Journal of Law, Economics, and Organization Advance Access published June 23, 2009

Determinants of Nationalization in the Oil Sector: A Theory and Evidence from Panel Data

Sergei Guriev*
New Economic School

Anton Kolotilin**
Massachusetts Institute of Technology

Konstantin Sonin***
New Economic School

In this article, we study nationalizations in the oil industry around the world during 1960–2006. We show, both theoretically and empirically, that governments are more likely to nationalize when oil prices are high and when political institutions are weak. We consider a simple dynamic model of the interaction between a government and a foreign-owned oil company. Even though nationalization is inefficient, it does occur in equilibrium when oil prices are high. The model's predictions are consistent with the analysis of panel data on nationalizations in the oil industry around the world since 1960. Nationalization is more likely to happen when oil prices are high and the quality of institutions is low, even controlling for country fixed effects. (*JEL* D23, L33, L71, P48)

1. Introduction

Recent years have brought back a phenomenon that has not been observed since 1970s: forced nationalizations of major foreign-owned oil assets in Bolivia, Ecuador, Russia, and Venezuela. As in the 1970s, these nationalizations have become a serious problem for the majority of international oil companies

*Morgan Stanley Professor of Economics, New Economic School, Moscow, Russia. Email: sguriev@nes.ru.

**Department of Economics, Massachusetts Institute of Technology, Cambridge, Massachusetts, USA. Email: akol@mit.edu.

***SUEK Professor of Economics, New Economic School, Moscow, Russia. Email: ksonin@nes.ru.

This work has originated from Kolotilin's thesis at the New Economic School and was supported by the New Economic School's Research Center. We are grateful to Stephen Kobrin for providing us with data on nationalizations. We thank the editor Luis Garicano and two anonymous referees, as well as Victor Chernozhukov, Art Durnev, Georgy Egorov, Robert Gibbons, Craig Pirrong, Ekaterina Zhuravskaya, and participants at the Massachusetts Institute of Technology Organizational Economics lunch and conferences in Beijing and Moscow for helpful comments.

The Journal of Law, Economics, & Organization
doi:10.1093/jleo/ewp011

(Mouawad 2006). In 2007, the US Congressional Research Service Report for the Congress on the role of national oil companies (Pirog 2007) opened with the following statement: "In June 2007, ExxonMobil Corporation and ConocoPhillips, two of the largest U.S. oil companies, abandoned their multi-billion dollar investments in the heavy oil deposits of the Orinoco basin in Venezuela. This action followed the breakdown of negotiations between the companies and the government of President Hugo Chávez and Petróleos de Venezuela (PDV), the Venezuelan national oil company. Four other international oil companies, including Total S.A. from France, Statoil from Norway, BP from Great Britain, and Chevron from the United States, accepted agreements that raised the PDV share in their Orinoco projects from approximately 40% to a controlling interest of about 78%."

Recent nationalizations were not random or isolated events. As Bolivia's vice president Álvaro García Linera suggested, they are a part of an emerging policy model of the oil-producing countries:

> We offer our humble contribution to what we see as 21st century-style nationalization, which means that foreign companies with capital and know-how are present in the country with their machinery, and they can earn profits, but never again can they be the owners of the gas and the petroleum (Llana 2007).

The issue of forced nationalizations is related to one of the most important questions in economics: If property rights are so vital for economic efficiency, why are they so hard to uphold? In theory, the celebrated Coase theorem implies that if a government is less efficient in production, it should sell its property rights to the most efficient producer. In practice, the privatization literature (see a survey in Megginson[2005]) implies that switching to private ownership does increase productive efficiency in most cases. In the oil sector, extensive anecdotal evidence (e.g., Yergin 1991) shows that this argument is probably even more relevant than in other industries. Due to their economies of scale and their better use of human capital, multinational oil companies have become more efficient. Nationalizations have often caused losses in output and, ultimately, national income for countries that depend heavily on oil.

