

Analysis of the effect of oil revenues on tax revenues in rentier states

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Abstract

In this paper, we highlight a new aspect of rent dependency of governments in oil exporter countries. The primary hypothesis in this paper is that oil revenue is one of the tax level determinants in the rentier states. We examined this hypothesis using panel regression analysis and unbalanced panel data from 14 oil exporter countries over the period 1990 to 2010. Our primary finding is that (oil and natural gas) rents are a significant determinant of the tax revenue level in rentier states, and each unit of rent revenues generates approximately 0.2 unit tax revenue for these governments. Our findings could be regarded as a new warning to rentier states' governments because it demonstrates that in rentier states, governments are more dependent on rents than directly observed. Thus, we think that if oil rents significantly decrease in the near future, rentier states will be faced with more serious problem than they currently believe.

Keywords: Tax Revenues, Rentier States, Rent

JEL classification: H20, O13

1: Introduction

The structure and composition of governmental revenues have important implications in public sector economics. Tax revenues are preferable to other sources of revenue for many reasons, such as manageability and predictability, and can play a key role in developmental processes. However, some governments earn remarkable revenue from natural resources, which reduces the need for governments to tax. These revenues are called rents in the literature, and these governments are called rentier states. Unlike taxes, rents have been criticized in the theoretical and empirical literature for many reasons, such as instability of in the amount collected, the non-renewable nature and the depletion of this source of revenue. Additionally, political and economic problems may arise due to reliance on it. In contrast, the concept of the rentier state, introduced by

Mahdavy (1970), mainly refers to oil exporting countries. Mahdavy defines rentier state as those countries that receive substantial external rents on a regular basis. Beblawi (1987) argued that the Arab oil states are excellent examples of rentier states.

Rents are relatively costless for the state to collect (Dunning, 2008) and can help countries accelerate their economic growth. However, rentier states mainly exhibited weak economic and social performance, leading to the introduction of the concepts of "resources curse" and "paradox of plenty". These issues attempted to explain why rentier states suffer a curse rather than a blessing as a result of rents. A prominent argument in the resources curse view is that rents supplant tax revenue as the fiscal foundation for the state (Wong, 2009). Many empirical works attempted to confirm this argument and showed that rent revenues led

to inefficient tax systems in the rentier states (Tijerina and Pagan (2003), Reyes-Loya and Blanco (2008) and Bornhorst et al. (2009)).

In contrast, because oil is a depletable asset, rentier states are necessarily a passing phenomenon (Luciani (1987)). Luciani predicted that rentier states would live about six decades after the 1980s. However, recently, Renani (2013) offered new evidence and predicted oil rents, and therefore rentiers, would end before 2020. If this prediction is realized, oil states will be faced with serious fiscal and financial distress sooner than they forecast. Inefficient tax systems and a reduction in oil rents could create serious problems for rentier states. These states have to have the foresight to prepare for this potential problem. However, in this paper, we show a new aspect of this problem.

It seems that a particular point has been ignored in the rentier state literature; that is, these countries not only have inefficient tax levels, but this level of tax is significantly supplied by the rent. In other words, although the evidence indicates that rents make tax systems inefficient, we believe that rents are one of the direct determinants of this inefficient tax level, and therefore, the dependency of rentier states on rents is greater than that observed directly. Our reasons for this hypothesis are arranged as follows:

1. The trade balance of rentier states shows that rents are the main source of the foreign exchange supply. The impact of the exchange rate on foreign trade is not ignorable because rent revenues usually appreciate the real exchange rate of these countries and increase imports. The importation performed in the presence of rents provides a good and easy base to tax. Therefore, we may say that international trade tax creates a way for rents to affect the total tax revenues in rentier states.

2. Resource rents allow these states to use a large labor force. As Beblawi (1987) noted, the governments in such countries are major employers in their economies, and the number of government employees in these states is only

matched by socialist-oriented states. In this environment, increases in rent empower the governments to increase employment, salaries, transfers, subsidies and other payments. These types of payments increase payroll taxes and, thus, introduce a new connection between tax and rents.

3. Companies that are responsible for the exploration, extraction, transportation and export of resources that produce rents pay considerable taxes. For example, PEMEX¹ in Mexico pays a value-added tax for various production stages (Reyes-Loya and Blanco, 2008), and NIORDC² in Iran pays the same taxes.

4. Rents allow governments to make substantial investments and create infrastructure. The existence of these infrastructures reduces the cost of economic activities and, therefore, increases the profits of firms. This process increases profit taxes.

Because of the reasons outlined above, in this paper, we are going to empirically consider whether rents are a determinant of tax revenues. In addition, we will attempt to measure the real contribution of rents to the total government revenues in rentier states.

The rest of this paper will be organized as follows: the next section will provide a literature review about tax revenues and rents and then present data, theoretical framework and empirical model of the paper. Section 3 focuses on the results of the estimations, and Section 4 is devoted to the conclusions and policy implications.

2. Methods

2.1: Literature Review

This subsection provides a brief review of the main issues that are related to our subject. Literature review consists of three subsections, the first subsection reviews the concepts of rent and rentier states in the literature. The second subsection is devoted to empirical work that

¹ Petróleos Mexicanos that known as PEMEX (which translates to Mexican Petroleums) is the Mexican state-owned petroleum company, and it is engaged in the exploration, production, transportation, refining, storage and sale of hydrocarbons and derivatives.

² The National Iranian Oil Refining and Distribution Company (NIORDC) is part of the Ministry of Petroleum of Iran. NIORDC performs all operations related to the refining and distribution of oil products in Iran.

specifies a function that describes tax revenue behavior, and the third subsection presents a literature review of the tax and rent nexus.

