Research Journal of Applied Sciences, Engineering and Technology 6(10): 1799-1804, 2013
DOI:10.19026/rjaset.6.3906
ISSN: 2040-7459; e-ISSN: 2040-7467

Submitted: November 12, 2012 Accepted: February 18, 2013 Published: July 20, 2013

Research Article

Estimation of Tax Capacity and Effort and Oil Revenue

[1]Mahnaz Rabiei and [2]Fatemeh Esmaelnia Balagetabi
[1]Islamic Azad University South Tehran Branch, 209-Iranshahr Street, P.O. Box: 11365/4435, Tehran, Iran, Tel.: 0098-21-22894151; Fax: 0098-21-22904738
[2]Islamic Azad University, South Tehran Branch, Tehran, Iran

Abstract: In this study, the tax capacity and effort and its relationship with oil revenue of 6 selected countries member in OPEC such as Iran, Kuwait, United Arab Emirates, Venezuela, Algeria and Saudi Arabia are considered. The study has been applied by panel data within 1990-2008. According to the results of Husman test, fixed effects method was confirmed for estimation of panel data. Therefore, tax capacity model was compiled and estimated via fixed effects method. The variables affecting the tax capacity including per capita income, open economics (import and export ratio to the gross domestic product) and oil revenue ratio to gross domestic product and tax capacity with one lag were considered. The summary of the analysis indicated that the relationship between the per capita income, oil revenue to gross domestic product ratio and tax capacity with one lag and dependent variable is positive and significant. Whilst the open economics grade in the oil countries has negative and significant relationship with the tax capacity. At the next stage, the tax effort was computed for the studied countries according to the results of tax capacity model estimation. The results of this study indicated that the tax effort in Iran is placed in lower ranks than Venezuela, Algeria and with a inconsiderable difference to Saudi Arabia in the fourth rank out of six studied countries.

Keywords: OPEC, panel data, tax, tax effort index

INTRODUCTION

The taxes are considered as the most common and important resource for supplying the public revenues and one of the most efficient and effective financial policy tools by means of which the government may provide many of social and welfare services to the people and orientate the socioeconomic currents and activities in their proper direction. Unfortunately, some people deem the tax collection as earning further income for administrating the governmental organizations and what is considered fewer is that high rate of oil sale revenue and low rate of tax collections in the government's revenue composition, in addition to resulting in burdensome outcomes such as dependency of state revenue to the export of a product will deprive the state economics of the possibility of using financial means. The tax capacity provides the required information on state economic power in mobilizing the tax resources for responding the financial problems and execution of economic policies. One of the most important necessities based on its ground the extant paper has been prepared, is determining the state potential tax capacity and appropriate measures for enhancing the actual tax collections and reducing the gaps between actual collections and potential tax capacity. In the extant paper, at first, upon establishing a model, the factors affecting tax capacity are assessed by econometrics and after finding the passive factor that is the tax capacity, the tax efforts of several countries member o OPEC is computed and ultimately, the relationship between tax effort of some OPEC countries including Iran, Algeria, Venezuela, United Arab Emirates, Kuwait and Saudi Arabia within 1990-2008 and the oil revenues of those countries are studied in order to specify that how the oil revenue changes will vary the tax effort in such countries.

THE CONCEPT OF TAX CAPACITY AND EFFORT

The tax capacity of each country will provide the economic power of that country for mobilizing the tax resources in order to the state authorities can solve the financial problems and implement appropriate economic measures and policies as well. According to another definition of tax capacity; it is the potential tax value that every country may earn it proportional to its different revenue bases and economic activities. In any economics, the tax capacity is a function of effective factors and is computed accordingly. Whilst, versus potential tax, an actual tax exists that its tax revenues is

Corresponding Author: Mahnaz Rabiei, Islamic Azad University South Tehran Branch, 209-Iranshahr Street, P.O. Box: 11365/4435, Tehran, Iran, Tel.: 0098-21-22894151; Fax: 0098-21-22904738

different from the actual tax must be earn. In other word, the actual tax is the available tax collections. Infact, the tax effort is obtained by dividing the actual tax to potential tax ratio.

