# The Estimation of Tax Capacity in Oil Exporting Countries: A Panel Data Approach

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## Abstract:

The tax capacity is one of the main concepts in public finance and provides the required information on state economic power in mobilizing the tax resources for responding the financial problems and execution of economic policies. For this purpose, the main objective of this paper is to estimate the tax capacity for oil exporting countries over the period of 1995-2008 by applying panel data approach. The summary of results indicates that the GDP per capita and trade openness are the main factors affecting the ratio of tax revenue to GDP. Also, the empirical findings of this study reveal that countries with a low share of oil exports have more Potential tax capacities. Moreover, the potential tax capacity of Iran is the same as its actual tax during the period of study.

**JEL Classification**: C33, O57, H20

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## 1. Introduction

By Increasing the government's commitment to achieve their goals such as economic growth, prices stability, increasing employment and more equitable distribution of income, governments spending are growing and they do to pick up on the different ways of financing. Today economists refer to tax as the best source of finance money for infrastructure investments and important stimulus for economic growth and development. In some countries, including Iran, due to the availability of alternative resources like oil, there is less attention to tax revenues. However, these countries have acknowledged the role of tax incomes in the funding structure and looking for increasing their tax potential.

The following are some definitions that are useful to understand our study. While tax capacity represents the maximum tax revenue that could be collected in a country given its economic, social, institutional, and demographic characteristics, potential tax collection represents the maximum revenue that could be obtained through the law tax system. Tax gap is the difference between this potential tax collection and the actual revenue, which is a function of tax capacity and the extent to which, by tax laws and administration, a society wishes to mobilize resources for public use.

This paper estimates the tax capacity of 18 oil-exporting countries using panel data approach. The two hypotheses of this study are as follows:

1 - The tax capacity of major oil exporting countries (economies of oil) is lower than the tax capacity of the countries with a low share of exports (non-oil economies).

2 - The tax capacity in Iran is upper than its actual tax.

The next section reviews the literature are discussed. In the third section, the estimation of the model is introduced and finally, the overall conclusions have been presented.

## 2. Review of Literature

In this section, the theoretical foundations of the subject will be presented, and then most empirical studies in the field of tax capacity estimation will be presented.

### 2.1-Theoretical Base

The stochastic frontier model of Aigner, Lovell and Schmidt (1977) is the standard econometric platform for this analysis. A panel version of this model can be written as;

$$\ln\tau_{it}=\alpha+\beta^{T} x_{it} + v_{it} - u_{it} \quad (1)$$

*uit*= represents the inefficiency, the "failure" to produce the relative maximum level of tax collection or production. It is a non-negative random variable associated with country-specific factors which contribute to country *i* not attaining its tax capacity at time *t.*

*uit*> 0 = but *vit* may take any value.

τ= *it* represents the tax capacity to GDP ratio for country *i* at time *t*;

*xit*= represents variables affecting tax revenue for country *i* at time *t*;

β = is a vector of unknown parameters,

*vit* = is the statistical noise, known as the disturbance, or error term**.** It is a random (stochastic) variable which represents all those independent variables that affect the dependent one but are not explicitly taken into account as well as measurement errors and incorrect functional form; *vit* can be positive or negative and so the stochastic frontier outputs vary on the deterministic part of the model.

It is usually assumed that:

a) $v_{i\,t}$ has a symmetric distribution, such as the normal distribution, and

b) $v_i$ and $u_i$ are statistically independent of each other.

Figure 1 illustrates the main characteristics of the frontier model considering only one independent variable from which tax capacity depends on. If this is the case the model takes the following form:

lnti= β0+ β1xi+vi-ui(2)

Where β0+ β1xiis the deterministic component, *vi* is the noise, and *ui* is the inefficiency.

