Relational Taxation with Oil and Gas Companies

Radoslaw Stefanski,∗ Gerhard Toews†
Marta Troya-Martinez‡
Rick van der Ploeg §

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Abstract

International contracts are difficult to enforce, especially in countries with weak institutions. Hence, oil rich countries can hold up international oil firms by renegotiating taxation once the investment is sunk. If future gains from trade exist, countries can devise a self-enforcing agreement that is “back-loaded” (Thomas and Worroll (1994)). When the country’s credibility is low, delaying investment and tax collection enhances the country’s credibility. On the other hand, a high credibility country’s do not need to back-load the contract. The latter provides a natural empirical counterfactual. Moreover, for the agreement to be enforceable, countries with weaker institutions should receive a higher share of the available rents, especially, in periods of higher uncertainty. Using a novel data set of oil and gas contracts in many heterogeneous countries - more and less credible, we find evidence in line with the theory.

Keywords: Relational Contracts, Taxation, Development, Oil.

JEL Classification: D86, L14, H20, O10, P48, Q30.

∗University of St. Andrews and OxCarre; rls7@st-andrews.ac.uk.
†New Economic School and OxCarre; gtoews@nes.ru.
‡New Economic School and CEPR; marta.troyamartinez@gmail.com.
§University of Oxford, CEPR and CESifo; rick.vanderploeg@economics.ox.ac.uk.
1 Introduction

Most economists agree that political institutions are important for growth and development (Acemoglu, Johnson and Robinson, 2005). In the context of natural resource extraction, it has been shown that in certain circumstances weaker institutions in general and ownership rights in particular slow down the use of resources and, thus, reduce the potential for countries to benefit from the abundance of natural resources ((Bohn and Deacon, 2000), (Cust, Harding et al., 2014)). In this paper we ask whether self-enforcing agreements may emerge in states that fail to credibly commit to contracts with private oil and gas companies.

To test this idea we present a model that captures the lack of credibility on the government side by adapting the model of Thomas and Worrall (1994). The model features a government and an oil company who have a relational contract over an infinite number of periods. Every period, the company makes an observable investment to produce oil which cannot be formally contracted on. To motivate investment, the government promises a favorable tax scheme. The investment, together with the random realization of the oil price, determines the company’s profits. At this point, the government decides which level of taxes actually to impose. If the government reneges on the taxes, the company will never invest in the country again, while if the company reneges on the investment, the government will always expropriate any future investment. In the optimal contract, the level of both the investment and taxes needs to be self-enforced.

Self-enforcing agreements ensure that the countries’ short-term incentive to expropriate is smaller than the long-term incentive to attract more investment in the future. In particular, the short-term incentives are the firm’s profits in the current period, while the long-term incentives are the current taxes plus the discounted value of the relationship (in terms of future taxes). Everything being equal, governments that discount more the future, will need larger taxes to satisfy the self-enforcing constraint. Similarly, a government that is facing a sporadic smaller discount factor (e.g. the country is at the end of the election cycle), will increase taxation to
keep the agreement self-enforcing.

Finally, Thomas and Worrall (1994) show that the optimal self-enforcing agreement is "back-loaded". In particular, the company will increase the government’s value of the relationship over time. It will do so by first increasing investment progressively and then by increasing the taxes paid to government. Delaying the collection of taxes and the firm’s investment makes the threat of terminating the relationship more effective by increasing the government’s cost of any deviation. In other words, a back-loaded agreement enhances the credibility of government by pushing potential gains towards the end of the relationship. When the government’s credibility is not a problem, there is no need to under-invest at the beginning of the relationship. The latter provides a natural counterfactual in the framework of our empirical analysis.

To sum up, the model predicts that governments with weak institutions should: 1) collect a larger share of profits to honor the agreement with the company, 2) collect larger taxes in periods of higher future uncertainty about the government remaining in power, and 3) should back-load investment and tax collection to enhance their credibility.

We then use a proprietary database which has been collected and provided to us by Wood Mackenzie to test the theoretically expected relationships. This database contains information on revenues, capital costs, labor costs and - crucially - tax expenditures for all major oil and gas firms at the country-concession-firm level for more than 3 decades. This amounts to 214 firm-concession combinations and 3381 observations in 41 countries. Finally, we classify the 41 countries according to their quality of institutions - high and low - using the quality of constraints imposed on the country’s executives in the Polity IV database.