STUDY MODEL

In consideration of different researches applied in the context of tax capacity estimation and upon utilizing the Eltony (2002) model, the proposed pattern because of suitability of functional form and compatibility with the economic conditions, has been identified according to the logarithmic function. The model is expressed as follows:

$$\log(\text{taxgdp}_{it}) = c_{\circ} + c_1 \log(rgdppc_{it}) + c_2 \log(openess_{it}) + c_3 \log(oi\lg dp_{it}) + c_4 \log(taxgdp(-1)_{it}) + u_{it}$$

In which:

u	= Disorder sentence
i	= Specifies the country
t	= Specifies the time
taxgdp	= Tax to gross domestic product ratio (tax capacity)
rgdppc	= Income per capita
openness	= Open economics
oilgdp ratio	= Oil revenue to gross domestic product
taxgdp (-1)	= Tax to gross domestic product ratio with a time lag
gdp	= Gross domestic product.

It is notable that openness (open economics) is achieved from total ratio of import and export to gross domestic product.

STUDY REVIEW

In 2011, Abdul Jalil (2011) proceeded with the sample tax system in his study titled "the land based on the tax capacity and effort in Malaysia Peninsula". This study explains that seven states out of thirteen states in Malaysia are encountered the fatal financial problems up to such extent that are exposed to the bankruptcy One of the presented solutions is assigning further tax liabilities to the provincial governors. But some authors have argued that the provincial governors of Malaysia don't use their tax bases as best and assigning further liabilities to them only will result in more inefficiency. The results indicate that more developed countries are inclined to higher tax effort index in proportion to the less developed countries. In addition, the provincial governments following the high financial effort will achieve a rather better financial situation (Abdul Jalil, 2011).

Davoodi and Grigorian (2007) have estimated in their study the tax capacity and effort for Armenia by panel data. This study explains that in spite of recording a growth rate twice as many 2000, the tax to gross domestic product ratio in Armenia was rather fixed equal to 140, 5%. In this study, the tax ration is a function of actual income per capita, constitutional quality and inflation rate, agricultural sector share of GDP, trade to GDP ratio, shadow economic activity, fuel exporting share of industrial export and urban population share of total respective population. The results indicate that the gap between actual collection of the tax and its potential collection in this country is up to 60, 5% of gross domestic product (Davoodi and Grigorian, 2007).

Hudson and Teera (2004) have studied on "Tax performance". The objective of this study is analyzing the tax performance by means of what Musgrave has expressed in 1969 as the random method. They have used the regression method in order to assess the tax performance and so computed the tax effort. This study was applied via the combined data obtained from 122 developing and non-developed countries within 1975-1998. The results demonstrate that a significant relationship exists between the tax ratio and total independent variables including tax evasion, per capita income, trade, agricultural and industrial share, expenditures, foreign debt and population density in the different group of the country (Hudson and Teera, 2004).

Sobarzo (2004) has provided a study on the "assessment of tax capacity and effort in Mexico via sample tax system". According to this study, prior to two last decades, Mexico has improved its intergovernmental tax structure from a very centralized system to a mutilated plan and system as a result the provincial governments have achieved the major and important expenditures and many of tax liabilities remained on the federal government. According to the results, it is concluded that the big cities not only establish the active economics but issues such as official activities, tax evasion, tax avoidance and other illegal activities exist there in (Sobarzo, 2004).

Bird *et al*. (2004) have provided a survey titled "social institutions and tax effort in the developing countries' in 2004. The main objective of this study is that a more authentic and legal situation to be created for the more appropriate level of tax effort in the developing countries in the necessary and vital status. The most important performance of this study is studying the contractual model of tax effort by demonstrating this point that for specifying the tax effort, not only the good offer factors are effective but social institutions or common demand factor are very important for all countries in order to specify the tax effort (Bird *et al*., 2004).