In this article, we analyze determinants of oil nationalizations around the world. One immediate observation is that nationalizations of oil companies took place when oil prices were high (Figure 1). Specifically, most nationalizations took place in the 1970s when oil prices were at historically high levels. Once oil prices came down in the 1980s and 1990s, nationalizations virtually disappeared and reemerged only in the last decade when oil prices (in real terms) climbed back to the levels of the 1970s and then exceeded them. The correlation between high oil prices and "resource nationalism" seems to be well understood by oil executives and analysts. CEOs of Eni and Exxon, as well as those of the leading oil consulting firms, agree that while high oil prices bring high cash flows to international oil companies, they also raise

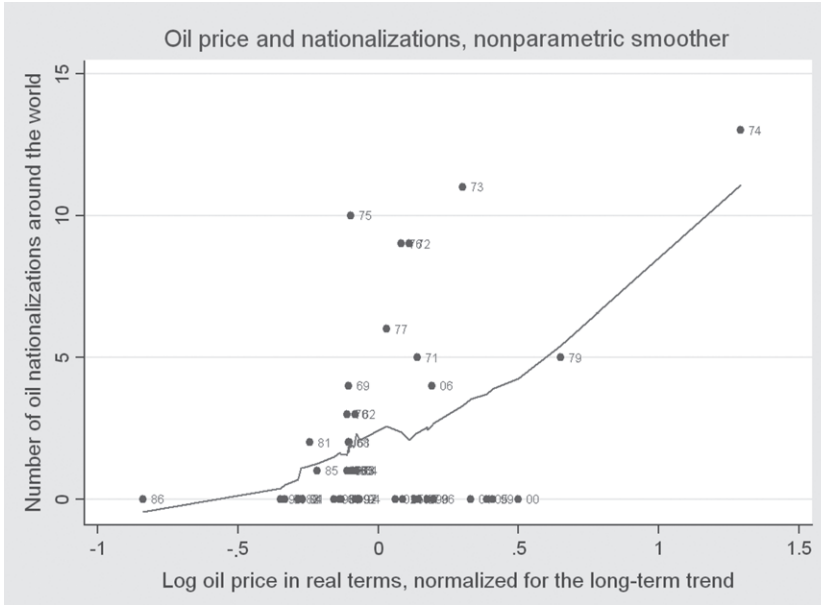

Figure 1. Oil Price (in Real Terms) and Number of Nationalizations in the Oil Industry Around the World in 1960–2006. For Each Year, We Estimate the Oil Price's Trend for the Previous 50 years and Plot the Deviation from the Trend.

the bargaining power of oil-producing countries (New York Times, May 6, 2006).

On the one hand, it seems natural that the higher the oil price, the more valuable the oil assets are, and the stronger the government's incentives are to expropriate. On the other hand, given the costs of nationalization, it is not immediately clear why a government would respond to a positive oil price shock with nationalization rather than with simply imposing higher taxes. Contract theory implies that the government is better off keeping property rights intact and taxing the oil companies' rents. Using taxes contingent on (observable and verifiable) oil prices, the government can preserve oil companies' incentives for investment in new fields and cost-reducing technologies. This straightforward solution, however, relies on external enforcement of contracts, which is not the case: government is both an enforcer and a contracting party. Therefore, this contract should be treated as a relational contract (see Bull 1987; Baker et al. 1994; Levin 2003). Such a contract is self-enforced. The only protection for a private company is the government's desire to benefit from more efficient production in the future—as long as checks and balances within the government assure that the government currently in office maximizes long-term payoffs.

Analysis of this relational contract results in a simple prediction: when the current oil price is high, (inefficient) nationalizations may take place in equilibrium. In this case, the immediate prize is too valuable relative to future

revenues. Each party's self-enforcement constraint is harder to meet, and the logic of relational contracting falls apart. Therefore, we should expect more nationalizations during periods of higher oil prices. Another prediction is that nationalization is more likely whenever there are fewer checks on the government so that the government finds it hard to commit not to nationalize.

We test these predictions using data on all nationalizations of foreign-owned oil companies around the world during 1960–2006. We focus on oil as nationalizations of oil companies are high-profile events and are relatively easy to keep track of. Also, oil is a globally traded commodity with a long-time series of prices. We show that nationalizations are indeed more likely to take place when oil prices (controlling for its long-term trend) are high and in countries with weak political institutions. Most importantly, the results hold even controlling for country fixed effects. In other words, in a given country, nationalization is likelier in periods when this country's institutions are weaker (and when oil prices are high).