The horizontal axis of figure 1 represents the values of inputs (log of GDP and so on) and the vertical axis the values of the output (log of tax effort). Points **A** and **B** shows the actual tax revenue of two countries (A and B).Without inefficiencies country A would collect **C,** and country **B** would collect **D**. For country A the noise effect is positive, and then its frontier revenue is above the deterministic frontier revenue function. On the other hand, for Country

B, the noise effect is negative, and then its revenue frontier is under the deterministic frontier revenue function.

While frontier revenues are distributed above and below the deterministic frontier revenue function, actual tax revenues are always below this function because the noise effect is positive and larger than the inefficiency effect.

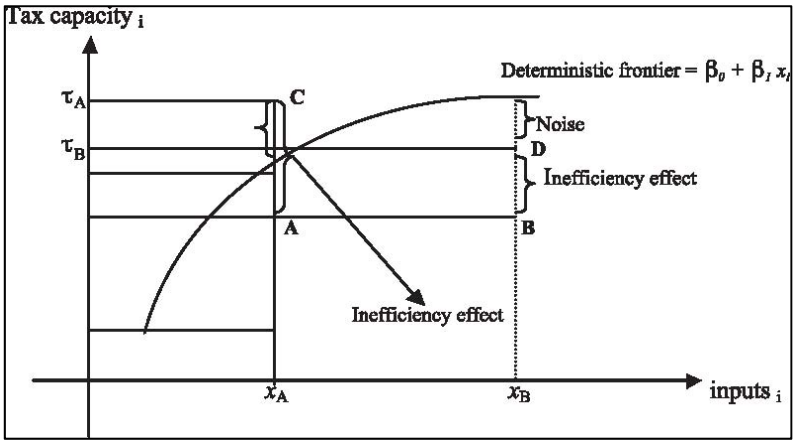


**Figure1. The Stochastic Production Frontier**

The analysis aims to predict and measure inefficiency effects. To do so, we use the tax effort, defined as the ratio between actual tax revenue and the corresponding stochastic frontier tax revenue (tax capacity). This measure of tax effort has a value between zero and one.

The difference between current tax revenue and tax frontier can be interpreted only as the level of unused tax, but not strictly as a measure of inefficiency. The presence of unused tax may be caused by two factors: people's preferences of low provision of public goods and services, so the low tax revenue is chosen intentionally, and inefficiency of governments in tax collection (Pessino and Fenochietto, 2010) .

## 3. Empirical Studies

Eltony (2002) measured tax effort in Arab countries. This study makes use of pooled time-series and cross-sectional country data for the 1994-2000 time periods for 16 Arab countries to examine the determinants of the tax effort. The results suggest that in the Arab countries, the main determinants of the tax revenue share in GDP are the per capita income, the share of agriculture in GDP and the share of mining in GDP. Other variables that are also important are the share of exports, imports and the outstanding foreign debts. Furthermore, country-specific factors appear to be important determinants of tax share, e.g., the political system; attitudes toward government; the quality of tax administration and other institutions of the government. The results for the tax effort index showed that for Arab countries that are facing a budget deficit, especially those of the GCC, there is room to increase their tax revenues by reforming their tax systems.

Grigorian and Davoodi (2007) use panel data approach for 141 countries. They find empirical support for the hypothesis that the persistence of Armenia's low tax-GDP ratio can be traced to persistence of weak institutions and a large shadow economy. The gap between the potential and actual tax collection in Armenia could be as high as 6 percent of GDP. They conclude with some policy recommendations that, if adopted, can boost revenue buoyancy.

Gupta (2007) contributes to the existing empirical literature on the principal determinants of tax revenue performance across developing countries by using a broad dataset and accounting for some econometric issues that were previously ignored. The results confirm that structural

factors such as per capita GDP, agriculture share in GDP, trade openness and foreign aid significantly affect revenue performance of an economy. Other factors include corruption, political stability, share of direct and indirect taxes etc. He also makes use of a revenue performance index, and finds that while several Sub Saharan African countries are performing well above their potential, some Latin American economies fall short of their revenue potential.