Table 1: Unit root test on the variables

	ADF-fisher χ^2	ADF-Choi Z-stat	Prob
Loilgdp	65.4786	-6.32169	0.0000
Lrgdppc	45.3715	-4.07033	0.0000
Lopeness	49.2336	-4.93969	0.0000
Ltaxgdp	63.8775	-5.84496	0.0000
Resid	72.4769	-6.52662	0.0000

Table 2: Intergroup convergence

Panel PP statistic	Statistic	Prob	Statistic	Prob
	-2.360277	0.0091	-1.549821	0.0606

Table 3: Intergroup convergence test

	Statistic	Prob
Group PP statistic	-2.082531	-2.082531

Table 4: Husman test

Test Summary	χ^2 Statistic	χ^2 d.f.	Prob.
Cross-section random	36.462017	3	0.0000

Eltony (2002) applied a research titled "measurement of tax effort in Arabic countries". This study has been applied by using time and cross sectional series statistics of 16 Arabic countries (these countries have been divided in three groups of Persian Gulf Cooperation's member, non-oil and general) within 1994-2000, according to this study; many of Arabic governments have confronted the problems in collecting the adequate income for their general expenditures and my encounter in shortage (Eltony, 2002).

Castalls *et al*. (2001) have studied on "estimation of tax capacity and financial equity-a study on the local governments of Spain". The objective of this study is estimation of tax capacity of local Spanish governments. In this survey, the data extracted from a period within 1993 to 1999 has been used. The variables used in this study including all costs of local government, tax capacity, current gratuitous contributions of the central government, investing gratuitous contributions, population density (the population in per square kilometer) and income and the variables related to the tax capacity including standard tax rate, tax basis, standard tax basis and tax effort. Upon estimating the tax capacity of local governments in Spain and via OLS method, they concluded that in lieu for tax capacity reduction, 35% of this shock is compensated by reducing the public expenditures, 25% by increasing the tax amounts and the remaining (40%) by means of increasing the debts rate (Castalls *et al*., 2001).

ESTIMATION OF PANEL DATA

Whereas the extant study is a comparative study and the tax capacity and effort of the countries within 1990-2008 among 6 countries member of OPEC, thus the estimations based on the panel data are used. In this study, before assessing the model, the statics or stationary conditions are verified for each one of the model variables in order to not be unit root or the same unreliability.

Unit root test: A test for static being: Unit root test is a test that is provided for analyzing the statics. In the first hypothesis, it is assumed that the variable has unit root. The results of this test for loilgdp indicate that considering the obtained probability in the area and with fixed value, it is not significant and has a unit root. For solving this problem, the test is applied for all variables by one lag and for a fixed value. The results indicate that all variables are static in reliability level of 100% (Table 1).

CONVERGENCE

To avoid spurious regression situation, convergence test is used as a pre-test (Granger, 1986; Pedroni, 2004). How convergence panel data composed by seven different groups into four groups and three test statistic (Pedroni, 2004).

Hypothesis has been raised for proving the nonexistence of convergence and panel prefix explains this method. The software results of convergence test in (Table 2):

The summary of the test indicates that out of four panel statistics (intergroup method), Philips & Perron statistics with the probability level of 1% have the most matched statistic for rejecting hypothesis 0 Therefore, the model variables have convergence. The statistics resulted from intergroup method are Convergence statistics of panel data group average and in this study are shown by prefix "group". The hypotheses of intergroup method are as follows:

For all i $\quad H_o: \alpha_i = 1$

For all i $\quad H_1: \alpha_i < 1$

In this method ε_is have no equal value. The results of intergroup convergence test of panel data with respect to its hypotheses in (Table 3):

The results of Phillips and Perron static in probability level of 1% indicate that this statistic is significant and group convergence between panel data is in progress.

Estimation of the equations via panel data: At first, the coefficients equality of variables affecting the tax capacity of different countries member of OPEC is discussed, so that the initial test of data panel are

Table 5: Tax effort index of OPEC countries (1991-1999)

Country	1991	1992	1993	1994	1995	1996	1997	1998	1999
Iran	0.78	0.80	0.44	0.71	0.88	0.96	0.99	0.79	0.84
Kuwait	0.19	0.04	0.98	0.35	0.25	0.23	0.32	0.39	0.28
UAE	0.27	0.39	0.25	0.70	0.47	0.52	0.49	0.56	0.50
Venezuela	0.93	0.70	0.80	0.87	0.75	0.87	0.99	0.69	0.86
Algeria	0.78	0.74	0.76	0.75	0.82	0.78	0.82	0.63	0.75
Saudi Arabia	0.76	0.78	0.80	0.79	0.66	0.73	0.79	0.73	0.76

Table 6: Tax effort index of OPEC countries (2000-2008)