We find that the government’s lack of credibility to commit (as measured by the weakness in its executive constraints) is reflected in the way contracts are implemented as predicted by the theory. We show that less democratic countries systematically receive a higher share of the profits
which is necessary for them to honor the agreement. Using Venezuela’s election in 2012 as a case study, we show that an increase in uncertainty when approaching the election resulted in an increase in the shares of the profits received by the government.\footnote{1} Finally, less democratic countries systematically have more back-loaded contracts than more democratic ones. Moreover, as predicted by the theory, oil companies in less democratic countries increase first investment and then taxes to reward the government for honoring the agreement.

The findings of the paper contribute to the empirical literature on relational contracts such as Antràs and Foley (2015), Macchiavello and Morjaria (2015), Gibbons and Henderson (2013) and Blader et al. (2015).\footnote{2} This literature has mainly focused on inter and intra-firm relationships. Moreover, the empirical progress of this literature has been limited by the unavailability of transaction data in environments with limited or no formal contract enforcement. Instead, in our paper, one side of the relationship is the government allowing us to explore the effect of institutions on relational contracting. Moreover, we are the first to provide evidence about the contract back-loading predicted by the theory.

In the resource economics literature, other papers have looked at the effect of institutions in the oil industry. (Stroebel and Van Benthem, 2013) consider a model where the oil company can provide the government with insurance. They consider stationary contracts and show that expropriation occurs in equilibrium (unlike in (Thomas and Worrall, 1994)) because the government’s expropriation cost is private information. Empirically, they find that expropriation is more likely when oil prices high and that more insurance is offered to countris with better institutions. Guriev, Kolotilin and Sonin (2011) also find empirically that nationalization is more likely to occur when oil prices are high and the quality of institutions low, but they use a model where firms (not the governments) can renege on the taxes. Thus, taxes cannot be to high so they are paid and as result the govern-

\footnote{1}{We are currently collecting information on the elections for our sample to test the theoretically prediction.}
\footnote{2}{See Gil and Zanarone (2017) for a recent survey.
ment has incentives to expropriate when oil prices are high. In Jaakkola, Spiro and Van Benthem (2019) show that taxation and investment exhibit cycles by using a model where the government’s commitment is limited to one period and the company cannot commit to never invest in the future. We are the first to document empirically the consequences of lack of commitment on the timing of investment and tax collection.

In the next section we set up a model and derive the hypotheses. In section 3 we describe the data. In section 4 we present the results. In the last section we conclude.

2 The model

In this section, we present a model of the relationship between a risk neutral government and a risk neutral oil and gas firm who interact repeatedly over an infinite horizon of discrete periods. The model delivers three predictions which we then test in Section 4. We borrow this model from Thomas and Worrall (1994) adapted to the oil and gas industry.

![Figure 1: Timeline of period t](image)

The timeline for each period is shown in Figure 1. Every period, the firm provides an investment $I$ (which depreciates within one period). Then an oil price $p$ is realised, which together with the investment, it determines...
the firm profit \( r(I; p) \). The price is i.i.d. over time and the probability of a price \( p \) is \( s_p \), independent of time. It is assumed that \( r(I; p) \) is twice-continuously differentiable in \( I \), increasing and concave in \( I \), \( r(0; p) = 0 \), and increasing in \( p \). Finally, the government chooses a transfer \( \tau \), leaving the firm a net profit of \( r(I; p) - \tau \). Thomas and Worrall (1994) assume that both the government and the firm have the same discount factor \( \delta \) and are credit constrained: \( r(I; p) - \tau \geq 0 \) and \( \tau \geq 0 \). Regarding the information structure, everything is observable to everyone.