2.1.1: rent and rentier state

In classical economic theory, rent was understood as any surplus left over after all costs of production had been met and were paid to the owner of the land for use of its natural resources (Yates, 1996). Although there are different definitions for rent in Smith, Malthus, Ricardo and others' views, in recent microeconomic theory, rents are generally known as the result of any cost asymmetry between a group of firms. Perhaps the closest definition of rent to what has been used in the rentier state literature is Ricardo's definition. Ricardo understood rent to be a gift from nature (Yates, 1996). In contrast, rentier refers to whoever owns this gift and does not have a unique definition in the social and economic literature. With oil nationalization in 1950s in Iran and other countries, the concept of rentier met a new dimension and rentier agents have been transformed from landlords and firms to governments and countries. The oil price shock in the 1970s increased oil rents for oil countries to an unprecedented level. These two events created a new generation of states that were called rentier states by Mahdavy (1970). Mahdavy defined rentier states as countries that receive a substantial amount of external rent on a regular basis. Mahdavy believed that external rents could be earned from the sale of oil, workers' remittances, or foreign aid. Afterwards, Mahdavy, Beblawi (1987) and Luciani (1987) extended the rentier state literature.

Today, rentier states have a vast literature and some well-known expressions, such as the resource curse, and all related issues, such as Dutch disease and the paradox of plenty, lie within this scope because they attempt to describe different aspects of economic or social problems that have emerged in these countries.

Because oil is not a renewable resource, from the beginning, it has been predicted that someday oil reserves would be depleted, and therefore, rentier states would cease to exist in the future. Luciani (1987) argued that rentier states are necessarily a passing phenomenon, and he predicted that rentier states would last about 6 decades after the 1980s. However, recently, Renani (2013) offered new evidence

and predicted that oil rents, and therefore rentiers, would end before 2020. He believes that oil rents will vanish not due to depletion of oil reserves but because of the high price of oil. He argues that the high price of oil has gradually changed the pattern of world energy consumption and other sources of energy have become more economical than oil. However, regardless of whether Renani's prediction comes true, sooner or later, rentier states will end, and rentier states are close to this event; therefore, these countries must prepare themselves for this outcome and its consequences.

2.1.2: tax regressions

Tax and its behavior have been the focus of many empirical economic studies. In this subsection, we review some studies specify models for the consideration of tax behavior. Lotz and Morss (1967) used per capita income and trade share as tax ratio determinants for 79 countries and found that these two variables affect the tax ratio significantly. These researchers introduced the degree of monetization in 1970 as a new explanatory variable for tax ratio regression. Chelliah (1971) added the share of agriculture and the share of mining to the set of explanatory variables and found that these variables also have a significant effect on tax revenue. Tanzi (1988) argued that tax fluctuations in developing countries are greater than could be explained by a limited set of explanatory variables. He analyzed the connection between tax levels and several macroeconomic policies and variables (such as the exchange rate, import substitution policies, trade liberalization, inflation, public debt and financial policies). Ghura (1998) explained the tax ratio using a similar set of factors along with human capital, corruption, external grant, external debt and terms of trade. With a sample of thirty-nine sub-Saharan African countries over the period 1985–1996, the results of Ghura's research indicated that the tax ratio was significantly and adversely affected by the inflation rate and the extent of corruption, and this variable was directly affected by external grants and human capital. Tanzi and Davoodi (2000) used few explanatory variables to estimate tax ratio regressions, i.e., all of these variables had

already been used in tax regressions. Bird et al. (2006) added a set of institutional factors (such as governance and rule of law) and framing institutions (such as the size of the shadow economy and inequality) to the tax ratio function and found that all of these factors significantly affected tax performance. Gupta (2007) extended tax regressions using some policy variables, including the various sources

2.1.3: tax and rent nexus

After the introduction of rentier states, the relationship between the two main components of government revenues in rentier states (i.e., resources revenue and tax revenue) has attracted significant attention in empirical and theoretical studies. Among the studies that examined the impact of resource revenues on tax revenue, we could find two opposite views. Some studies argued that rent could affect tax revenues positively because a vibrant natural resource sector dominated by a few large firms can generate large taxable surpluses (Gupta, 2007 and Bothole, 2010). In contrast, a prominent argument in the resources curse view is that rents supplant tax revenue as the fiscal foundation for the state (Wong, 2009). Many empirical works attempted to confirm the latter argument and showed that rent revenues lead to inefficient tax systems in rentier states. Tijerina and Pagan (2003) analyzed the relationship between oil revenues, taxes, government spending and GDP in Mexico using a Vector Auto Regression (VAR) model. The results of this study suggest that there is a substitution effect between oil revenue and tax revenue. Reyes-Loya and Blanco (2008) conducted a time-series analysis and examined three different specifications to determine how governmental income generated from oil exports influenced fiscal policy (non-oil tax revenues) in Mexico. The results showed that there is an inverse relationship between oil-related revenue and tax revenue from non-oil sources. Bornhorst et al. (2009) examined the relationship between government revenues from hydrocarbon (oil and gas) related activities and revenues from other domestic sources in a panel of 30 hydrocarbon producing countries. The main finding of this study is that there is an offset of approximately 20%, which is robust to the inclusion of control variables and alternate estimation methodologies. Bothole (2010) argued that the effect of

of tax revenue as a percentage of revenue, the highest corporate and income tax rate, and the average tariffs. Mahdavi (2008) estimated a set of regressions for tax revenue and its components. He found that some variables affect both the level and composition of the total tax revenue, while others affect its components in opposite directions, altering their net effects on the revenue level.

resource revenues on the tax ratio is conditional to the quality of the institutions and examined this issue using data from sub-Saharan African countries over the period 1990-2007. The results of this study showed that the impact of resource revenues on the tax ratio is ignorable.

A review of the empirical studies that examine the relationship between taxes and rents show that most empirical studies examined the relationship between the tax “ratio” and rents, and it seems that none of these studies have examined the relationship between the tax “level” and the rents. Our study is going to fill this gap in the literature.