Country	2000	2001	2002	2003	2004	2005	2006	2007	2008
Iran	0.53	0.73	0.65	0.70	0.70	0.86	0.68	0.68	0.71
Kuwait	0.25	0.28	0.25	0.24	0.27	0.22	0.20	0.25	0.23
UAE	0.51	0.53	0.58	0.56	0.57	0.57	0.56	0.59	0.58
Venezuela	0.80	0.72	0.77	0.86	0.82	0.90	0.87	0.87	0.86
Algeria	0.99	0.71	0.73	0.71	0.75	0.75	0.81	0.71	0.90
Saudi Arabia	0.73	0.78	0.80	0.73	0.76	0.71	0.77	0.77	0.71

Reference: researcher computations

estimated as pooling and via common OLS method for the various gradients. (In such modeintercept and gradients are equal for all countries):

$$\underset{}{Log\ TaxGDP} = \underset{(-3/39)}{-3/55} + \underset{(5/55)}{0/68\log RGDPPC} - \underset{(2/61)}{0/18\ Log\ Openess} + \underset{(-2/36)}{0/18\ Log\ OilGDp} + \underset{(110/29)}{0/99\ L(TaxGDP\ (-1))} + \varepsilon_{it}$$

$$R - Squared = 0/94$$

$$Adjusted\quad R - Squared = 0/94$$

$$F - Statistic = 449/51$$

$$Durbin - Watson\quad Stat = 2/63$$

Fixed effects model test: The variables are estimated according to the fixed effects and considering the variance inequality for all cross sections. Via this method, the significance level of explanatory:

$$\underset{}{Log\ TaxGDP} = \underset{(-1/58)}{-3/52} + \underset{(2/80)}{0/69 Log\ RGDPPC} - \underset{(-2/23)}{0/39 Log\ Openess} + \underset{(2/36)}{0/22\log OilGDP} + \underset{(7/63)}{0/58\log(TaxGDP(-1))} + \varepsilon_{it}$$

variables is determined based on the dependent variable. Whereas in the fixed effects method, the gradients between the cross sections are not equal but the intercept is different between the cross sections. The general model of this method is as follows:

$$R - Squared = 0/98$$

$$Adjusted\quad R - Squared = 0/98$$

$$F - Statistic = 832/00$$

$$Durbin - Watson\quad Stat = 2/20$$

Choosing one of partial least square model and fixed effects model: Two following hypotheses are explained for choosing one of the above models:

H_0 = Pooling
H_1 = Fix Effect

In the first hypothesis we are seeking to prove the intercepts equality for the different cross sections whilst in the second hypothesis considering the equality of variables gradient, the countries' intercepts are different.

For choosing between partial least square model and fixed effects model, bound F test is used. This test is restated as follows:

$$\text{Re } strictF = \frac{\left(R_{fe}^2 - R_{pls}^2\right)/N-1}{\left(1 - R_{fe}^2\right)/(NT - N - K)}$$

In the above equation:

R_{fe}^2 = Coefficient of determination in fixed effects method
R_{pls}^2 = Coefficient of determination in partial least square method
N = The number of cross sections
K = The number of explanatory variables
T = The time duration

If computational F is bigger than critical F, the fixed effects method will be chosen. According to the data related to the model and through computing bound F test, the computations of this test indicated that the bound F is approximately equal to 40. Whilst the F value in table with the degree of freedom (N-1, NT-N-K) is approximately equal to 3. Therefore, the computational F is higher than table F and ultimately the fixed effects method is accepted.

Random effects test: In the random effects model or error components model, it is assumed the intercept is a single unit selected randomly out of a greater society with a fixed mean value. So, the single intercept is explained as a deviation of fixed mean value. One of the advantages of this model to the fixed effects model requires lower degree of freedom. As well, this model is appropriate when intercept (random) of each sectional has no correlation with explanatory variables. Therefore, Generalized Least Square (GLS) is used for estimation of the parameters. The estimation of the

following model has been provided via random effects method:

$$\log TaxGDP = \underset{(-0/40)}{-0/75} + \underset{(1/73)}{0/33}\log RGDPPC - \underset{(-0/94)}{0/22}\log Openess + \underset{(0/95)}{0/11}\log OilGDP + \omega_{it}$$

$$R - Squared = 0/04$$

$$Adjusted \quad R - squared = 0/02$$

$$F - Statistic = 1/79$$

$$Durbin - Watson \quad stat = 0/75$$

Whereas this test estimate the variables via GLS method, therefore doesn't confirm the explanatory variable of tax capacity with one lag.