Our econometric results are consistent with rich anecdotal evidence available in the existing literature. Yergin (1991) provided a detailed narrative of major events in the oil industry, paying particular attention to the fate of international oil majors. Moran (1973) described how international treaties may increase the costs of nationalization. Eaton and Gersovitz (1983) discussed the risks that companies face when they invest abroad. This studies provided numerous examples and historic account of expropriations. In particular, Eaton and Gersovitz emphasized that investments in extractive industries such as oil are probably exposed to a higher risk than those in other industries due to the fact that extractive industries require high investments at the initial stages before production begins. Eaton and Gersovitz also pointed out that some foreign oil companies used the following strategy to protect their assets from expropriations: The companies did not explore new oil reserves until they had emptied explored oil reserves and used the threat of withdrawal from future exploration in the case of expropriation. This strategy is associated with excessive costs due to inefficiently long delays, underinvestment in exploration, and inefficiently high speed of extraction of explored oil reserves. Eaton and Gersovitz also provided an example of an opposite strategy where an oil company continuously invests in an upgrade of its plant even before this investment was justifiable. This strategy allowed the firm to be ahead of the local engineers' expertise, although with some inefficient cost.

A few articles study the issue empirically. Williams (1975) estimated the amount of expropriations of foreign owners, both with and without compensation, in developing countries from 1956 to 1972; he showed that 20% of foreign investment in these years was expropriated without compensation. Kobrin (1980, 1984a, 1984b) described the nationalizations in detail. His initial argument (see Kobrin 1980) was that nationalizations are usually *selective*, that is, they focus on specific firms or industries. Hence, nationalizations are driven by rational economic interests rather than by ideology or short-term political opportunism. Later, Kobrin (1984a) argued that oil-producing countries do not necessarily need to nationalize the assets to achieve control over

selected strategic enterprises; regulation would be sufficient. Considered jointly, Kobrin's explanations of the increase in nationalizations in the early 1970s (Kobrin 1980) and the decline of nationalizations in the late 1970s (Kobrin 1984a) set a perfect stage for our theoretical and econometric study. Although Kobrin certainly ruled out ideological drivers of nationalizations, he put forward a variety of interrelated economic hypotheses that are hard to test without a formal model and a multivariate regression analysis. Kobrin (1985) emphasized that once one government expropriates, there is a visible "domino effect." Other oil-exporting governments learn from the experience. He tested whether the number of expropriations follows a Poisson process. He rejected the hypothesis of a Poisson process and explained this by the "domino effect," where expropriations are more likely to be clustered over time. Note that his result can alternatively be explained by the fact that the nationalization rate is a function of worldwide oil prices and other relevant economic factors that change over time.

The first systematic multivariate regression analysis of nationalization risks was carried out by Jodice (1980). He used data on the Third World for 1968–76 and covered multiple sectors, not just oil. Jodice ran a cross-country regression and found that poorer and war-torn countries are more likely to nationalize.

Bohn and Deacon (2000) investigated the impact of property rights protection on investment and production in the natural resources industry. In their model, there is an exogenous probability of nationalization. This risk may have two countervailing effects. On the one hand, firms underinvest in long-term production capacity; on the other hand, firms may also try to extract and sell resources inefficiently early. Bohn and Deacon ran cross-sectional regressions to show that the first effect dominates and insecure ownership rights result in underinvestment rather than in overinvestment. In Thomas and Worrall (1994), a firm and a state are involved in a multiperiod interaction in an environment with poorly protected property rights. The state, which cannot produce on its own, can expropriate the firm's one-period proceeds but gets nothing in subsequent periods. The firm has all the bargaining power but has no access to the revenue generated by the sale of oil. Initially, the firm underinvests, but in the long run, it invests at the socially optimal level (for certain parameter values). In our model, the government can produce on its own, albeit less efficiently than the private firm, and the government, rather than the firm, has full bargaining power. Most crucially, the party in control of production (either the government or the private firm) can retain revenues for the given period. As a result, when oil prices are high, nationalization does occur in equilibrium, unlike in Thomas and Worrall's model.

