



Estimation of sociopolitical determinants in the privatization of oil companies

Estimación de determinantes sociopolíticas en la privatización de compañías petroleras

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ABSTRACT:

This paper presents new evidence regarding the determinants of privatizing National Oil Companies (NOC) from a panel data of 49 oil-producing countries for the period 1996 to 2014. We find—*ceteris paribus*—that countries with greater corruption control, a more positive perception of government effectiveness, a more participatory political system, greater regulatory quality, and high efficiency in the execution of contracts and property rights, are more likely to privatize their NOCs compared with countries with lower levels in these governance indicators.

Keywords: Privatization, NOC, Sociopolitical, Governance

RESUMEN:

Este artículo presenta nuevas evidencias sobre los determinantes de la privatización de las Compañías Estatales de Petróleo de un panel de 49 países productores de petróleo para el período comprendido entre 1996 y 2014. Encontramos, *ceteris paribus*, que los países con mayor control de la corrupción, una percepción más positiva de la efectividad del gobierno, un sistema político más participativo, una mayor calidad regulatoria y una alta eficiencia en la ejecución de los contratos y los derechos de propiedad, tienen más probabilidades de privatizar sus compañías petroleras comparado con los países con niveles más bajos en estos indicadores de gobernanza.

Palabras clave: Privatización, Estatales, Sociopolítico, Gobernanza

1. Introduction

National Oil Companies (NOCs) control 73% of world's oil reserves and 65% of gas reserves, with the remainder controlled by International Oil Companies (IOCs) (Victor et al., 2011). This exposes a paradox regarding the ownership structure of oil and gas companies, since different studies have shown that, historically, NOCs are dramatically less economically efficient than the IOCs (e.g. Eller et al., 2007; Victor, 2007; and Wolf, 2009). Therefore, the inefficiency posed by NOCs suggests that privatization might be a better economic solution.

There has been an ongoing debate in the literature as to whether NOCs should be privatized or not (Goodman and Lovemen, 1990). It has been argued that the best economic performance in terms of efficiency as shown by an increase in revenue and global production, has been after a NOC becomes an IOC, even if only partially (Wolf and Pollitt, 2008). However, Vickers and Yarrow (1988) suggest that a decision regarding a NOC's ownership structure may be influenced by government incentives and constraints. Hence, decisions regarding retention of state companies may be more closely related to government objectives than purely commercial objectives (Cabrales et al., 2017). Government objectives may include employment creation, income redistribution through subsidized prices, and the maximization of backward and forward linkages, in order to develop national oil industries (Fattouh and El-Katiri, 2012; Warshaw, 2012).

The issue of privatization has been previously explored by various authors (e.g. Clarkson et al., 1989; Clarkson, Hanke, and Thompson, 1989; Bienen and Waterbury, 1989) showing the superior efficiency of the private sector in managing resources and austerity in terms of costs. A limited amount of literature has focused on the study of privatization determinants in different industries and, ultimately, even less has covered the types of oil company ownership. Concerning the determinants of property types in the oil industry, the literature is very limited. Goodman and Lovemen (1990) arguing for nationalization and Warshaw (2012) arguing for a unified framework of nationalization and privatization are the most outstanding cases. These studies have found that when oil prices are high, the probability of nationalizing an oil company increases, while the probabilities of privatizing an oil company increase only when oil prices are low. In addition, both consider it relevant to include a variable that captures the shock of oil price (Pindyck, 1999), as shown in Annex A. Other variables, such as the level of production, the possibility of the diffusion of privatization and/or nationalization of oil companies, and the logarithm of the population of each country, were incorporated in such studies. The authors conclude that due to the economies of scale that manage this sector, countries with a high level of production can reduce the costs of expropriation, increasing the likelihood of nationalization. Finally, at a socio-political level, these studies conclude that democratic governments with strong systems of Checks and Balances are more likely to privatize their NOCs, while autocratic countries with weak systems tend to nationalize their oil companies.

Along the same lines, we expand upon the socio-political dimensions by deepening governance indicators that can affect the privatization of oil companies. Guriev et al. (2011) and Warshaw (2012) use the Executive Constraints and Polity 2 of the Polity IV data base indicators, which refer to the control executed by other powers over the Executive and the comprehensive democratic development, respectively. While these indicators involve two important governance issues, that is, the autonomy of the government and the level of democracy in countries, these analyses leave aside specific issues, such as the perceptions of agents on services and public policies, civil service, contract enforcement, property rights, the likelihood of crime and violence, and the inclusion of elites and private interests in

power, among others, which are not explicit in their analysis.

Similarly, a higher level of detail is required to analyze the privatization behaviors in the oil industry, as it is according to World Bank indicators that the relative difference between countries can be measured. Such differences go beyond the political regime, as discussed in previous studies (e.g. Guriev et al., 2011; Ross, 2012; Warshaw, 2012). Thus, to achieve the core objective of this paper, a nonlinear probability model will be performed for a panel of data consisting of 49 oil producing countries during the time frame of 1996 to 2014. The main variables to be analyzed will relate to the following governance indicators: Voice and Accountability, Political Stability, Government Effectiveness, Regulatory Quality, Rule of Law, and Control of Corruption.