Pessino and Fenochietto (2010) present a model to determine the tax effort and tax capacity of 96 countries and the main variables from which they depend. The results and the model allow us to clearly determine which countries are near their tax capacity and which are some way from it, and therefore, could increase their tax revenue. Our study corroborates previous analysis in as much as the positive and significant relationship between tax revenue as percent of GDP and the level of development (per capita GDP), trade (imports and exports as percent of GDP) and education (public expenditure on education as percent of GDP). The study also demonstrates the negative relationship between tax revenue and inflation (CPI), income distribution (GINI coefficient), the ease of tax collection (agricultural sector value added as GDP percent), and corruption.

Le and his Colleagues (2002) deal with the concept and empirical estimation of countries' taxable capacity and tax effort. They employ a cross-country study from a sample of 110 developing and developed countries during 1994–2009. *Taxable capacity* refers to the predicted tax-to-gross domestic product ratio that can be estimated empirically, taking into account a country's specific macroeconomic, demographic, and institutional features, which all change through time. Tax effort is defined as an index of the ratio between the share of the actual tax collection in gross domestic product and taxable capacity. The use of tax effort and actual tax collection benchmarks allows the ranking of countries into four different groups: low tax collection, low tax effort; high tax collection, high tax effort; low tax collection, high tax effort; and high tax collection,

low tax effort. The analysis provides broad guidance for tax reforms in countries with various levels of taxable capacity and revenue intake.

Botlhole (2007) contributes to the empirical literature on the principal determinants of tax-GDP ratio in sub-Sahara Africa by means of an interaction term introducing the notion that the effect of resource revenues is conditional on the quality of institutions. The principal findings are that the quality of institutions and resource revenues are strong determinants of tax ratio, and that the interaction term, typically not considered in the literature, significantly affects the tax ratio. Thus, if countries improved their quality of institutions, more tax revenues could be raised from resources. Like most previous studies, the important role played by Per-Capita GDP and trade openness in improving the tax ratio is confirmed. The results however suggest that the structure of value-added; agriculture, service and industry shares are strongly detrimental to the tax ratio. He also measures the region‘s tax effort and finds that over 1990-2007, sub-Saharan African countries perform well below their tax potential.

## 4. The Model Selection and Data Sources

The model used in this study is according to the World Bank study (2008), Botlhole (2007) and Gupta (2007). The econometric model is presented as follows:

(3)

$$L\left(\frac{T}{GDP}\right)_{it} = \alpha_0 + \alpha_1 L(GDP)_{it} + \alpha_2 L(IND)_{it} + \alpha_3 L(OPEN)_{it} + \alpha_4 L(URBPOP)_{it}$$
$$+ \alpha_5 OX^* L(GDP)_{it} + \alpha_6 OX^* L(IND)_{it} + \alpha_7 OX^* L(OPEN)_{it} + \alpha_8 OX^* L(URBPOP)_{it} + \varepsilon_{it}$$

Where:

- (L (T / GDP)): logarithm of the ratio of tax revenue to GDP
- (LGDP): logarithm of GDP per capita in constant prices in year 2000 (dollars of USA).
- (LIND): logarithm of the value added of the industrial sector's share of GDP.
- (LOPEN): logarithm of the degree of trade openness.

• (LURBPOP): logarithm of the ratio of urban population to total population.

• $\varepsilon$ is the error term, L represents the logarithm, i represents country and t represents the time.

Also Dummy variable (OX) for oil exporting countries is OX=1 and otherwise is OX=0.

The study period is since 1995 to 2008 years and data are collected according to WDI 2010 database and Eltony's study (2002).

Statistical sample of the oil exporting countries is selected according to two groups. The first group of the oil exporting countries is selected according to classification of UNCTAD in 2008, and the second group of the oil exporting countries with a low share of oil production and oil consumption is selected according to classification of BP in 2008.

## 5. Findings and Results

First of all, we should make sure that the variables are stationary, because of the spurious regression problem. For this purpose, we use the panel unit root test (LLC test). As table1 shown, all variables are stationary in their levels.