Another relevant strand of literature is the dynamic theory of political transitions. Acemoglu and Robinson (2001) argued that democratic revolutions are more likely when the economy is in a downturn. In our model, nationalizations happen when oil prices are high, which corresponds to positive terms-of-trade shocks for an oil-producing country. The difference comes from the relative short- and long-term benefits in the two models. In our model, the state compares the immediate proceeds of nationalization against long-term losses

in efficiency. In Acemoglu and Robinson (2001), the median voter, revolting against the elite, trades off immediate deadweight losses of the revolution, and the future gains of greater control over political decision making.

The rest of the article is organized as follows. Section 2 contains a model that links stochastic movement of oil prices to the government's incentives to expropriate. Section 3 describes the data used in the empirical exercise and reports the empirical results. Section 4 concludes.

2. Theory

2.1 Setup

We consider an infinite-period game between two risk-neutral agents: the private (foreign) firm and the government. Each agent maximizes the net present value of expected future cash flows.[1] Both have a discount factor of $\delta \in (0,1)$ per period.

There is a natural resource, for example, oil, which is extracted by either the firm or the government and then is sold in a perfectly competitive global market.

2.1.1 Production Technology.

Extracting Q_t barrels of oil in period t requires an investment of $K_t = Q_t^{1/\alpha}$ units of capital, here $\alpha \in (0,1)$. The cost of capital for the firm is normalized to 1. The government is less efficient. To install K units of capital, it needs to spend γK, where $\gamma > 1$. For simplicity, we assume that capital stock depreciates fully in one period.

2.1.2 Oil Price.

The global price of oil, p_t, follows an i.i.d. process with a distribution function $F(p_t)$. The expected price is $\mathbb{E}[p_t] = \int p dF(p) = P$. The support of the distribution is $[\underline{p}, \overline{p}]$. We allow for both bounded and unbounded supports $\overline{p} \leqslant \infty$. (We have also analyzed more sophisticated stochastic processes for p_t; the results are similar and available upon request.)

2.1.3 Timing.

Before the beginning of the game, the government decides whether to extract oil by itself or to delegate production to the firm. In this latter case, the government commits to tax schedule T_t, which can potentially depend on the whole history of prices of oil and investment levels.[2]

In each period t, the timing is as follows:

1. The party in control (either the firm or the government) decides how much to invest, K_t. If the firm is in control, it decides whether to pay the

1. The government's objective function would be the same if it maximized the welfare of the rest of society, excluding foreign firms, and the tax revenues were distributed to the society.

2. The assumption that the government can commit to the tax schedule is not crucial since the optimal tax schedule (see Propositions 1 and 2) is incentive compatible for the government, that is, the government would not revise the tax schedule even if it could.

tax T_t. If the firm does not pay taxes, the government nationalizes the company without any cost and makes the investment decision.

2. The oil price, p_t, is realized.
3. If the firm is in control, the government decides whether to expropriate, in which case the industry becomes public and the government incurs a cost $C \geqslant 0$ of nationalization.
4. The party in control (either the firm or the government) sells $Q_t = K_t^{\alpha}$ at price p_t.

The parameter C captures the cost of nationalization that may include internal or external legal or political risks, reputational problems, or direct costs of ownership transfer. In a more sophisticated model, one could distinguish between different mechanisms that provide constraints on the government's behavior—through direct punishment or repeated interaction. However, in this article, we do not provide microfoundations for this cost; we simply assume that there is a fixed exogenous cost of nationalization.