2.2: Tax data from rentier states

In this subsection, we review the tax data that will be used in this paper. The rentier states in this paper are oil exporter countries where the oil rents comprise a substantial share of the governmental revenues. We used two criteria to select countries: first, at least 40 percent of governmental revenues were generated by rents (this criterion was derived from Luciani’s definition of an allocation state). Due to lack of data on governmental revenues for rentier states, a second criterion for the selection of our sample was, inevitably, the existence of data. Regarding these two criteria, we used unbalanced panel data from 14 oil exporter countries over the period 1990 to 2010. The details of our sample follow:

- Kuwait, Mexico, Oman and Bolivarian Republic of Venezuela over the period 1990-2010.
- Islamic Republic of Iran and Republic of Yemen over the period 1990-2009.
- Bahrain and Syrian Arab Republic over the period 1990-2008.
- United Arab Emirates over the period 1990-2005.
- Algeria over the period 1994-2009.
- Republic of Congo over the period 1992-2005.

- Qatar over the period 2004-2010.
- Nigeria over the period 2004-2008.
- Sudan over the period 1997-1998.

As mentioned above, rents in rentier states alleviate the need for governments to tax, resulting in inefficiencies in the tax systems of most of these countries. Fig. 1 shows the average tax to GDP ratio for our sample countries and OECD countries, and fig. 2 performs this comparison in a more dynamic manner. It is obvious from fig. 1 that the tax ratio for all rentiers is less than OECD's, and this simple evidence confirms the inefficiencies of the tax systems in most rentier countries. It is clear from fig. 1 that, in five countries of our sample (consisting of Nigeria, United Arab Emirates, Kuwait, Bahrain and Oman), the tax ratio even is less than five percent. When we review the tax rules in these countries, we observe that, in these five countries, many potential tax bases (e.g., income, property, corporate, and heritage) are not utilized and there is a long list of official tax exemptions in these countries. For example, in the United Arab Emirates, there are no taxes levied by the Federal Government on income or the wealth of companies and individuals. Additionally, taxes on foreign banks are not enforced in any of the emirates (United Arab Emirates tax guide, 2013). Kuwait also has a very similar tax pattern. In the 2013 ranking of the Heritage Foundation, Kuwait, Oman, Qatar, Bahrain and Nigeria were in the top 10 list of worst tax performances. However, in our analysis, these low tax revenues means that, even if we prove that tax revenues are supplied by rents, our findings have no significant implications for these five countries because the governments in these countries have no significant reliance on

tax revenues in practice. For this reason, in the following sections, we estimate our models with and without these five countries (i.e., with 14 and 9 countries³).

According to fig. 2, we could confirm that rentier states do not utilize their tax capacities completely and the existence of rents causes these governments to not experience a vital need to tax revenues. In the literature, the negative relationship (or substitution effect) between rents and tax emanate from this fact. As noted in Section 2, Tijerina and Pagan (2003), Reyes-Loya and Blanco (2008) and Bornhorst et al. (2009) have attempted to show this negative relationship in different ways. Fig. 3 shows this negative relationship in our sample. However, our aim in the present paper is not to show this negative relation. We are going to show that, in rentier states, this (inefficient) tax level is fed by rents and the dependency of rentier states on rents is greater than what can be directly observed. A simple piece of evidence for our goal is shown in Fig. 4. Note that this figure depicts the level of the tax revenue against the level of the rent; we use averaging to eliminate the time dimension. Some points about Fig. 4 should be mentioned. First, we use the logarithms of the variables to reduce the range of the data variations. Second, the trend line in Fig. 4 shows a positive relationship between the level of the rents and the level of the tax revenues in rentier states, which could be interpreted as a (certainly dubious) piece of evidence for our main hypothesis. To the best of our knowledge, no empirical research exists that addresses this relationship between the level of rent and the level of tax. In the following sections, we attempt to offer some stronger evidence for our hypothesis.

³Our sample of 9 countries consists of all of the above-mentioned countries except Nigeria, the United Arab Emirates, Kuwait, Bahrain and Oman.