Therefore, the core objective of this paper is to identify which governance factors determine the decision to privatize NOCs. While previous studies have addressed research on the determinants that affect the type of ownership of companies in different industries, there are few studies that have focused on the oil industry (Guriev et al., 2011; Warshaw, 2012). The latest study on this issue, conducted by Warshaw, concludes that the most democratic regimes tend to have a greater number of privatizations than expropriations; however, he leaves the question open regarding which specific factors make this happen (Warshaw, 2012). Accordingly, the present paper aims to expand upon the socio-political dimensions that can affect the privatization of NOC. Consequently, the inclusion in this study of the six dimensions of the World Bank Governance Indicators allows one to understand which specific factors of governance influence the ownership structure of the oil companies, and to which extent, in both individual and aggregate ways. This paper is organized as follows: the second section describes the methodology implemented and data used to measure the effects exerted by the socio-economic factors and the governance indicators on the probability of privatization of State oil companies; the third section shows the results obtained and the marginal effects found for each of the variables analyzed; and finally, the sixth section explains the findings and limitations presented.

2. Methodology

In order to answer the research question, this study will follow an empirical approach constructed of a nonlinear probability model *Logit*, where the variable of interest will take the value of 1 if the government's shareholding percentage in the NOC decreases during the year t , or 0 if the shareholding percentage increases (Wolf & Pollitt, 2008).

where D_{it} is a dummy variable that represent if the government's participation in the NOC decreases during the year t , and X_{it} refers to the vector of observations of the country i during the corresponding year t , both made to the control variables set as well as to the explanatory variables set. While β represents the vector of the coefficients associated with each type of variable previously mentioned, and ϵ_{it} corresponds to the model error.

Given that the structure of the data needed for this study corresponds to the same unit of the cross-sectional analysis (oil-producing countries) at different times, it is said to have a panel structure data. So, the type of effects to be considered in this study must be identified. On one side, there are the fixed effects, which assume that the error, ϵ_{it} , can be decomposed into a fixed and constant part for each individual, α_i , and into a random part, η_{it} , which meets the assumptions of the Ordinary Least Squares (OLS) Method; on the other hand, there are the random effects which have the same specification of the fixed effects

model, except that such ϵ_{it} is a random variable with a mean value $E(\epsilon_{it}) = 0$ and a variance σ^2 (Montero and Granados, 2011).

Therefore, the test that allows to identify the kind of effects that must be estimated in a panel data model is the *Hausman Test*. The null hypothesis of this test is that there are no systematic differences between the estimators of the fixed effects and the random effects. Thus, if the null hypothesis is rejected, there would be endogeneity in the model, so it is preferred to use a model with fixed effects. On the contrary, if the null hypothesis is accepted, it means that there is no correlation between the error and the regressors, ϵ_{it} , so it is preferred to choose a model with random effects (Wooldridge, 2001).

2.1. Data description

The sample used in this study consists of a panel data based on 49 oil-producing countries reported by the *BP Statistical Review 2016*, with a time frame between 1996 and 2014. The reasons behind only producing countries are being studied lie in the fact that these are more likely to have a NOC for the oil operation and - in most of the cases - these countries derive the highest revenue from oil, implying a greater reliance of the country towards the industry (Warshaw, 2012). As a result, the information reported by these countries will allow to perform a specialized analysis of the sector, avoiding distortions in the results.

2.1.1. Dependent Variable

As it was mentioned, the dependent variable will take the value of 1 if the government shareholding of the country i in its NOC decreases during the year t , or 0 otherwise.

The information for partial privatization was mainly taken based on the research of Wolf and Pollitt (2008) and related media reports. Based on these, 25 privatizations were recorded in 12 different countries during the observed period. The detail of the countries with the dates of each event is shown below:

Table 1
Events of Privatization by country.

| Country | Year |
|-----------|------------------------------|
| Argentina | 1999 |
| Brazil | 2000, 2001 |
| Canada | 2005 |
| China | 1999, 2000, 2001, 2006, 2007 |
| Colombia | 2007 |
| UK | 1996 |
| India | 1999, 2004 |
| Italy | 1996, 1997, 1998, 2001 |

| | |
|--------------------|------------------|
| Norway | 2001, 2004, 2005 |
| Romania | 2004 |
| Russian Federation | 1999, 2006 |
| Thailand | 1998, 2001 |

Data source: Wolf and Pollitt (2008) and related media reports

2.1.2. Independent Variables

According to what was identified and explained in the literature review, three groups of relevant variables were identified:

1. **Control Variables:** These refer to the variables of the oil industry:
2. **Oil prices:** according to Nolan and Thurber (2010) this variable is found to be inversely related to the probability of privatization, since a higher price generates less need to minimize costs and risks, and implies higher income for the owner sector. For these reasons, under higher prices the desire of a government to exercise direct control over the oil company is much greater than in a regime of low prices (Nolan and Thurber, 2010)
3. **Oil price random shock:** it refers to the deviation price from the trend. This variable is included in order to avoid a spurious relationship between the price and the dependent variable, given the non-stationarity of the explanatory variable (Gurieva et al., 2011). The estimation of this value corresponds to a random effect (ϵ_t) calculated from the model specified by Pindyck (1999), and updated for this study based on the number of oil prices reported by *BP Statistics* for the years between 1861 and 2015, at constant prices of 2015:

$$\ln(OilPrice) = 0.998 + 0.769 \ln(OilPrice)_{t-1} - 0.0095 t + 0.00006 t^2 + \epsilon_t \quad (2)$$

It should be noted that the direction of the variable effect is not defined with certainty, because it depends on the types of random events which are included in this variable and that can affect positively or negatively the crude oil price. For more details of the estimates of this model it is recommended to check Annex A.

1. **Oil production:** it reflects the level of production of oil in the studied countries and, according to the related literature, it positively affects the probability of privatization of the NOCs (Gurieva et al., 2011).
2. **The possibility of privatization diffusion among countries:** it refers to the number of privatizations made by other countries in the previous year (Warshaw, 2012).

Table 2
Explanatory variables - Control

| Variable | Description | Expected | Source |
|-----------|---|----------|-----------------------|
| | | Sign | |
| Oil Price | At constant prices of 2015 | (-) | BP Statistical Review |
| Shock | Random effect. Residual econometric model | (?) | Authors |
| | | | |

| | | | |
|------------------------------------|---|-----|-----------------------|
| Oil Production | $Ln(Production)$ | (+) | BP Statistical Review |
| Diffusion of privatization between | Number of privatizations in other countries | (+) | Authors |

1. **Socio-Economic Variables:** these refer to the size, level of market development, and financial situation of the country. The related variables are:
2. **Population:** it represents the size of the country and it is directly related to private and foreign investment (Mogrovejo, 2005).
3. **GDP per capita:** it refers to the level of economic development and it is related to the theory that associates privatization with rich and mature nations (Bortolotti et al., 2004).
4. **GDP percentage growth:** it is related to the economic cycles. In this sense, higher growth in GDP refers to a worldwide economic *boom*, so that fiscal pressures on the country may be lower and therefore there would be less need to privatize the oil company (Bortolotti et al., 2004).
5. **Market capitalization:** it refers to the liquidity of the country, which according to Bortolotti et al. (2004) facilitates the sale of assets and enables profit maximization.
6. **Government debt:** it is associated with higher fiscal pressures on the country. Thus, a rise in its value will increase the need for the State to seek financing in order to fund public spending, which in turn would increase the likelihood of privatization of oil companies (Bortolotti et al., 2004).

Table 3
Explanatory variables - Socio-Economic

| Variable | Description | Expected | Source |
|-----------------------|--|----------|------------|
| | | Sign | |
| Population | $Log(population)$ | (+) | World Bank |
| GDP per capita | GDP per capita at constant 2011 prices, adjusted for Parity of Acquisitive Power | (+) | World Bank |
| GDP Growth % | Percentage variation of the GDP between and | (-) | World Bank |
| Market Capitalization | Market Capitalization / GDP | (+) | World Bank |
| Government Debt | External Debt / GDP | (+) | World Bank |

1. **Governance Variables:** These refer to the institutional and regulatory context in which the country operates. In this dimension, 6 governance indicators are taken from the World Bank, as follow:
2. **Voice and Accountability:** it refers to the degree to which the citizens of a country are able to participate in selecting their government. It also alludes to freedom of expression, freedom of association and free media (Kaufmann and Kraay, 2016).
3. **Political stability and absence of violence measures and/or terrorism:** it measures the perception about the chance of political instability and/or politically motivated violence, including terrorism (Kaufmann et al., 2011).
4. **Government effectiveness:** it reflects the perception of the quality of public

services, the quality of public administration and the degree of its independence from political pressures, as well as the quality of the formulation and implementation of policies, and the credibility of the government's commitment to such policies (Kaufmann et al., 2011).

5. **Regulatory quality:** it refers to the perception of the government capability to formulate and implement policies and regulations that allow and promote the development of the private sector (Kaufmann et al., 2011).
6. **Rule of Law:** it refers to the perception of the extent to which the agents trust and follow the society rules, specifically the quality of contract enforcement, property rights, the police and the courts (Kaufmann et al., 2011).
7. **Corruption control:** it reflects the perception of the extent that is exerted by the public power for the private benefit, as well as the "capture" of resources of the State by selected minorities of elites and private interests (Kaufmann et al., 2011).