2.1.4 Equilibrium Concept. We focus on subgame perfect equilibria in the repeated game. For simplicity's sake, we assume that the government expropriates the company whenever it fails to pay taxes and that the government cannot privatize the firm in the future.[3]

2.1.5 Ownership and Control Rights. In this article, we do not distinguish between ownership and control. Although we are aware of the debate over ownership and control rights in the literature on property rights and on corporate governance, we intentionally avoid the distinction between them for practical reasons. The goal of this article was to understand the decision to shift from a situation, in which a private firm controls oil extraction, sells oil, and pays taxes out of oil revenues, to the situation where the government is in charge of the production process and receives the oil revenue directly. In principle, one can also consider a situation where the government is the ultimate owner but hires a private firm to run the oil field. This arrangement—which is actually the case in many countries—is, for our purposes, equivalent to the case of a private firm being in control. Indeed, in this case, the private firm is in control of production and revenues. In practice, there is only a nominal distinction between the situation where the government is the owner and gives the private firms licenses for running the oil fields, and the situation where private firms have both ownership and control rights. Indeed, as the government itself enforces the contracts, the ownership rights are only nominal. In both cases, expropriation can take place—either by revoking the license or by taking away the ownership rights.

3. Historically, there have been examples of a privatization following a nationalization. Yergin (1991) described the story of the Nigerian government, which seized British Petroleum's assets in 1973, only to auction them off soon afterwards.

What matters for our analysis is which party controls production (and, therefore, the revenue) in a given period. If a private firm is in control of production in period t, it is this firm's decision whether to pay taxes in this period. The government cannot immediately compel either the production decision or the financial decision in this period; the government can only threaten expropriation. This setting is different from that of Thomas and Worrall's and other articles in the relational contracts literature, where the principal controls the revenue and pays out a wage to the agent. We believe that our setting is more realistic, at least for modeling oil nationalizations.

2.2 Benchmark Outcomes

The first-best outcome is as follows: the oil business is private, and the level of investment is

$$K^* = \arg\max_K \{PK^\alpha - K\} = (\alpha P)^{\frac{1}{1-\alpha}}.$$

The total expected discounted payoff is

$$U^* = \frac{1}{1-\delta}\frac{1-\alpha}{\alpha}K^*.$$

If the government is in control, then the investment is

$$K_{\text{exp}} = \arg\max_K \{PK^\alpha - \gamma K\} = \left(\frac{\alpha P}{\gamma}\right)^{\frac{1}{1-\alpha}} = \gamma^{-\frac{1}{1-\alpha}}K^*$$

and the government receives a payoff equal to

$$U_{\text{exp}} = \frac{1}{1-\delta}\left[\max_K PK^\alpha - \gamma K\right] = \gamma^{-\frac{\alpha}{1-\alpha}}U^*.$$

2.3 Equilibrium without Nationalization

For some parameter values, the first-best investment level $K_t = K^*$ can be supported along the equilibrium path. In this section, we will solve for the equilibrium in which (a) the government has no incentives to expropriate and (b) the firm is better off paying taxes.

This equilibrium is similar to that in the relational contracts literature (Levin 2003). The government does not expropriate as the one-period returns to nationalization are below the future payoffs related to higher production efficiency. The government benefits from the firm's more efficient investment as it can charge higher taxes. Still, the taxes have to be sufficiently low, so that the firm's quasi-rent provides it with incentives to pay the taxes rather than sell one period's worth of output and then quit the country. These self-enforcement constraints impose the conditions on parameters under which the first-best outcome is supported in equilibrium.

Since there is no risk of nationalization, it is optimal to implement the first-best level of investment $K_t = K^*$. The first best is an equilibrium outcome whenever the current one-period payoff $p_t K_t^\alpha$ is sufficiently low compared to the net present value of future revenues.

Proposition 1. There exists an equilibrium without nationalization with the first-best level of investment that maximizes the government's value if and only if the oil price volatility is not too high ($\overline{p}$ is sufficiently low given the expected price P), institutions are strong (C is high), both agents are sufficiently patient (δ is high) , and the government is sufficiently inefficient (γ is high) so that:

$$\frac{\overline{p}}{P} \leqslant \frac{C}{PK^{*\alpha}} + \frac{\delta}{1-\delta}(1-\alpha)\left(1-\gamma^{-\frac{\alpha}{1-\alpha}}\right). \tag{1}$$

The tax level in this equilibrium is $T^* = (1-\delta)U^*$.