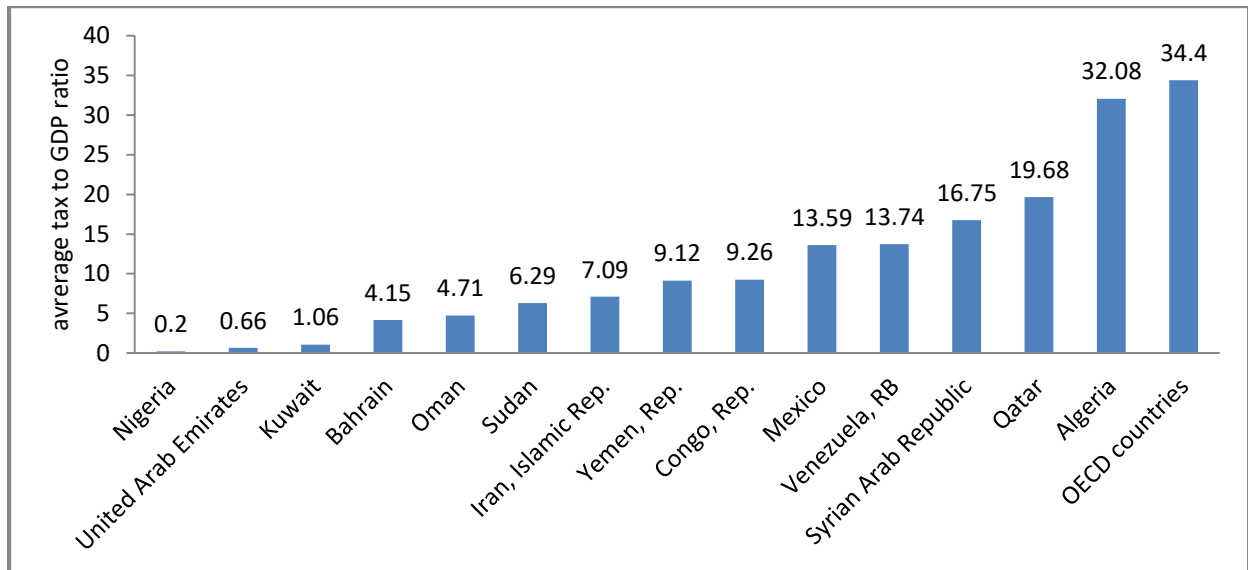


Fig. 1 average of tax to GDP ratio for rentier states and OECD countries

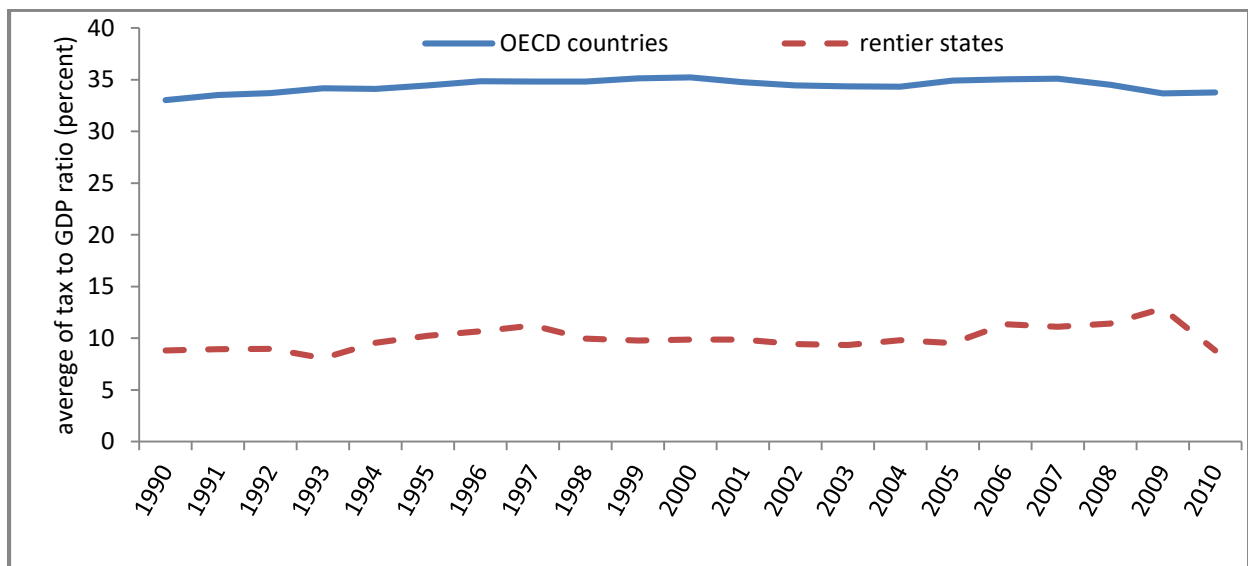


Fig. 2 average of tax to GDP ratio for rentier states and OECD countries over the years