Choosing between two fixed and random effects methods: The next subject is that we should specify that which method is used for estimation of accumulated data. Therefore, Husman test presented in 1987 is used.

According to Husman test, the difference between estimators of fixed and random effects methods has been deemed as hypothesis 0. Therefore, rejection of H0 indicates the fixed effects method.
This test is restated as follows:

$$H = \left[(B_{fe} - B_{re})'(COV_{fe} - COV_{re})^{-1}(B_{fe} - B_{re})\right] \cong \chi^2$$

where,

K = The number of explanatory variable
B_{re} ,B_{fe} = Coefficients vectors in both fixed and random effects methods, respectively
COV_{re} ' COV_{fe} = Coefficient covariance matrix in both fixed and random effects methods, respectively

Hypothesis 0 and alternative hypothesis in this test are as follows:

Hypothesis 0: The random effects method is more efficient.

Alternative hypothesis: The fixed effects method is more efficient.

As it is observed, Husman test function has asymptotic distribution $\chi 2$ and its degrees of freedom are equal to the number of model explanatory variables. According to Husman test, if computational $\chi 2$ is bigger than critical values, hypothesis 0 is not acceptable and fixed effects method is more efficient.

The summary of Husman test is as follows (Table 4).
Probability of this test indicates that the model may be estimate via fixed effects method in 100% reliability level.

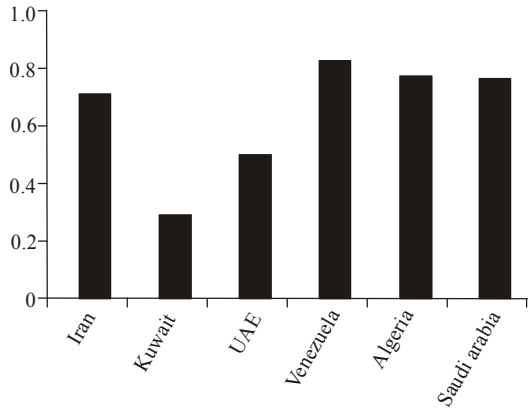

Fig. 1: Mean value of tax effort index of OPEC countries

Computation of tax effort index: For estimation of tax effort, it is required to introduce an index for determination of which. Tax effort index (T_e) is obtained from actual tax effort to estimated tax effort ratio:

$$T_e = \frac{(\frac{T}{Y})}{(\frac{T}{Y})^*}$$

In fact, the tax effort is achieved from dividing the actual tax ratio (T/Y) to the potential tax ratio (T/Y)*. The actual tax ratio is achieved from dividing the total received tax in a country during one year by GDP or national production in the same year. This ratio is usually between 0 and 1. Whatever the obtained number for the tax effort is closer to 1, it shows that the tax effort is closing to tax capacity. Comparing the countries with respect to this index, if this index for one country is higher than the other countries, it shows its better tax performance (Table 5).

Tax effort index in these countries indicate that during the years the country earns the most tax revenue, the country has the highest tax effort index. This index has the highest rate for Iran in 1997, Kuwait in 1993, UAE in 1994, Venezuela in 1997, Algeria in 2000 and Saudi Arabia in 2002 (Table 6).

The mean value for tax effort index of each one of the studied countries member of OPEC within 1991-2008 indicated that Iran, Kuwait, UAE, Venezuela, Algeria and Saudi Arabia have a mean value equal to 0.74, 0.29, 0.51, 0.83, 0.77 and 0.75 (Fig. 1).