Proof. In order to prove the Proposition, one has to check that neither party has incentives to deviate. At any moment, the firm should prefer the equilibrium payoff (net of investment costs and taxes) to the deviation (do not invest, do not pay taxes once, and get zero thereafter). We will refer to this condition as the firm's self-enforcement constraint (at $t+1$)

$$\frac{1}{1-\delta}\frac{1-\alpha}{\alpha}K^* - \sum_{\tau=t+1}^{\infty}\delta^{\tau-t-1}\mathbb{E}_t[T_\tau] \geqslant 0.$$

The government should also prefer the equilibrium payoff to nationalization. If the government expropriates, it grabs $p_t K^{*\alpha}$, pays the cost C, and then produces with suboptimal technology. The latter strategy brings the net present value of U_{exp}. Therefore, the government's self-enforcement constraint (at t) is

$$\sum_{\tau=t+1}^{\infty}\delta^{\tau-t}\mathbb{E}_t[T_\tau] \geqslant p_t K^{*\alpha} - C + \delta U_{\text{exp}}.$$

Adding up the two self-enforcement constraints (after multiplying the firm's constraint by δ), we obtain a necessary condition for this equilibrium to exist:

$$\frac{p}{P} \leqslant \frac{C}{PK^{*\alpha}} + \frac{\delta}{1-\delta}(1-\alpha)\left(1-\gamma^{-\frac{\alpha}{1-\alpha}}\right) \quad \text{for any } p \in [\underline{p}, \overline{p}].$$

This is also the sufficient condition. Indeed, whenever $T_t = T^* = \frac{1-\alpha}{\alpha}K^*$, the firm chooses K^*, both self-enforcement constraints are satisfied, and the firm gets a zero continuation payoff, which means that government's value is maximized. □

The intuition behind equation (1) is straightforward. The left-hand side is proportional to the benefits of expropriation; it is the value of the current period's revenue $pK^{*\alpha}$ normalized by the future expected per-period payoff $PK^{*\alpha}$. The right-hand side is the cost of expropriation (again, normalized by $PK^{*\alpha}$): the direct cost, proportional to C, and the discounted future stream of efficiency losses, $\frac{\delta}{1-\delta}(1-\alpha)\left(1-\gamma^{-\frac{\alpha}{1-\alpha}}\right)$.

Since the firm has the option to run away with one-period returns, the highest tax that the government can impose is the net present value of future profits. As the model is stationary, future revenues do not depend on the current oil price and thus neither does the tax depend on the oil price. Thus, the government's instantaneous profit from expropriation is exactly equal to the one-period return, and when the oil price is high, there is a higher temptation to expropriate.

The comparative statics are also fully intuitive: the first-best outcome is easier to maintain in equilibrium whenever patience δ, government inefficiency γ, and the direct cost of expropriation C are high. In particular, if the government could choose C, it would be better off to improve institutions (increase the cost of expropriation C) so it would be easier to commit to abstaining from expropriation. Note also that parameters C and γ affect the model only through the government's outside option $-C+\delta U_{\text{exp}}$.

2.4 Equilibrium with Nationalization

The results above are fully in line with the existing literature on relational contracts, which describes the conditions for the first-best outcome to be supported in equilibrium. In this section, we study the situation when the oil price is very volatile and equation (1) does not hold. In this case, the investment is suboptimal, and nationalization may take place along the equilibrium path.

As both parties expect the expropriation to occur with a nonzero probability, it is no longer obvious that it is optimal to have private ownership in the first place. Indeed, if a private firm is in control, it will take into account the possible future expropriation and will therefore underinvest. If the probability of future expropriation is sufficiently high, the resulting inefficiency due to this underinvestment may be larger than the technical inefficiency of government control. Thus, if γ is sufficiently close to 1, the analysis would be trivial: the government would never allow private ownership in the first place. In this section, we consider the more interesting case: we shall assume that $\gamma-1$ is large so that private ownership is optimal *ex ante*.

Along the equilibrium path prior to nationalization, the investment is constant over time $K_t=\widetilde{K}$ and solves the following dynamic optimization problem (see Appendix A for a detailed proof):

$$\overline{V}_G=\max_K -K+PK^{\alpha}+\delta\overline{V}_G-[(\delta(\overline{V}_G-U_{\text{exp}})+C)(1-F(\widetilde{p}))], \tag{2}$$

where $\widetilde{p}=\frac{\delta(\overline{V}_G-U_{\text{exp}})+C}{K^{\alpha}}$ is the threshold price of oil above which expropriation occurs.