A contract \( c \) at time \( t \) is a pair \( (I^t(h^{t-1}), \tau^t(h^t)) \) that depends on the history up to time \( t - 1, h^{t-1} \). The expected payoff functions of the government and the firm can thus be written as follows:

\[
V(c; h^{t-1}) = \mathbb{E} \left[ \tau^t(h^t) + \delta V(c; h^t) \right]
\]

\[
U(c; h^{t-1}) = -I^t(h^{t-1}) + \mathbb{E} \left[ r(I^t(h^{t-1}); p^t) - \tau^t(h^t) + \delta U(c; h^t) \right]
\]

It is assumed that the contract \( c \) is not enforceable in the court. Instead, the contract needs to be self-enforcing, that is, neither the government nor the firm should ever have an incentive to violate it. If the government deviates from the agreed transfer, it is assumed that the firm will stop investing in the country ever after. Therefore, if the government ever deviates, it will appropriate all the profits. The following condition ensures that the government has incentives to honour the agreement:

\[
\tau^t(h^t) + \delta V(c; h^t) \geq r(I^t(h^{t-1}); p^t) \tag{1}
\]

Likewise, it is assumed that if the firm does not invest the agreed amount, the government will always expropriate. Therefore, the following condition guarantees that the firm has incentives to honour the investment:

\[
U(c; h^t) \geq 0
\]

Define by \( I^* \) the welfare maximizing level of investment: \( E \left[ r'(I^*; s) \right] = 1 \). If the firm and the government can commit to a contract, then the firm will invest \( I^* \) every period. When the players cannot commit to the contract, the optimal contract need to be self-enforcing. It is useful to look at the government’s incentive to honor the contract in (1). This constraint
says that, for the government to honor the agreement, the amount taxed plus the future value of the relationship (in terms of future taxes) should be larger than the what the government would get if it expropriates the firm. Note that the discount factor $\delta$ is multiplying the future value of the relationship. In practice, $\delta$ is a measure of how much the government cares about the future and one can think it is affected by the country’s institutions. Accordingly, one would think that countries with bad institutions have a smaller $\delta$ than countries with good institutions. Assuming that prices and investment is the same in both types of countries, then (1) says that in countries with bad institutions taxes should be larger than in countries with good institutions, otherwise, governments will not honor the agreement.

Hypothesis 1: According to equation 1, average taxation in countries with weaker institutions should be larger.

This hypothesis compares countries with different institutions and there are many things that may change from one country to another. To avoid this endogeneity problem, the next hypothesis looks at changes in discount factor within a given country.

Hypothesis 2: According to equation 1 a decrease in the discount factor in a period of higher uncertainty will increase taxation.

The last hypothesis looks at structure of the optimal contract as proven by Thomas and Worrall (1994). In particular, they show that the optimal self-enforcing agreement is “back-loaded”. In particular, the firm will increase the government’s value of the relationship over time. The firm will do this: first, by progressively increasing investment until the first best level $I^*$ is achieved, and continue by progressively increasing the taxes paid to the government. The authors show that if the government is risk averse or there is capital accumulation (i.e. $I$ does not depreciate in one period), taxes can be paid earlier on but the dynamic structure of the contract will remain unchanged.

The rational behind this contract is that, the firm, by delaying the collection of taxes and the firm’s investment makes the threat of terminating the relationship more effective by increasing the country’s cost of any deviation. In other words, a back-loaded agreement enhances the credibility
of the respective country by pushing potential gains towards the end of the relationship. On the other hand, when the country’s credibility is high, there is no need to underinvest at the beginning of the relationship. The latter provides a natural counterfactual in the framework of our empirical analysis.

**Hypothesis 3:** Contracts will be more backloaded in countries with weaker institutions.

### 3 Data

**Oil and gas contracts**  Our first data set contains information on the 24 biggest private and public oil and gas firms. The selection of firms is based on Ross (2012), who constructed the list based on the stock value and the value of the resources owned by the firms.\(^3\) For each of these firms we observe a number of financial variables reflecting their activities across countries between 1980 and 2013.