Relationship between oil revenue and tax efforts of opec countries: This survey is feasible by correlation index. The correlation index indicates the relationship

intensity and type (direct or inverted). This coefficient is between 1 to -1. In case of no relationship between two variables, it is equal to 0. Upon providing the data related to the oil revenue variable to the gross domestic product and tax effort index and by means of correlation coefficient statistical factor, the direction and value of relationship between two above variables are determined for the OPEC countries. The formula of coefficient of correlation is as follows:

$$Corr\ (Tax\ , oil\ ) = \frac{Cov\ (Tax\ , Oil\ )}{\sigma_{Tax}\,\sigma_{Oil}} = \frac{E[(Tax\ -\ \mu_{Tax}\ )\ (Oil\ -\ \mu_{Oil}\ )]}{\sigma_{Tax}\,\sigma_{Oil}}$$

E = Mathematical expectation
Cov. = Covariance
Corr. = Symbol of correlation
σ = Standard deviation

The software computation aiding Excel indicated that this coefficient for Iran is equal to -0.53, it shows that upon enhancing the oil revenue in Iran, the government efforts fewer for obtaining the tax, statistically the direction of relationship between oil revenue variable and tax effort variable is inverted and relationship intensity is rather strong (whatever it is close to -1, the relationship intensity is stronger relationship type is inverted).

This coefficient for Kuwait, Venezuela and Algeria is respectively equal to +0.13 m +0.54 and +0.15. These statistics indicate that the tax effort of the government is increased upon increasing the oil revenue. Statistically, the variable intensity for Kuwait and Algeria is rather low and for Venezuela is rather strong. The obtained coefficient of correlation for United Arab Emirates and Saudi Arabia is respectively equal to -0.15 and -0.19. This summary shows that upon enhancing the oil revenue, the tax effort of the government is reduced. The relationship intensity is inverted and rater weak statistically.

CONCLUSION

This study reviews the tax capacity and effort and its relationship with oil revenue in 6 selected countries member in OPEC including Iran, Kuwait, UAE, Venezuela, Algeria and Saudi Arabia. In this study, the tax capacity model is formed according to its effective factors. The variables including per capita income, open economics, oil revenue and tax capacity with one lag. The summary indicated that the per capita income, oil revenue ratio to gross domestic product and tax capacity with one lag have positive and significant relationship with the dependent variable. The effectiveness of per capita income was more than two other variables, whilst the economic openness in the oil countries has negative and significant with the tax capacity. The summary of relationship between tax effort and oil revenue of selected OPEC countries is respectively equal to -0.53, +0.13, -0.15, +0.54, +0.15 and -0.19. According to the result obtained from extant model, the upon oil revenue enhancement as the major revenue of the government, it shall consider the enhancement of other part of its revenue means tax revenue and take necessary measures such as adopting appropriate regulations towards tax revenue increment. Also, it is recommended upon changing the regulations and proportional modification of tax collection modes and preventing from conducting economic activities in unofficial sectors, tax effort enhancement is possible. Increasing the employees' skill and utilizing the equipped techniques and technologies and of high efficiency, tax capacity and effort will be increased through accelerating the record and collection of tax information and reducing the tax evasion.

REFERENCES

Abdul Jalil, A.Z., 2011. Land-based tax capacity and tax effort of the state governments in peninsular Malaysia: A Representative Revenue System (RRS) approach. E-BANGI: J. Soc. Sci. Human., 6(2): 206-219.

Bird, R.M. and J.M. Vazquez and B. Torgler, 2004. Societal Institutions and Tax Effort in Developing Countries. Working Paper 04-06, Georgia State University.

Castalls, A. and A. Esteller and M. Vilalta, 2001. Tax Capacity Disparities and Fiscal Equalization: The Case of Spanish Local Government. Working Paper.

Davoodi, H.R. and D.A. Grigorian, 2007. Tax Potential and Tax Effort: A Cross-Country Analysis of Armenia's Stubbornly Low Tax Collection. IMF Working Paper.

Eltony, M., 2002. The Determinants of Tax Effort in Arab Countries. ERF Working Paper Series, Marrakech, Morocco, pp: 1-21.

Granger, C.W.J., 1986. Development in the study of co-integrated economic variables. Oxford Bull. Econ. Stat., 48(3): 226.

Hudson, J. and J.M. Teera, 2004. Tax performance: A Comparitive Study. J. Int. Develop., 16(6): 785-802.

Pedroni, P., 2004. Panel co-integration: Asymptotic and finite sample properties of pooled time series tests with an application to the PPP hypothesis. Econom. Theory, 20(2004): 597- 625.

Sobarzo, H., 2004. Tax Effort and Tax Portial of State Governments in Mexico: A Representative Tax System. Working Paper #315, KEELLOGG Institute, Horacio Sobarzo.