The Tables 2, 3 and 4 present a summary of the analyzed variables with the proper description, source, and expected sign. Similarly, Annexes B and C show the main descriptive statistics related to each variable.

Table 4
Explanatory variables - Socio-Political

| Variable | Description | Expected | Source |
|---|---|----------|------------|
| | | Sign | |
| Corruption Control | Approximate range between . The higher the value of the indicator, the greater the control of corruption. | (+) | World Bank |
| Voice and Accountability | Approximate range between. A higher value of the indicator shows increased participation of citizens. | (+) | World Bank |
| Political Stability and lack of lack of violence measures | Approximate range between. A higher value of the indicator means a higher political stability and absence of violence. | (+) | World Bank |
| Government effectiveness | Approximate range between. A higher value of the indicator means a greater perception of effectiveness of the government. | (+) | World Bank |
| Regulatory Quality | Approximate range between . A higher value of the indicator means a greater perceived regulatory quality. | (+) | World Bank |
| Rule of law | Approximate range between . A higher value of the indicator means a greater the perception of compliance and trust in compliance to the social rules. | (+) | World Bank |

2.1.3. Correlation Analysis

The correlation coefficients of Pearson, among the explanatory variables, are presented to identify redundant information and avoid potential multicollinearity problems that could result when estimating models:

Table 5
Correlation Matrix

| | Control of Corruption | Government Effectiveness | Political Stability | Regulatory Quality | Rule of Law | Voice and Accountability | Democracy | Executive Constraints | Oil Price | Shock | Lag Privatization | Oil production + | Population | GDP per capita | % GDP growth |
|---------------------------------|-----------------------|--------------------------|---------------------|--------------------|-----------------|--------------------------|-----------------|-----------------------|-----------------|----------------|-------------------|------------------|-----------------|-----------------|--------------|
| Control of Corruption | 1 | | | | | | | | | | | | | | |
| Government Effectiveness | 0.96*** 0.00 | 1 | | | | | | | | | | | | | |
| Political Stability | 0.74*** 0.00 | 0.73*** 0.00 | 1 | | | | | | | | | | | | |
| Regulatory Quality | 0.9*** 0.00 | 0.94*** 0.00 | 0.69*** 0.00 | 1 | | | | | | | | | | | |
| Rule of Law | 0.96*** 0.00 | 0.96*** 0.00 | 0.78*** 0.00 | 0.92** 0.00 | 1 | | | | | | | | | | |
| Voice and Accountability | 0.8*** 0.00 | 0.81*** 0.00 | 0.57*** 0.00 | 0.82** 0.00 | 0.79*** 0.00 | 1 | | | | | | | | | |
| Democracy | 0.6*** 0.00 | 0.63*** 0.00 | 0.42*** 0.00 | 0.67** 0.00 | 0.6*** 0.00 | 0.83** 0.00 | 1 | | | | | | | | |
| Executive Constraints | 0.57*** 0.00 | 0.62*** 0.00 | 0.33*** 0.00 | 0.66** 0.00 | 0.57*** 0.00 | 0.87** 0.00 | 0.87*** 0.00 | 1 | | | | | | | |
| Oil Price | -0.05* -0.05 | -0.04 -0.2 | -0.07** -0.02 | -0.01 -0.64 | -0.03 -0.34 | -0.03 -0.22 | 0.03 -0.36 | 0.05* -0.06 | 1 | | | | | | |
| Shock | -0.02 -0.52 | -0.02 -0.55 | -0.03 -0.32 | 0.0008 -0.98 | -0.02 -0.59 | -0.01 -0.71 | 0.005 -0.86 | 0.02 -0.46 | 0.53*** 0.00 | 1 | | | | | |
| Lag Privatization | 0.04 -0.18 | 0.01 -0.69 | 0.05* -0.08 | 0.001 -0.96 | 0.01 -0.81 | 0.02 -0.5 | -0.03 -0.26 | -0.05* -0.08 | 0.65*** 0.00 | -0.01 -0.62 | 1 | | | | |
| Oil production | 0.2*** 0.00 | 0.21*** 0.00 | 0.04 -0.2 | 0.15** 0.00 | 0.19*** 0.00 | 0.09** 0.00 | -0.03 -0.45 | 0.08** -0.02 | 0.02 -0.5 | 0.02 -0.5 | 0.005 -0.89 | 1 | | | |
| Population | -0.01 -0.62 | 0.07** -0.01 | 0.28*** 0.00 | 0.04 -0.13 | 0.01 -0.72 | 0.15** 0.00 | 0.24*** 0.00 | 0.32*** 0.00 | 0.05* -0.05 | 0.02 -0.54 | -0.06* -0.05 | 0.37** 0.00 | 1 | | |
| GDP per capita | 0.69*** 0.00 | 0.67*** 0.00 | 0.67*** 0.00 | 0.67** 0.00 | 0.71*** 0.00 | 0.42** 0.00 | 0.33*** 0.00 | 0.25*** 0.00 | 0.12*** 0.00 | 0.04 -0.12 | 0.09** 0.00 | 0.35** 0.00 | 0.23*** 0.00 | 1 | |
| % GDP growth | 0.17*** 0.00 | 0.17*** 0.00 | 0.09*** 0.00 | 0.2*** 0.00 | 0.17*** 0.00 | 0.2*** 0.00 | 0.18*** 0.00 | 0.25*** 0.00 | -0.01 -0.66 | 0.09** 0.00 | 0.07** -0.02 | -0.04 -0.19 | 0.09*** 0.00 | 0.11*** 0.00 | 1 |