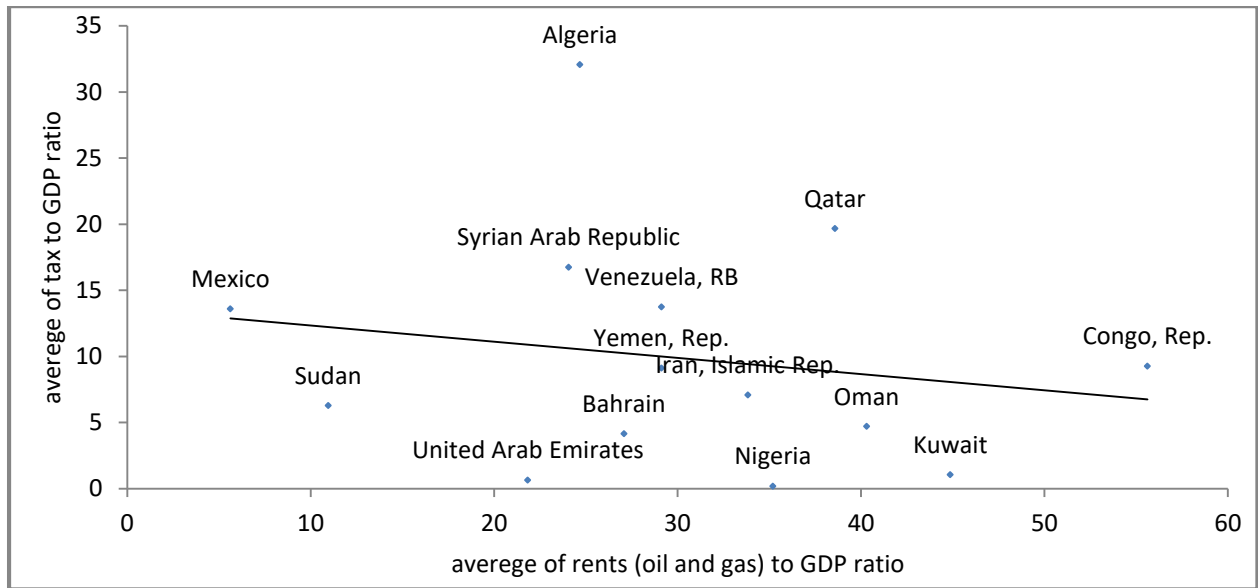


Fig. 3 average of ratios tax and rents to GD

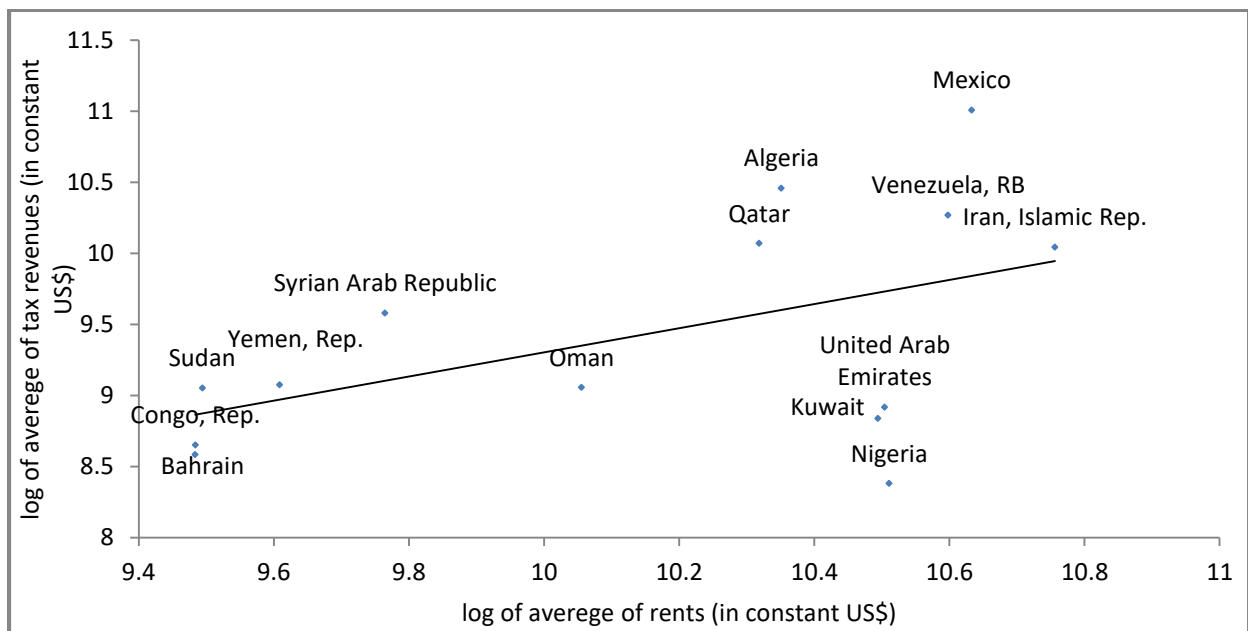


Fig. 4 average of rents and tax levels

2.3: the theoretical framework and empirical model

The empirical works that consider determinants of tax revenues mainly follow two general methods to specify tax regression. Some works, such as Lotz and Morss (1967, 1970), Chelliah (1971), Tanzi (1988), Bird et al. (2006), and Bornhorst et al. (2009) use linear regression without any optimization processes. However,

some other works, such as Heller (1975), Leuthold (1991), Ghura (1998) and Mahdavi (2008), derive a linear regression using an optimization process. Although the final specifications of these two methods are the same, in this paper, we use the second method with several modifications.

In this method, we derive an equation for the desired tax level⁴ using a constrained maximization process within the public sector. The utility function of the public sector decision maker is assumed to be in the following form:

$$U = U(Y - T, G, F + L, R) \quad (1)$$

where Y is the non-rent GDP, T is the total tax revenue, G is the total government spending, F+L is the net external finance from government (sum of the net foreign grants (F) and net external debt (L)), and R is the total government revenue from oil and natural gas (rent). All of these variables are in real terms. For the marginal utility of variables, as in the previous studies, we assumed that

$$U_G, U_R > 0$$

$$U_{F+L} < 0 \text{ if } F + L > 0$$

$$, U_{F+L} > 0 \text{ if } F + L < 0$$

Heller (1975), Leuthold (1991), Ghura (1998) and Mahdavi (2008) assume that the marginal utility of Y-T is positive. We should be careful when applying this assumption to rentier states. In the rentier state literature, rents allow the governments to live off an external income, thus functioning independently of the domestic economy (Wong, 2009). Based on this logic, Luciani (1987) regarded rentier states as exoteric states and argued that, in these states, strengthening the domestic economic base may occur or may not occur. In this situation, we cannot make any clear assumptions about the marginal utility of the Y-T term. The budget constraints faced by the public sector decision maker are given by

$$T + F + L + R = G \quad (2)$$

by making some modifications to the applied model of Heller (1975), Leuthold (1991), Ghura (1998) and Mahdavi (2008)⁵ assumed that the realized tax revenues (T) is a function of the desired tax revenue (T*), the economic environment (E), the availability of specific tax bases (B) and the level of corruption (C), which means

$$T = f(T^*, B, E, C) \quad (3)$$

The desired tax revenue is determined by maximizing (1) relative to (2). We, similar to other studies, assume that the utility function has a quadratic form, but based on our modifications, we define this function as follows:

$$U = \alpha_1(Y - T - Y_S) - \frac{\alpha_2}{2}(Y - T - Y_S)^2 + \alpha_3(G - G_S) - \frac{\alpha_4}{2}(G - G_S)^2 - \alpha_7(F + L) - \alpha_8(F + L)^2 + \alpha_9R - \frac{\alpha_{10}}{2}R^2 \quad (4)$$

where all α s except α_1 and α_2 are certainly positive, and Y_S and G_S are the subsistence level of income and the government expenditure, respectively. This particular form is selected to ensure the decreasing nature and given sign for the marginal utility. Because Y_S and G_S are unobservable, following Leuthold (1991) and Ghura (1998), we assume that they are simple linear functions of income as follows:

$$G_S = \beta_0 + \beta_1 Y \quad (5)$$

and

$$Y_S = \theta_0 + \theta_1 Y \quad (6)$$

Maximizing (4) relative to (2) with respect T and G and with replacement of (5) and (6) yields the desired tax function as follows:

$$T^* = \alpha + \beta Y + \gamma (R + (F + L)) \quad (7)$$

Where

$$\alpha = \frac{\alpha_1 - \alpha_3 + \alpha_2 \theta_0 - \alpha_4 \beta_0}{-(\alpha_2 + \alpha_4)} \quad (8)$$

and

$$\beta = \frac{\alpha_2 \theta_1 - \alpha_2 - \alpha_4 \beta_1}{-(\alpha_2 + \alpha_4)} \quad (9)$$

and

$$\gamma = \frac{\alpha_4}{-(\alpha_2 + \alpha_4)} \quad (10)$$

Combining (3) and (7) yields

$$T = f(Y, R, F + L, B, E, C) \quad (11)$$

Because we eliminate the assumption of positive marginal utility for Y-T using (1), we

⁴ As we noted in the previous section, all research that has been previously conducted specified linear regression for the tax to GDP ratio (as the dependent variable), but in the present study, to achieve our

goal, we attempted to find a linear regression for the tax level.

