status of the trader (taxpayer).

4. Discussion and conclusion

In this paper, we have explored factors that determine are the source of random effects through citizen's perceptions and whether how their tax behavior is correlated with their perceptions in case to understand the origin of random effects observed in DRC taxes panel data. Result from different analysis provide robust results for several theoretically founded determinants of tax compliance which show random effects 'source among others:

Respondents state that the tax rate is high (66.4%) and find it worthwhile paying taxes (68.2%). Moreover, the rate of taxation does not depend on the category of goods declared (see table $N^0$2 where F (2,167) =.86; p-value>.05), nor on the marital status of trader (see table $N^0$1 where F (2,167) =1.82; p-value>.05). Neither is there any link between the tax rate applied to goods and the marital status of the taxpayer (see table $N^0$12 where χ^2=8.20; p-value>.05), or between the imported goods and the tax rate (see table $N^0$11 where χ^2=8.97; p-value>.05).

Taxpayers do not see the social benefits in terms of the counterpart of the taxes they pay (67.1%). This confirms the statistical link observed between achievements on the ground and taxpayers' satisfaction (cfr. Table $N^0$8 where

χ^2=14.89; p-value<.05) on the one hand, and the link between public achievements for social benefits of taxpayers and the interest of paying the tax at the time of declaration (cf. table N^{0}7 where χ^2=11.77; p-value<.05) on the other hand. There is also a statistically significant difference between traders interested in paying tax and those who are not, in terms of satisfaction with the government's use of the taxes collected (see table N°4 where t(168)= 3.01; p-value<.05). According to [3] quoted by OECD "previous work using the 2008-2009 Latino barometro surveys shows a positive correlation between fiscal citizenship and satisfaction with education and health services". Because of dissatisfaction, taxpayer presents their goods for declaration to tax officials (82.9%) and is attracted by the cooperative welcome (74.1%) by tax officials or cooperates with influential authorities at different levels of government (17.6%) to move goods across. A small handful of taxpayers relies on customs declarants (8.2%) who in turn contact tax officials; this diversion is also a source of tax evasion. This is corroborated by the friendly (23.1%) and cooperative (37.3%) attitudes of tax administration agents adopted when collecting taxes. In addition to dissatisfaction, these attitudes encourage taxpayers to evade tax and push them to reach an amicable arrangement to move goods across the border. The hypotheses of corruption and tax evasion maintained by the tax administration is here confirmed by [18].Tax systems in most poor countries are characterized by widespread corruption and tax evasion. Tax compliance is influenced by the government counterpart which is offered to people to satisfy the public services such as infrastructure, education, electricity, health services,…In this paper, as there is no fiscal exchange visible, the taxpayer compliance attitude is to avoid tax and make cooperation in terms of corruption or arrangement with fisc employment. The dissatisfaction of public services offered is among factors which demotivate taxpayers to pay taxes.

Tax knowledge and awareness in tax matter have also a significant impact on tax compliance attitude since a statistical significance difference between non-intellectual traders, traders with an academic qualification in economics and traders who have studied in other fields respectively emerged in degree of knowledge on tax matters with (F (2,164) = 4.53;p <.05) and on the assessment of tax rate on import-export goods (F (2,155) = 8.97, p <.05). Fiscal knowledge correlates with attitudes towards taxation and that tax behaviour can be improved by a better understanding of tax laws [15]. In this study, knowledge and awareness contribute significantly to the model since the p-value (0.00) for the constant and gradient are less than 0.05, so in explaining tax compliance among Export Processing Zones investors in Kenya, tax knowledge and awareness were found to be statistically significant. The study findings revealed that tax knowledge and awareness have a very close relationship with taxpayers' ability to understand the laws and regulations of taxation, and their ability to comply with them [15]. In DRC, the low knowledge and awareness (54.5%) in tax matters have an influence in tax compliance and implies the loss of tax culture.

Contacting influential people in government (17.6%) or tax administration (74.1) to evade tax is a demotivating factor for those who even thought of paying

their taxes. This is also argued in [17]. In political governance, moving from ministry of finance to the separate entity granted in law, autonomy from the central executive power, partly with the purpose of limiting direct political interference in day-to-day operations [19].It is seen that low degree of development and governance compared to neighboring countries as developed in introduction is also the source of income fluctuations in the DRC

The lack of legitimacy in the political institutions and the government policy influences the taxpayers' attitudes and behaviour in this study which tend to evade tax. Legitimacy could be described as belief or trust in the authorities, institutions, and social arrangements to be appropriate, just and work for the common good. Political scientists have addressed how political legitimacy and civic identification are fostered [10].

Indeed, in this reflection, which focused on the perception or social representations around fiscal practice: the case of the city of North-Kivu Province, we noticed that taxpayers hold in mind the idea of counterpart of the taxes they pay in terms of achievements on the ground for the improvement of their social conditions. As this is not visible, the contract between the taxpayer and the tax authorities has been broken for several reasons. These include corruption, fraud and tax evasion perpetuated by tax agents seeking to wrap taxpayers in this allure and the latter subscribe to it in order to get richer. Also, the level of knowledge in tax matters is among factor influencing fluctuations in taxes revenues in DRC. The study shows that pay level is only one of several factors affecting the behaviour of tax officers. In an environment where the demand for corrupt services is extensive and monitoring ineffective, wage increases may end up functioning as an extra bonus on top of the bribes taken by corrupt. Those are several factors which explain random effects encountered in DRC tax revenues panel data.