The government can implement this level of investment with the following tax schedule: $\widetilde{T}=-\widetilde{K}+\widetilde{K}^{\alpha}\int_{\underline{p}}^{\widetilde{p}} pdF(p)$ if the investment level is $\widetilde{K}$ and very high tax otherwise.

The optimal $\widetilde{K}$ maximizes social welfare, which takes into account the nontrivial probability of expropriation $1-F(\widetilde{p})$. The intuition behind the optimization problem (2) is as follows: with probability $F(\widetilde{p})$, the government does not expropriate and the social welfare is $-K+PK^{\alpha}+\delta\overline{V}_G$, and with probability $1-F(\widetilde{p})$, the social welfare decreases by the deadweight loss of $(\delta(\overline{V}_G-U_{\text{exp}})+C)$.

Proposition 2. If equation (1) does not hold, the equilibrium that maximizes the government's value is as follows. Consider $\widetilde{p}$ and $\widetilde{K}$ that solve the optimization problem (2). Whenever the oil price, p_t, exceeds $\widetilde{p}$, the government nationalizes; after nationalization, the investment is K_{exp}. As long as the oil

price is below $\widetilde{p}$, there is no nationalization, the firm invests $\widetilde{K} < K^*$, and the tax level is:

$$\widetilde{T} = -\widetilde{K} + \widetilde{K}^{\alpha} \int_{\underline{p}}^{\widetilde{p}} p dF(p).$$

As institutions become very strong $C \to \infty$, the investment level approaches the first-best $\widetilde{K} \to K^*$.

Assume further that the density function $f(\cdot) = F'(\cdot)$ is well defined and such that $p^2 f(p)$ is decreasing in p at $\widetilde{p}$. Then, the probability of nationalization $1 - F(\widetilde{p})$ decreases with both the strength of institutions, C, and the government's inefficiency, γ; the equilibrium level of investments $\widetilde{K}$ increases in both C and γ.

The Proof is relegated to Appendix A.

The technical assumption that $p^2 f(p)$ is decreasing in p is natural if expropriations are relatively rare events, that is, when $\widetilde{p}$ is sufficiently large. If $p^2 f(p)$ were weakly increasing in p, then the expected oil price P would not be finite.

The result that the higher the cost of expropriation C, the less likely is expropriation, is not trivial. On the one hand, a higher cost of expropriation makes expropriations relatively unattractive. On the other hand, this cost is actually paid along the equilibrium path with some probability, hence private ownership is less efficient. Proposition 2 shows that the positive effect dominates when the cost of expropriation is sufficiently high.

Remark 1. The equilibrium outlined in Proposition 2 also includes outcomes where the firm underinvests, but the probability of expropriation is trivial. This happens when the distribution of the oil price is bounded and the firm invests so that the government is indifferent between expropriating and keeping the company private exactly when the oil price reaches its upper bound, so that $\widetilde{p} = \overline{p}$. This case is characterized by the same optimization problem (2). Empirically, however, this case is hard to distinguish from the equilibrium without nationalization.

3. Empirical Analysis

The model has two testable implications. First, a positive oil price shock increases the risk of nationalization. Second, weak political institutions increase the risk of nationalization. Indeed, the stronger the institutions, the higher the costs of nationalization C. In the next subsection, we discuss the variables we use to test these predictions and to control for alternative explanations.

3.1 Data

3.1.1 Nationalizations. The data on nationalizations come from four major sources complemented by our own search in Google, ProQuest, and Factiva.

The four main sources use a similar methodology (described in Kobrin 1980) and cover three different time periods. The first data set was compiled by Kobrin (1980, 1984a) and covers 1960–79. The second data set comes from Minor (1994) and covers 1980–92. The third one comes from Coyle (2003) and covers 1993–2002. The fourth one comes from Kobrin (1984b) and covers 1918–82 (this data set includes nationalizations in oil production only). Our own search was also based on Kobrin's approach and covered 1913–2006.