The involvement of a firm in a particular country is always preceded by the creation of an agreement between the firm and the country hosting the firm. If the firm is granted 100% ownership of the product extracted the agreement is referred to as a concession.\(^4\) The negotiation and the allocation of concessions greatly varies and depends on a country’s petroleum laws and regulations. The total amount and the structure of payments received by government under a concession are often referred to as a fiscal system. In some countries, a single fiscal system applies to the entire country; in others, a variety of fiscal systems exist. In many cases, the concessions allocated to the same firm within the same country are also

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\(^3\)Three firms were not included due to data limitations: the national oil companies of Iraq and Libya, and Surgutneftegaz which is a Russian hybrid (partly private and partly public). Since all of these companies are state owned and do not operate outside their own state we do not consider this to be a significant limitation for our purposes.

\(^4\)In our analysis we focus on concessions because it allows us to calculate the revenues generated by firms across countries. The agreement is referred to as a service contract if the firm is granted 0% ownership and as a production sharing agreement if the firm is granted between 0 and 100% ownership. Such agreements imply that at least a share of the generated revenues by the firm is owned by the government of the country in which the firm is operating.
interlinked in a variety of ways, such as a joint calculation of the tax base\textsuperscript{5}. Therefore, in what follows, we will aggregate our variables to the level of states in the US and countries in the rest of the world and refer to repeated country-firm observations as concessions. Once agreed upon, a concession grants exclusive rights to firms to explore and extract oil and gas in a geographically defined area and sell the extracted amount.

In Table 1 we provide basic descriptive statistics. Total Revenue is calculated as the quantity produced in barrels of oil-equivalent multiplied by the current price per barrel in US$ and is defined as $pQ_i^f$ for firm $f$ in country $i$. Capital Costs are calculated as the amount spent on durable goods (assets with lifetime $>1$ year) in US$ and are defined as $rK_i^f$. Operational Costs are calculated as the amount spent on labor and non-durable goods e.g. (mostly) salaries and wages but also materials, insurance and maintenance in US$ and are defined as $w_tL_t^i$. Our main variable of interest is the Government Take which can be thought of as the price the firm pays for receiving the right to explore and extract the product. It captures the total amount of payments received by the government. This measure typically captures a variety of different flows, such as bonuses, rentals, royalties, corporate income taxes, and a number of special taxes. We use the government take since it is the most common statistic used for the evaluation of contracts. (Johnston, 2007; Venables, 2016). See Johnston (2007) for a discussion on the advantages and the disadvantages of such a measure. See Mintz and Chen (2012) for an excellent survey of tax and royalty systems

\begin{table}
\centering
\begin{tabular}{lccccc}
\hline
 & mean & p50 & sd & max & min \\
\hline
Total Revenue & 4768.11 & 760.80 & 19964.47 & 436419.10 & 1.80 \\
Capital Cost & 508.02 & 91.20 & 1532.29 & 19756.90 & 0.10 \\
Operational Cost & 586.43 & 108.00 & 2381.40 & 45709.20 & 0.10 \\
Gov. Take / Taxes & 2731.44 & 329.30 & 15143.22 & 364597.5 & 0.00 \\
\hline
\end{tabular}
\end{table}

\textit{Source: Own Calculations}
Table 2: Summary statistics

<table>
<thead>
<tr>
<th></th>
<th>mean</th>
<th>p50</th>
<th>sd</th>
<th>min</th>
<th>max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Executive Constraints</td>
<td>0.6</td>
<td>0.7</td>
<td>0.31</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

Source: Own Calculations

across a number of countries for which detailed data is publicly available.

The data has been collected by Wood Mackenzie\(^6\) which is a leading consultancy in energy and mining industries and is collected in a variety of ways. First, they conduct face to face interviews with energy firms in the relevant countries and official reports of such firms. Second, they use information form publications of regulatory authorities and governments of the respective countries. Third, they use a variety of media sources. We are not the first to use their data for research purposes (see for instance Stroebel and Van Benthem (2013) and Jaakkola, Spiro and Van Benthem (2019)).

**Executive constraints** To test the first and the last hypothesis, we additionally need data which allows us to differentiate between countries which have weak and strong institutions, which we get from Polity IV measure containing coded annual information on regime and authority characteristics for all independent states. In particular, we use the variable executive constraint, which measures the extent of institutional constraints on the decision-making powers of the chief executive, whether an individual or a collective executive. Table 2 provides the summary statistics for our sample of countries.