Acknowledgements.
Sincere thanks to the Doctoral School of University of Burundi through the Institute of Applied Statistic 'LURMISTA' supported by the Government of Burundi through the Ministry of Education and Scientific Research. My gratitude to ' Laboratoire de Mathematique-Equipe de Recherche en Mathematiques Appliquées aux Sciences Sociales-EMASS' of University of Douala and Research Center in Applied Mathematics of University of Nairobi. My acknowledgments to my supervisors Professors NAHAYO Fulgence, MANENE M. Moses and Louis Aimé FONO for their high scientific quality advice.

References

[1] L.Bruce.Bowerman and Richard T. O'Connell, *Forecasting and Time Series: An Applied Approach*, Third edition, Duxbury Press, California, 1993.

[2] D. Byamungu Wanguwabo, Modeling tax income revenues using Kernel Approach. Case study of North-Kivu Province time series forecasting in Democratic Republic of Congo, *International Journal of Science and Research*, **8** (4) (2019).
[3] C. Daudet and A. Melguizo, Taxation and more representation?: On fiscal policy, social mobility and democracy in Latin America , Documents de travail du centre de développement de l'OCDE (2010), N0294, OCDE, https://doi.org/10.1787/5Km5Zrrs9bbt-en., p.30
[4] C. Douglas Montgomery, Cheryl L. Jennings, and Murat Kulahci, *Introduction to Time Series Analysis and Forecasting*, Wiley Series in Probability, John Wiley and Sons, Inc., Hoboken, New Jersey, 2008.
[5] O.H. Fjeldstad and J. Semboja, Why people pay taxes: The case of the development levy in Tanzania, *World Development*, **29** (2001), 2059-2074.
[6] Gaston Hakiza et al., Research Report on the state of the public service in Burundi, MFPTE, October, 2015.
[7] Global Witness, Les forets de la RDC victimes d'une grande braderie: Evasion fiscale, arrangements illégaux, **12** (20) (2013).
[8] Jens Chr.Andving and Odd-Helge Fjeldstand, Research on corruption. A policy oriented survey, Norwegian Agency for Development Co-Operation NORA, December, 2000.
[9] M. Kibanda, Le monstre appelé corruption. Kinshasa: Institut des stratégies pour le développement durable (2005), p.69.
[10] Merima et al., To pay or not pay ? Citizen's attitudes towards taxation in Kenya, Tanzania, Uganda and South Africa (2005), p.7.
[11] Mufundji Tshinat-kark Clément, Le systeme d'imposition des revenus en République Démocratique Congo. L'état de lieu, enjeux et perspectives d'avenir in KAS African law study library-Libraire Africaine d'études Juridiques 2 (2015), p.384
[12] P. Ngaosyvathn, Le Role de l'impot dans le pays en voie de développement T1, Paris (1974). LGDJ, pp.146-183.
[13] Ngoy Ndjibu and Mutonwa Kalombe Jean-Marie Pacifique, Analyse critique du système fiscal de la RDC: Fondément juridique et application de la loi, KAS African Law Study Library-Librairie Africaine d'Etudes juridiques2 (2015), p.495.
[14] Ngoy Ndjibu et al., Analyse critique du systeme fiscal de la rdc : fondement juridique et application de la loi, KAS African Law Study Library – Librairie Africaine d'Etudes Juridiques 2 (2015), p.491.
[15] Obongo Matibe Bernard et al., Influence of Tax Knowledge and Awareness on Tax Compliance Among Investors in the Export Processing Zones in Kenya (2018).
[16] OCDE, Quels sont les déterminants du civisme fiscal (2019)? Document de consultation publique, p.11.
[17] Odd-Helge Fjeldstad, Corruption in tax administration: Lessons from institutional reforms in Uganda (2005), CMI, p.11.

[18] Odd-Helge Fjeldstad, Fighting fiscal corruption: lessons from the Tanzania revenue authority, Public Admin. Dev. 23, 165–175 (2003) Published online in Wiley InterScience (www.interscience.wiley.com) DOI: 10.1002/pad.278
[19] Odd-Helge Fjeldstad and Mick Moore, Revenue Authorities and Public Authority in Sub-Saharan Africa, *The Journal of Modern African Studies*, **47** (1) (2009), pp. 1-18.
[20] S. Richupan, Determinants of income tax evasion: Role of tax rates, shape of tax schedules and other factors (1987), in: Gandhi, V. P. (ed.). International Monetary Fund.
[21] K.W Smith, Reciprocity and fairness: Positive incentives, in: J. Slemrod (ed.) Why people pay taxes. Tax compliance and tax enforcement (1992), Ann Arbor: The University of Michigan Press, pp. 223-250.
[22] B. Salanie, Théorie de la fiscalité, Paris (2002): Economica, p.7
[23] S. Terpker, Revenue authorities: a comparison of the experiences of Ghana and East African Countries, *Bulletin for International Fiscal Documentation*, **53** (1999), 171-179,
[24] O. Therkildsen, Autonomous tax administration in sub-Saharan Africa: the case of the Uganda Revenue Authority (2004), Forum for Development Studies.
[25] C. Von Soest, Donor support for tax administration reform in Africa: experiences from Ghana, Tanzania, Uganda and Zambia (2008), German Development Institute, discussion paper 2, Bonn: German Development Institute.

Received: March 17, 2021; Published: April 14, 2021