⁵ Rent is not present in the optimization process of any of these studies.

cannot make any certain predictions about the sign of the variables in the tax revenues function.

Because the variables that are in the E and B vectors are not derived from the optimization process, empirical researchers are relatively free to choose them. To select these variables, we draw on the empirical literature. For vector B, the variables that we selected are the degree of openness (the sum of the exports and imports to the GDP ratio) and the share of agricultural activity (the value added from the agricultural sector to the GDP ratio). The foreign trade sector of the economy has traditionally been a base that is easy to tax, and exports and imports are still taxed directly in many economies because the administrative costs of monitoring, assessing, and collecting taxes on goods that enter or leave the country at specified locations are relatively low. Thus, a larger foreign trade sector in the economy leads to larger trade taxes, resulting in smaller taxes for the other types of taxation (Mahdavi, 2008). In contrast, greater openness is typically associated with higher rates of productivity and economic growth (Edwards (1998), Frankel (1999), Bornhorst et al. (2009)). For these reasons, a positive correlation would be expected between the degree of openness and the tax revenue.

There are many reasons that the size and share of the agricultural sector can negatively affect tax revenues. In the agricultural sector, especially in developing countries, a large number of transactions occur in informal markets, and some of the products in this sector are self-consumed; therefore, bookkeeping in this sector is very poor, and many researchers argue that the agricultural sector is a difficult sector to tax.

We use two variables as economic environment indicators (vector E): inflation and the degree of monetization of the economy. Ghura (1998) argued that the effect of inflation on tax revenue could be traced through three channels. First, in an inflationary environment, the existence of tax payment lag decreases the real tax revenues (Tanzi-Olivera effect). Second, some of duties are levied at specific rates and do not adjust with inflation; therefore, inflation would gradually decrease real tax

revenue. Finally, in an inflationary environment, economic agents attempt to make portfolio adjustments in favor of assets that typically avoid domestic taxes. Therefore, inflation negatively affects tax revenues. Mahdavi (2008) argued that the degree of monetization is likely to be associated with a higher level of financial development, a larger volume of money-based transactions, and a more efficient method for quantifying the size of various tax bases. Thus, a greater degree of monetization is expected to be associated with greater tax revenue. We measure the degree of monetization using the ratio of M2 to GDP.

Finally, we found several empirical studies that provide evidence of the negative effect of corruption on tax revenue. The effects of corruption on taxes could be classified into two main categories: direct and indirect. The direct effects refer to the effects of corruption that affect the behaviors of taxpayers and tax collectors that directly decrease governmental tax revenues. For example, Tanzi and Davoodi (2000) argued that, in the presence of corruption, some of the taxes paid by taxpayers are diverted into the pockets of the tax administrators. In contrast, corruption can affect some determinants of tax revenues (mainly economic growth)⁶ adversely. In other words, corruption can decrease economic growth (or other tax determinants) and, thus, can decrease the tax base. For example, Tanzi (1998) argued that corruption reduces investment; consequently, it reduces the rate of growth. He explained that such a reduction in investment is assumed to be caused by higher costs and the uncertainty that corruption creates. Alternatively, as another example of indirect effects, Mauro (1995) and Gupta et al. (1998) found that corruption decreases government spending on education and health. Because it is accepted that these types of governmental spending positively correlate with economic growth, it could be concluded that this effect might be another path through which corruption affects tax revenues (Tanzi and Davoodi (2000)). Summarizing the above discussion about the relationship between corruption and tax revenues, we may say that corruption can be regarded as a potential

⁶ We regard these types of corruption effects on tax revenues as indirect effects.

determinant of tax revenues and corruption affects tax revenue negatively.

Based on the above discussions, the basic regression that we estimate in this study is

$$\begin{aligned} tax_{it} = & \alpha_0 + \beta_1 rent_{it} + \beta_2 Ynoil_{it} + \\ & \beta_3 grant_{it} + \beta_4 exdebt_{it} + \beta_5 agri_{it} + \\ & \beta_6 trade_{it} + \beta_7 inf_{it} + \beta_8 \left(\frac{M2}{Y}\right)_{it} + \beta_9 corr_{it} + \\ & \delta_i + \gamma_t + u_{it} \end{aligned} \quad (12)$$

where *tax* is the tax revenue level (the total tax revenue of government in constant 2005 US\$, which is taken from the Government Financial Statistics (GFS) and World Development Indicators (WDI)), *rent* is the oil and natural gas rent (the sum of oil and gas rent in constant 2005 US\$). The oil and gas rents are the difference between the value of the oil and natural gas production at world prices and the total costs of production (the source for these data is the WDI); *Ynoil* is nonoil GDP, i.e., GDP minus rents (the sum of the oil and natural gas rents - both variables are define at constant price in 2005 US\$, WDI); *grant* is the international grant (constant 2005 US\$, International Debt Statistics); *exdebt* is the net external debt flow (constant 2005 US\$, WDI); *agri* is the share of agricultural in GDP (WDI); *trade* is the ratio of the sum of the imports and exports to the GDP (WDI); *inf* is the inflation rate (the annual inflation rate as measured by the percent change in the CPI, WDI and World Economic Outlook (WEO)); *M2/Y* is the ratio of M2 to GDP (in percent, WDI); *corr* is the corruption index (an index of corruption, which takes integer values ranging from 0 (high corruption) to 6 (low corruption) - the data for this variable are taken from the International Country Risk Guide (ICRG)); and δ_i and γ_t capture the country and time specific effects.