We normalize the executive constraints variable to 0 and 1, and we define countries with a value of $\geq 0.8$ as countries with good checks and balances. Figure 2 show how many firm-government relationships start in countries with weak and strong executive constraints in each year.

\(^6\)https://www.woodmac.com/
4 Results

To test the first hypothesis we are interested in, we compute the total share of taxes (government take) received by country \( i \) from firm’s \( f \) profits in period \( t \):

\[
\alpha_{i,t}^f = \frac{\tau_{i,t}^f}{p_t q_t^f - costs_{i,t}^f} \tag{2}
\]

where \( p_t q_t^f \) is firm’s \( f \) revenues in country \( i \) at time \( t \) and \( \tau_{i,t}^f \) are the taxes collected by the country (government take).

Figure 3 plots the distribution of \( \alpha_{i,t}^f \) for more and less democratic countries. As suggested by Hypothesis 1, we can see that the less democratic countries tend to get a larger share of the profits. As highlighted constraint 1, if less democratic countries have a smaller \( \delta \), their share of the profits should be larger so the constraint is satisfied and they can credibly honor
the agreement. If this were not the case, smaller taxes would push those countries to renege on their agreements and, we would not observe such contracts empirically (i.e. survival bias).

Of course, the results presented in Figure 3 do not confirm any causal relationship. To push it a bit further in this dimension we look at a specific case in which we know that a country experienced a drop in $\delta$ in a particular point in time due to increased political uncertainties in the upcoming elections. Venezuela is an oil rich country. In 2009 the Constitution was changed to abolish term limits, which allowed the incumbent president Hugo Chavez to run again for a reelection in 2012. A government that faces an election in the near future has the discount factor reduced since with some probability it will not be re-elected and will not accrue the future value of the relationship. If equation 1 is binding, one would expect that the share of the oil profits received by the government should increase to compensate for the reduced future value.

In Figure 4, we plot the firm specific $\alpha_{i,t}^f$ of firms active in Venezuela in that time period between 2009 and 2012. The results presented con-
firm our predictions. While the profit share across the companies active in Venezuela do not seem to follow an apparent trend before 2009, this changes immediately after 2009 when the share of profits starts increasing homogeneously until 2012 when the election takes place and uncertainty is resolved. Note that between 2012 and 2013 the share of taxes paid does not change significantly, as expected.

Figure 4: Timing of tax collection

Finally, to test the third hypothesis we turn to analyze the timing of tax collection and investment. To do so, we compute the share of cumulative taxes and cumulative tax collected by the country in period $t$:

$$\beta_{i,t} = \frac{\delta^t \tau_{i,t}}{\sum_{j=1}^{T} \delta^t \tau_{i,t}}$$

(3)

where $\beta_{i,t}$ is the share of the present value of total taxes collected in period $t$. Analogously, we calculate $\gamma_{i,t}$ the share of the present value of total investment $I_{i,t}$ made in period $t$ as:

$$\gamma_{i,t} = \frac{\delta^t I_{i,t}}{\sum_{j=1}^{T} \delta^t I_{i,t}}$$

(4)
The results are presented in Figure 5 and are in line with the theoretical prediction suggesting that the collected of taxes and investments are back-loaded in less democratic countries.

Oil firms decide to have a larger share of the investment and pay a larger share of taxes early on in the relationship when they are producing in more democratic countries. Instead, in less democratic countries, firms back-load to these decisions to towards the end of the relationship. Interestingly, they start giving a more valuable relationship to the less democratic government by increasing investment first and taxes later, just as the model predict.

5 Conclusion

We present a model in which a large multinational companies need to establish a long-term relationship with different countries that differ in terms of their institutional qualities.
We first show that countries with worse institutions receive a higher share of total profits to be shared. Using Venezuela as a case study, we show that the share in profits seems to increase during periods of higher uncertainty supporting the idea that the former is not an artifact of the cross-sectional comparison. We plan to explore this mechanism systematically by using the election data for our sample.

Finally, we show that the timing of tax collection and investment is such that countries with weaker institutions suffer from delayed investment and receive taxes later - relative to countries with better institutions. Thus, all our empirical results are in line with the theoretical predictions.
References


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