P-value at the bottom (***) p<0.01, ** p<0.05, * p<0.1)

As shown in the Table 5, Oil Production, % GDP Growth, and GDP per capita are

correlated with governance indicators, being coefficients statistically significant at the level. However, for the first two variables these values are less than , and even for certain indicators this correlation is less than , suggesting that there is an association but no redundancy of information between these variables.

The opposite case occurs for the GDP per capita, as the magnitude of the correlation coefficients with governance indicators is above . This implies that these variables cannot be incorporated simultaneously when performing a regression, since inconsistent estimators would be generated due to the redundant information presented between them. The same is applicable for Oil Price and Diffusion of privatizations between countries variables, which have an inverse and significant correlation that can be explained by the lower trend to privatize at high regimes in oil prices, as it was specified in the description of variables.

Table 5 shows two additional variables to the ones mentioned in the previous section: Democracy and Executive Constraints. These variables refer to the index analyzed by previous studies (e.g. Guriev et al., 2009; Warshaw, 2012) in order to represent the political regime and the scope of institutional constraints on the decision-making of chief executives, respectively (Marshall and Jaggers, 2007). In this regard, it is worth noting that the governance indicators analyzed in this study have a strong and statistically significant relationship with these variables, more specifically, with the indicator *Voice and Accountability*, which measures the perceptions of participation and freedom of citizens. However, as it can be observed in the correlation matrix, indicators such as *Control and Corruption*, *Political Stability* and *Rule of Law*, have a lower magnitude in their correlation coefficients, indicating that there is information that the political regime and the institutional constraints cannot explain for themselves. Thus, the need to include other indicators to measure the relative differences between countries when analyzing the probability of privatization of oil companies is ratified.

After analyzing the 6 Governance Indicators, it is possible to see that they correlate among themselves with coefficients greater than . This prevents the inclusion of all these variables when performing the probability nonlinear model, due to the presence of possible multicollinearity issues. However, considering that these indicators are the explanatory variables studied in this work, and that regardless of the problem of correlation each of them provides different information when analyzing the socio-political dimension, it was decided to solve the problem described generating a Governance Index.

2.1.4. Governance Index

The method used to generate the governance index is called Principal Component Analysis (PCA), which is commonly used as a technique of dimension reduction (James et al., 2014). This method consists in finding linear combinations between variables known as principal components (PCs) that capture the greatest variance in the data. Thus, the first component will be defined as the linear combination that accumulates the highest variability regarding all possible linear combinations of other variables; and the following PCs are those that capture the remaining variability of the data and are orthogonal to the previous PCs (Kuhn and Johnson, 2013).

The PCs can be expressed as follows:

$$PC_j = (a_{j1} * X_1) + (a_{j2} * X_2) + \dots + (a_{jp} * X_p) \quad (3)$$

Where the coefficients $a_{j1}, a_{j2} \dots a_{jp}$, correspond to the weights that provide each P indicators $X_1, X_2 \dots X_p$, to each of the j components calculated.

Using the statistical program R, the main components for the 6 Governance Indicators were generated, with the following results:

Table 6
Weights Matrix

| | PC1 | PC2 | PC3 | PC4 | PC5 | PC6 |
|--------------------|------------|------------|------------|------------|------------|------------|
| Standard Deviation | 2.248 | 0.730 | 0.464 | 0.340 | 0.214 | 0.200 |
| Variance Ratio | 0.842 | 0.089 | 0.036 | 0.019 | 0.008 | 0.007 |
| Accumulated Ratio | 0.842 | 0.931 | 0.966 | 0.986 | 0.993 | 1.000 |

Table 7
Proportion of Variance in each Component

| | PC1 | PC2 | PC3 | PC4 | PC5 | PC6 |
|------------------------------|------------|------------|------------|------------|------------|------------|
| Corruption Control () | 0.4294 | -0.0052 | 0.3005 | -0.5146 | 0.0426 | -0.6772 |
| Government Effectiveness () | 0.4329 | -0.0476 | 0.3053 | 0.0039 | -0.7669 | 0.3591 |
| Political Stability () | 0.3474 | 0.8010 | -0.4705 | 0.0853 | -0.0704 | -0.0640 |
| Regulatory Quality () | 0.4213 | -0.1830 | 0.1545 | 0.8110 | 0.1897 | -0.2671 |
| Rule of Law () | 0.4333 | 0.0781 | 0.2461 | -0.2060 | 0.6074 | 0.5781 |
| Voice and Accountability () | 0.3771 | -0.5626 | -0.7146 | -0.1665 | -0.0132 | 0.0520 |