3: Empirical Results and Discussion

This section reports the estimation results. Table 1 shows the estimation results of six different specifications for the unbalanced panel data from 14 oil exporter countries. We estimate different specifications to evaluate the robustness of our results; however, note that the specification of model (7) in Table 1 is the same as model (6). However, to control heteroscedasticity, we used robust variance

estimations in this model. Following the Dougherty (2007) procedure for model selection for panel data, at the beginning, the Hausman test was performed to choose between fixed and random effects. Based on the results of these tests, the random effects model was selected, and in the next stage of the Dougherty procedure, the Breusch and Pagan LM test was used to choose between random effects and simple OLS. Based on the results of these tests, we used a random effects model to estimate all of the regressions in table 1. The first and main finding is that the coefficient for rent is positive and statistically significant. In other words, our results show that the effect of oil and gas rents on the tax revenue level in rentier states is significant and positive, and this effect remains stable among the different specifications. The magnitude of the rent coefficients varies between 0.17 and 0.23 across the different specifications, and these findings indicate that each unit of rent revenue in the rentier states generates approximately 0.2 units of tax revenue for the government. These findings confirm our main hypothesis.

The results shown in Table 1 also show that the GDP (without oil rents) has positive and significant coefficients in all models. The coefficients for the GDP between all models vary over a very limited range (0.171 - 0.177) with little standard error. We could interpret these results as more evidence for the inefficiency of the tax systems in rentier states. Our results also suggest a negative and significant relationship between the corruption index and the tax revenues. In this study, we used the ICRG7 index of corruption, which takes integer values ranging from 0 (high corruption) to 6 (low corruption). These findings support the studies by Ghura (1998), Tanzi and Davoodi (2000), Bird et al. (2004) and Gupta (2007) and show that higher corruption is associated with lower tax revenues.

The degree of monetization has a positive and statistically significant effect on the tax revenue. Consistent with expectations, our results show that higher financial development is associated with higher tax performance, and this finding does not confirm the results reported by Mahdavi (2008).

⁷International Country Risk Guide Datasets

Table 1: Estimation results of random effects models with unbalanced panel data of 14 oil exporter countries.

Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
<i>rent</i>	*** 0.174 (7.67)	*** 0.189 (7.91)	*** 0.172 (7.58)	*** 0.180 (7.93)	*** 0.189 (7.70)	*** 0.230 (9.08)	** 0.230 (2.13)
<i>Ynoil</i>	*** 0.171 (23.57)	*** 0.176 (23.77)	*** 0.171 (22.76)	*** 0.170 (23.34)	*** 0.172 (23.60)	*** 0.177 (23.25)	*** 0.177 (21.30)
<i>grant</i>	0.220 (0.50)	0.210 (0.48)	0.263 (0.58)	0.268 (0.62)	0.224 (0.52)	0.442 (0.98)	0.442 (1.39)
<i>exdebt</i>	0.008 (0.66)	0.011 (0.88)	0.008 (0.68)	0.007 (0.57)	0.007 (0.55)	0.005 (0.42)	0.005 (0.64)
<i>agri</i>		0.091 (0.83)				0.102 (0.86)	0.102 (1.01)
<i>trade</i>		0.006 (0.27)				0.008 (0.34)	0.008 (0.34)
<i>inflation</i>			-0.028 (-0.97)			0.036- (-1.25)	-0.036 (-1.37)
<i>M2/GDP</i>				* 0.067 (1.86)		*** 0.144 (3.75)	** 0.144 (2.50)
<i>corruption</i>					0.737 (1.53)	*** 1.372 (2.65)	** 1.372 (1.95)
<i>constant</i>	*** -6.637 (-2.72)	** -9.473 (-2.43)	** -6.348 (-2.44)	*** -9.502 (-3.22)	*** -8.883 (-3.05)	*** -19.627 (-4.02)	*** -19.627 (-3.75)
observations	218	201	215	218	218	199	199
<i>R² overall</i>	0.91	0.92	0.92	0.91	0.91	0.92	0.92

Note: dependent variable in all models is level of tax revenue. ***, ** and * indicate statistical significant at level 1%, 5% and 10% levels, respectively. Values of the t-statistic are shown in parentheses. Difference between model (6) and (7) is that in model (7) we use robust standard errors to control for heteroskedasticity.

We also investigated how inflation affects tax revenues in rentier states. Our estimates show that there is not a significant relationship between inflation and tax revenues in these countries, and thus, none of the scenarios mentioned above about the relationship between inflation and tax revenues has occurred in our sample set.

There are some variables in the tax revenue function that describe the availability of specific tax bases (vector B); however, our results show that both variables in this vector have no significant effect on the tax revenue level. Although it was expected that the agricultural share affects the tax revenue negatively and the degree of openness affects

tax revenues positively, these results show that, in rentier states, tax revenues are independent of sectoral composition. Therefore, these

countries do not efficiently extract tax revenues from different tax bases.

Table 2: Estimation results of fixed effects models with unbalanced panel data of 9 oil exporter countries.

Variables	Model 8	Model 9	Model 10	Model 11	Model 12	Model 13	Model 14
<i>rent</i>	***0.225 (8.17)	*** 0.232 (7.96)	*** 0.228 (8.18)	*** 0.225 (8.22)	*** 0.261 (8.56)	*** 0.284 (9.09)	** 0.284 (2.22)
<i>Ynoil</i>	***0.186 (19.96)	*** 0.187 (19.87)	*** 0.186 (19.24)	*** 0.185 (19.82)	*** 0.188 (20.50)	***0.183 (19.62)	*** 0.183 (15.59)
<i>grant</i>	1.712 (1.56)	1.319 (1.10)	* 2.604 (1.85)	1.479 (1.34)	* 1.835 (1.71)	** 3.273 (2.25)	** 3.273 (2.41)
<i>exdebt</i>	0.015 (1.05)	0.015 (1.07)	0.013 (0.91)	0.013 (0.93)	0.011 (0.78)	0.000 (0.01)	0.000 (0.01)
<i>agri</i>		0.126 (0.83)				-0.080 (-0.49)	-0.080 (-0.58)
<i>trade</i>		0.002 (0.08)				-0.004 (-0.14)	-0.004 (-0.10)
<i>inflation</i>			0.001 (0.04)			-0.033 (-1.00)	-0.033 (-1.29)
<i>M2/GDP</i>				0.085 (1.43)		*** 0.168 (2.74)	0.168 (1.74)
<i>corruption</i>					*** 1.554 (2.54)	*** 2.565 (3.48)	** 2.565 (2.71)
<i>constant</i>	*** -9.373 (-6.54)	*** - 11.227 (-2.92)	*** -9.689 (-5.62)	*** - 12.338 (-4.91)	*** - 14.490 (-5.91)	*** - 21.831 (-4.54)	*** -21.831 (-4.22)
observations	138	138	137	138	138	137	137
<i>R² overall</i>	0.94	0.94	0.94	0.94	0.94	0.94	0.94