Table2: F Limer test

| Prob. | statistic |
|---|---|
| (0.000) | F=123.79 |

**Table 1; The Results of Unit Root Test for Variables**

| **Prob.** | **t statistic** | **variable** |
|---|---|---|
| (0.00) | -5.34 | L(T/GDP) |
| (0.000) | -3.54 | L(GDP) |
| (0.04) | -2.61 | L(IND) |
| (0.000) | -4.08 | L(OPEN) |
| (0.000) | -5.63 | L(URBPOP) |

Source: computation of research

The first test we should do here is whether the countries are similar or not? We use F Limer test to response the above question. The result is shown in Table 2, indicating rejection of the null hypothesis and the necessity of using panel data for both groups of oil exporting countries.

Source: computation of research

For choosing between fixed effects and random effects models, we need to use Hausman test. The result of this test are reported in Table 3 and indicates the rejection of the null hypothesis, thus we should use fixed effect model for estimation.

**Table3: The Results of Hausman Test**

| **Test Statistic** | **Prob.** |
|---|---|
| 17.20 | (0.02) |

Source: computation of research

The results show that there is a positive relationship between the logarithm of GDP per capita and the logarithm of degree of trade openness, and there is a positive relationship between the logarithm of GDP per capita and the ratio of tax revenue to GDP in selected oil exporting countries. These results are also consistent with the theoretical framework of the study. Also logarithm of the value added of industry sector in major oil exporting countries has a negative impact on tax revenue to GDP ratio. So there is a little attention to this part of tax incomes because of existence of oil incomes (in these countries). The results are shown in Table 4.

table4: The Model Estimation Results

| prob. | T statistic | Coefficients | **variables** |
|---|---|---|---|
| - | - | 1 | $L(\frac{T}{GDP})$ |
| (0.05) | -1.97 | -3.13 | $C$ |
| (0.00) | 3.48 | 0.66 | *LGDP* |
| (0.01) | 2.42 | 0.2 | *LOPEN* |
| (0.00) | -2.66 | -0.31 | *OX * LIND* |
| (0.00) | -3.74 | -0.02 | $T$ |
| (0.00) | 6.11 | 0.43 | *DUM* 42008 |
| (0.00) | -4.41 | -0.23 | *DUM* 171999 |
| (0.00) | 6.005 | 0.42 | $AR(1)$ |
| DW=1.88 | $R^2$=0.98 | $\overline{R^2}$=0.98 | F=440/71 (0) |

Source: computation of research

In next section, the average potential and actual tax (as results) has been reported in Table 5.

Table5: Potential and Actual Tax Income in Selected Oil Exporting Countries (1000 $)

Source: computation of research

## 6. Conclusions

The results of this paper show that there is a positive relationship between the logarithm of GDP per capita and the logarithm of degree of trade openness, and there is a positive relationship between the logarithm of GDP per capita and the ratio of tax revenue to GDP in selected oil exporting countries. These results are also consistent with the theoretical

framework of the study. Also logarithm of the value added of industry sector in major oil exporting countries has a negative impact on tax revenue to GDP ratio. Countries with a low share of oil exporting have higher potential tax income in comparing with countries with a high share of oil exporting. The potential and actual tax incomes of Iran are equal during the time of study.

| **country** | **Venezuela** | **Egypt** | **Malaysia** | **Iran** | **Kazakhstan** | **Syria** | **Trinidad and Tobago** |
|---|---|---|---|---|---|---|---|
| Potential Tax income | 17/1 E+11 | 16/9 E+11 | 15/8 E+11 | 8/4 E+11 | 3/18 E+11 | 3/02 E+11 | 2/86 E+11 |
| Actual tax income | 17/6 E+11 | 16/6 E+11 | 15/4 E+11 | 8/47 E+11 | 3/04 E+11 | 3/07 E+11 | 2/64 E+11 |

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