Consequently, all the data variability can be achieved with the 6 main components. However, the first component includes a large portion of the data variance (), so it can be concluded that this component is suitable to generate the index governance. Thus, based on the Weight Matrix presented in Table 7, it was established that the index would be represented by the following equation:

Looking at the weighting of the governance index proposed, we can see that the weights do not differ much from each other. However, the greatest contributions were made by the following indicators: Rule of Law, Government Effectiveness and Corruption Control. This means that differences between countries are further concentrated on the quality of contract enforcement, property rights, government credibility in the formulation and implementation of policies, and finally in the levels of corruption perceived by society in their institutions.

3. Results

In order to find the most robust model to explain the probability of privatizing state owned oil companies and avoid the correlation problems, different

specifications were tested in each regression. However, only the Oil Price, Shock, and Population control variables were found to be significant, as shown in Table 8.

Table 8
Logit Model with Random Effects

| Variables | (1) Privatization | (2) Privatization | (3) Privatization | (4) Privatization | (5) Privatization | (6) Privatization | (8) Privatization | (9) Privatization |
|----------------------------|-------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| Oil Price | -1,760 *** (0,544) | -1,775 *** (0,541) | -1,738 *** (0,545) | -1,867 *** (0,548) | -1,646 *** (0,536) | -1,848 *** (0,542) | -1,819 *** (0,540) | -1,801 *** (0,543) |
| Shock | 2,306 * (1,228) | 2,305 * (1,219) | 2,276 * (1,227) | 1,946* (1,167) | 1,873 (1,156) | 1,888 (1,157) | 1,944 * (1,162) | 1,833 (1,160) |
| Population | 0.813*** (0,243) | 0.748*** (0,216) | 0.795*** (0,235) | 0.781 *** (0,243) | 0.911*** (0,237) | ***0.758 (0,231) | ***0.786 (0,238) | 0.772 *** (0,238) |
| Governance Index (PC) | 0.0227 *** (0.00842) | | | | | | | |
| Governance Index (Average) | | ** 0.0421 (0.0176) | | | | | | |
| Corruption Control | | | 0.0375 ** (0.0159) | | | | | |
| Government Effectiveness | | | | 0.0504 ** (0.0196) | | | | |
| Political Stability | | | | | 0.0657*** (0.0214) | | | |
| Regulatory Quality | | | | | | 0.0505 ** (0.0203) | | |
| Rule of Law | | | | | | | 0.0476** (0.0186) | |
| Voice and Accountability | | | | | | | | 0.0498*** (0.0187) |
| Constant | -14.65 *** (5,361) | -12.64 *** (4,638) | -13.48 *** (5,050) | -13.58 *** (5,247) | -16.92 *** (5,402) | -13.15 *** (5,027) | -13.52 *** (5,136) | -13.37 *** (5,116) |
| Log Likelihood | 84,468 | 86,324 | 86,208 | 87,978 | 86,054 | 88,314 | 88,166 | 87,544 |
| Observations | 911 | 911 | 912 | 916 | 916 | 916 | 916 | 916 |
| Number of Countries | 49 | 49 | 49 | 49 | 49 | 49 | 49 | 49 |

Standard errors in parentheses (***) $p < 0.01$, ** $p < 0.05$, * $p < 0.1$)

The panel data implementation with random effects was determined, since a statistic test equivalent to and a p -value greater than the significance level of were obtained when the Hausman test was executed. Consequently, statistically there is no correlation between the regressors and the error, so choosing random effects allows to obtain consistent and efficient estimators. Similarly, a more intuitive justification for this choice is that the information of the governance indicators changes very slowly over time, so a hypothesis of fixed effects in a specific country would cause a loss in the degrees of freedom, affecting the estimate of the effects of these variables (Bortolotti et al., 2001).

Table 8 presents 8 models which intend to test the significance of the governance indicators within the probability of privatization of oil companies. On the one hand, models 1 and 2 analyze the control variables and the governance index, while, on the other hand, the models from 3 to 8 study each of the six indicators separately. It is noteworthy to see that the difference between model 1 and 2 lies in the method of calculating the governance index. The first was calculated from the major components, while the second was taken as a simple average of the 6 indicators.

In terms of the direction of the coefficients, it can be concluded that in all models the included variables produce the expected effect. Likewise, regarding

magnitude, the variable that influences the most the privatization in each model is the random shock in oil prices, although it is important to mention that not all specifications turn out to be significant.

Instead, it can be concluded that all governance indicators are indeed significant in explaining the probability of privatization of oil companies. Therefore, the relative differences in the countries in terms of regulation of institutions, political regime, political stability, control of corruption, and government effectiveness did influence the decision of a State to reduce its participation in the companies of this industry.