Note: dependent variable in all models is level of tax revenue. ***, ** and * indicate statistical significant at level 1%, 5% and 10% levels, respectively. Values of the t-statistic are shown in parentheses. Difference between model (13) and (14) is that in model (14) we use robust standard errors to control for heteroskedasticity.

Finally, the effects of the net external debt flow and external grant on the level of tax revenues are insignificant. One reason for this result is the fact that rentier states usually

receive significant amounts of external revenues from oil and gas selling and are less dependent on external grants or loans. Consequently, many rentier states are categorized among the less indebted countries,

and the share of external debt and grants in their budgets is very small.

The insignificance of some traditional variables along with the high values of R^2 in all specifications show that, in these countries, the tax revenues are extracted from limited bases, which could be interpreted as more evidence for the weakness of the tax systems in these states.

As noted in Section 2.2, because of the low of tax revenues in five countries of our initial sample, we excluded these countries from the sample and then re-estimated our models using the data from 9 countries. The results of the new estimations are shown in Table 2. Again, we estimated different specifications to evaluate the robustness of our results; however, model (14) in Table 2 is the same as model (13), but to control heteroscedasticity, we used robust variance estimations in this model. Based on Hausman test, the fixed effect model was chosen. Most of the results offered in Table 2 are consistent with those reported in Table 1; however, we briefly focus on the main points of these results. The coefficients of the rents are significant and positive, and the sign and significance of these coefficients remain stable among the different specifications. The magnitudes of the rent coefficients in the new regressions vary between 0.22 and 0.28 across the different specifications. These coefficients are greater than those in Table 1. By selecting a more homogenous sample of oil exporting states that exert minimal effort to collect taxes, our results indicate that, in these countries, the tax revenues are more dependent on the oil and gas rents.

The results shown in Table 2 also show that the GDP (without oil rents) has positive and strongly significant coefficients in all models, but in the new sample, the GDP coefficients are slightly greater than those that had already obtained. This result is compatible with our expectation because our main criterion for the selection of these countries was minimal tax effort and efficiency.

The other results shown in Table 2 again confirm a negative and significant relationship between the corruption index and the tax revenues. The coefficients of some variables consist of inflation, degree of openness, agricultural share and external debt, which are exactly the same as those shown in Table 1. The

degree of monetization and the net external debt keep the same signs as the former regressions, although the significance levels of these variables differ. The insignificance of several variables (such as the inflation and sectoral composition) and the high R^2 s in all specifications show that, in these countries, the tax revenue is mainly extracted from limited bases, and therefore, only a few regressors are required to explain most of the fluctuations in the tax revenue.

4: Conclusions and Policy Implications

Tax is one of the main policy instruments of traditional macroeconomics; thus, recognizing taxation's determinants can help policy makers make better policy decisions. Although tax is recognized as the principal source of government revenues, oil discovery and promotion of its price in international markets have changed the revenue patterns of governments in some countries. The countries that receive substantial amounts of external rent on a regular basis are called rentier states by Mahdavy (1970). Due to many reasons (such as the instability of oil prices, non-renewability of this source of energy and the political and economic problems that may arise from reliance on oil revenues), reliance on oil revenues has been criticized in the theoretical and empirical literature.

A prominent argument in the literature on rentier states is that rents supplant tax revenue as the fiscal foundation for the state (Wong, 2009). Many empirical works attempted to confirm this argument and showed that rent revenues lead to inefficient tax systems in rentier states. In this paper, in addition to showing the inefficiency of the tax systems in rentier states, we examined a new hypothesis about tax revenue determinants in rentier states. In particular, we determined if there is evidence for a dependency of the tax revenue on the rent revenue in 14 oil-exporting countries. We found a statistically significant and positive relationship between tax revenue and rent revenue in these countries.

The estimation results using different specifications and different subsamples show that each unit of rents generates approximately 0.2 units of tax revenue in rentier states. These findings show that, in rentier states, the governments are more dependent on rents than

directly observed. Our results have important implications for rentier states: that is, if Renani (2013) predictions are realized and oil rents significantly decrease before 2020, then rentier states will be faced with more serious problems than they imagine now. Therefore, our findings can be regarded as a new warning to rentier states. However, other results show that the nonoil GDP, the degree of monetization and corruption are also determinants of the tax revenue levels in rentier states.

Our results present new aspects of rent dependency problems; three main policy implications can be taken from these results:

First, in agreement with previous studies, we provide some evidence for the inefficiency of the tax systems in rentier states. Based on these findings, these countries are recommended to follow policies that make their tax systems more efficient. The International Monetary Fund (IMF) recommends that these countries diversify their tax bases to reduce their dependence on high oil prices (International Monetary Fund, 2006).

Second, our results can be interpreted as additional emphasis on a set of policies prescribed in the rentier state literature to avoid resources curse. This set consists of a large number of policies, such as the promotion of the quality of governance, transparency in dealings with oil and gas companies, stronger disclosure and anti-corruption rules, diversifying economies, discouraging dependence on resource rents, rent revenue stabilization, political and social reform, etc.

Finally, we showed that the tax level is increased by rents, and thus, rentier states should be more cautious about the probable future decrease in rents. All rentier states should attempt to decrease oil prices and prevent its increase in the future. These policies are recommended because they can postpone the demise of rentier states and provide more time for these countries to prepare their economies. OPEC8 can play an important role in achieving this goal.

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