When comparing models, it must be noted that the Political Stability and Absence of Terrorism is the indicator with the highest coefficient in contrast to the other five indicators, and, in turn, this is the model with the largest log likelihood. This suggests that by its own, it could be the indicator of governance that better explains the probability of privatization of oil companies. It is noteworthy that this comparison does not apply to the magnitude of the governance index by the main components, as this only covers 84.2% of the variability of the data, and it is calculated from a percentage of each indicator, so the magnitude of the effect may be less strong.

Finally, based on the results, it was proceeded to calculate the marginal effects of each variable for the model with the governance index proposed by this study, obtaining the results shown in Table 9.

Table 9
Marginal Effects

| Variable | Marginal Effect |
|------------------|-------------------------|
| Oil Price | -0.03042 ** (0.012) |
| Shock | 0.039865 * (0.024) |
| Population | 0.014058 ** (0.006) |
| Governance Index | 0.000392 ** (0.0001) |

Standard errors in parentheses (*** p <0.01, ** p <0.05, * p <0.1)

Thus, it can be concluded that with an increase of one dollar (USD) in oil prices, the probability of privatizing an NOC in a producing country would decrease by about 3.04 percentage points. Also, a unit increase in the deviation of the price trend causes an increase of 3.9 percentage points in the probability of privatization. Regarding the population, an increase of one point in the logarithm of the number of inhabitants causes the analyzed probability to grow by 1.4 percentage points. Finally, an increase in one point in the governance index leads to an increase of 0.03 percentage points in the probability that a State would decrease its participation in companies of the oil industry.

4. Conclusions

While different performance methodologies have proven an increase in technical efficiency of oil companies after a privatization event, many countries still continue to have a state oil company thanks to various social and political aspects that encourage this ownership structure. Thus, this study seeks to provide statistical evidence to identify the socio-political factors, especially on the governance indicators that influence how an oil producing State decides to reduce its stake in a state-owned oil company.

After analyzing a panel data from 49 countries in the period between 1996 and 2014, it can be concluded that the socio-political dimension is significant in explaining the privatization of the oil companies. Hence, *ceteris paribus* countries with greater control of corruption, a high perception of government effectiveness, a more participatory political system, a greater regulatory quality, and a high efficiency of the contracts enforcement and property rights, are more likely to privatize oil companies, compared to those countries that have a lower level in these indicators.

The above variables were statistically significant. However, due to the presence of a high correlation among them, these cannot be studied simultaneously. Consequently, this paper proposes a governance index calculated from the Principal Components method, in order to obtain an overall score on the socio-political dimension that each of the countries analyzed present.

One limitation of this study is the small number of privatization events occurred during the analyzed time frame (1996-2014). This, due to the availability of information of the governance indicators, which restricted us to this specific period. However, it is considered that this analysis has sufficient statistical evidence to conclude that the governance factors impacts directly on the type of ownership structure that the States decide to choose for their oil companies.

Finally, it is important to note that this study has positive character, not normative, so its purpose only lies in enriching the literature related to the privatization of oil companies, and does not intended to bias the reader for or against any type of ownership structure which was analyzed by this article.

In the end, there are socio-political considerations that must be pondered by governments when deciding whether to privatize their NOCs. If the decision is privatizing, governments must be aware of the different modifications and enhancements to the set of variables – corruption control, government effectiveness, participatory political system, regulatory quality, efficiency of contracts enforcement, and respect of property rights – that will impact the privatization decision and the successfulness of the process.

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Annexes

Annex A. Model for estimate the oil price shock

The information for the estimation of the oil price was obtained from the series reported by *BP Statistics* for the years 1861 to 2015, taking the price of crude oil at US per barrel and deflating with the US consumer price index for the year 2015.

The estimation was made based on the specification of Pindick model (1999) and was obtained by applying the Ordinary Least Squares Method. The regression results are shown below:

Table 10
Estimated by OLS for
the crude oil price

| Variables | $\ln(\text{OilPrice}_t)$ |
|------------------------------|---------------------------|
| $\ln(\text{OilPrice}_{t-1})$ | 0.769*** (0.0474) |
| t | -0.00953*** (0.00253) |
| t^2 | 6.43e-05*** (1.64e-05) |
| Constant | 0.998*** (0.206) |
| Observations | 154 |
| R^2 | 0.834 |

Standard errors in parentheses

Annex B. Descriptive Statistics

Table 11
Descriptive statistics for the control variables and explanatory variables

| Variable | Mean | Standard Deviation | Min | Max | Comments |
|--|---------|--------------------|---------|----------|----------|
| Oil Price | 4.0105 | 0.5771 | 2.92 | 4.76 | N=931 |
| Shock | 0.0116 | 0.2277 | -0.56 | 0.31 | N=931 |
| Oil Production | 6.5976 | 1.3487 | 1.6094 | 9.3693 | N=908 |
| Diffusion of Privatization between countries | 2.4404 | 2.1631 | 0 | 7 | N=931 |
| Population | 16.8225 | 1.7534 | 12.6197 | 21.0339 | N=931 |
| GDP per capita | 23471 | 25112.38 | 993.09 | 134447.8 | N=873 |
| %GPD Growth | 4.8658 | 9.0666 | -62.08 | 149.97 | N=901 |
| Capitalization Market | 55.1943 | 45.4679 | 0.04 | 303.57 | N=440 |
| Government Debt | 41.2709 | 29.7349 | 0.2139 | 283.7453 | N=241 |
| Corruption Control | 45.8464 | 20.8169 | 13.27 | 100.98 | N=912 |
| Government Effectiveness | 47.7698 | 19.861 | 7.49 | 97.13 | N=916 |
| Political Stability | 43.3786 | 19.8367 | -13.7 | 80.34 | N=916 |
| Regulatory Quality | 46.5536 | 20.3817 | 6.19 | 90.46 | N=916 |
| Rule of Law | 45.294 | 19.9892 | 11.52 | 91.87 | N=916 |
| Voice and Accountability | 40.2261 | 20.4308 | 5.56 | 86.53 | N=916 |

Annex C. Mean Difference

Table 12
Mean Difference

| Variable | Mean Difference | Standard Error | Min | Max | Comments |
|----------|-----------------|----------------|-----|-----|----------|
|----------|-----------------|----------------|-----|-----|----------|

| Variable | Privatization = 0 | Privatization = 1 | Mean Difference |
|--|-------------------|-------------------|-----------------|
| Oil Price | 4.0204 | 3.6528 | 0.3676*** |
| Shock | 0.0123 | -0.0136 | 0.0259 |
| Oil Production | 6.5883 | 6.9222 | -0.3338 |
| Diffusion of Privatization between countries | 2.4073 | 3.64 | -1.2327*** |
| Population | 16.7763 | 18.4976 | -1.713*** |
| GDP per capita | 23520.31 | 21726.72 | 1793.589 |
| GDP Growth (%) | 4.871 | 4.6824 | 0.1887 |
| Market Capitalization | 55.1726 | 55.7688 | -0.5961 |
| Government Debt | 41.3329 | 39.8389 | 1.494 |
| Corruption Control | 45.5824 | 55.7687 | -10.03** |
| Voice and Accountability | 39.8227 | 54.4284 | -14.6008*** |
| Political Stability | 43.1303 | 52.2312 | -9.1009** |
| Government Effectiveness | 47.4381 | 59.952 | -12.1009*** |
| Regulatory Quality | 46.2345 | 57.9256 | -11.6911*** |
| Rule of Law | 44.984 | 56.34 | -11.3559*** |

(*** p < 0.01, ** p < 0.05, * p < 0.1)

Annex D. Hausman test

$H_0: Cov(X_{it}, u_{it}) = 0$ (The difference between coefficients is not systematic)

$H_a: Cov(X_{it}, u_{it}) \neq 0$ (The difference between coefficients is systematic)

Test statistic:

$$(b - B)' [Avar(b) - Avar(B)]^{-1} (b - B) = 4.46$$

Table 13
Fixed Effects Estimation Vs. Random Effects Estimation

| | Coefficients | | |
|--|--------------|--|--|
| | | | |
| | | | |

| | (b) | (B) | (bB) | Avar(b)- Avar(B) |
|-----------------------|---------------|----------------|------------|---------------------|
| Variable | Fixed effects | Random effects | Difference | SE |
| Oil Price | -1.69776 | -1.865494 | 0.1677343 | 0.5005802 |
| Shock | 1.799259 | 2.068972 | -0.2697131 | 0.3767311 |
| Population | -0.9772124 | 0.8633829 | -1.840595 | 8.103247 |
| Current Account / GDP | 0.2063589 | 0.0742629 | 0.1320959 | 0.0801275 |
| Normalized index | 0.1041051 | 0.0228562 | 0.081249 | 0.0615085 |

where,

$b = \hat{\beta}$ fixed effects

$B = \hat{\beta}$ of random effects

$Avar(b)$ = Variances and Co-variances Matrix of $\hat{\beta}$ of fixed effects

$Avar(B)$ = Variances and Co-variances Matrix of $\hat{\beta}$ of random effects

P-value:

Prob> $\chi^2_5 = 0.4859$

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4. It must be borne in mind that this paper categorizes a National Oil Company (NOC) when it is controlled by a national state, and an International Oil Company (IOC) when it is owned by private stockholders. The inclusion of mixed capital companies in one of these categories depends on the corporative arrangements regarding the administration of the company, the capital composition, and the legal regime that they must observe in their home country.

5. This time frame was selected due to the availability of data of sociopolitical explanatory variables which intend to be analyzed.

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