Below, we describe Kobrin's methodology and data set in greater detail (see Kobrin [1980] for a comprehensive description). These data were mostly collected by the United Nations Economic and Social Council. The data only include forced divestments of foreign property, classified into four categories: (a) *formal nationalization,* (b) *intervention,* (c) *forced sale,* and (d) *contract renegotiation.* Unlike formal nationalization (which takes place in accordance with local law), intervention is an extralegal forced transfer of ownership (by either public or private actors). Contract renegotiation is a revision of contractual agreements involving the coercive power of the government, resulting in an effective transfer of ownership.

We only consider cases of nationalization in oil extraction (SIC codes 130 and 131). Our dependent variable is as follows:

$$N_{it} = \begin{cases} 1, & \text{if there was at least one nationalization in country } i \text{ in year } t \text{ in the oil sector;} \\ 0, & \text{otherwise.} \end{cases}$$

We study the period 1960–2006; according to the data sources above, during this period, there were 98 nationalizations in 42 countries (see Appendix B for the complete list). Most nationalizations were concentrated in the 1970s (see Figure 1). There were almost no nationalizations in the 1980s, none at all in 1990–2005, and quite a few in 2006.

3.1.2 Oil Price. We use crude oil price data from BP Statistical Review of World Energy, June 2008 (www.bp.com). Throughout the article, we only consider real rather than nominal prices; all prices are in 2007 US dollars.

In order to derive empirical implications from our model, we need to take into account that our theory predicts that probability of nationalization depends on the deviation of the oil price from its long-term trend rather than on the trend itself. Indeed, suppose that oil price is high but the expected future price (the trend) is also high. In this case, nationalization would not pay off.

In the model above, the oil price p_t is effectively normalized by the expected future trend. Thus, in the empirical analysis, we also need to control for the trend. To detrend the oil price series, we use a model from Pindyck (1999), who estimated the following equation for long-term oil price behavior:

$$\ln(p_t) = a^* \ln(p_{t-1}) + b + c^* t + d^* t^2 + \varepsilon_t.$$

For each year $t \in [1960, 2006]$, we estimate this equation for years $[t-50, t-1]$ and use the derived trend to predict p_t. Then, we use the deviation from the

trend ε_t as an independent variable throughout the article. We refer to this residual as the "oil price shock."

We estimate the trend using the past data as the nationalizations in year t could only be based on past rather than future data. The 50-year range for estimating the trend is driven by the availability of data: reliable oil-price time series only start from 1910.

In order to check whether the nationalizations were related to the oil price per se or the detrended oil price, we also use $\ln(p_t)$ and $\ln(p_t) - \ln(p_{t-1})$ as independent variables.

3.1.3 Institutions and the Cost of Nationalization. We proxy the costs of nationalization by the quality of political institutions using the Polity IV data set (Marshall and Jaggers 2006). We use "executive constraints" variable (XCONST). XCONST ranges from 1 to 7 and captures the existence of decision rules in the economy (the checks and balances on the executive). The XCONST variable captures the strength of institutions understood as the rules of the game. It is often used as the main proxy for institutions (see Henisz [2000] and a discussion in Glaeser et al. [2004]).

As a robustness check, we also use Polity IV's measure for "institutionalized democracy" (DEMOC) and obtain similar results.

Although there exist many other data sources for the quality of institutions, only Polity IV provides annual data for the whole period under study. All other indices (including those from Freedom House) do not cover the 1970s when most of the oil expropriations took place.

3.1.4 Gross Domestic Product Per Capita. We also control for the general level of development using the logarithm of the real gross domestic product (GDP) per capita. The data come from the World Development Indicators. Unfortunately, there are many gaps in these data prior to 1980 in less developed countries, where and when most nationalizations took place. This is why we will estimate specifications both with and without per capita GDP (the latter to increase the sample size).

3.1.5 Regime Change. In our model, government is infinitely lived. In real life, nationalizations may be driven by a change in government. We use data on leadership turnover to control for this relationship. The change of a ruler is a dummy variable, which indicates whether there was a transition in a given country in a given year. The data were compiled from www.worldstatesmen.org.

3.1.6 Country Coverage. We have excluded the countries of the former Soviet Union, North Korea, Yugoslavia, Germany, Namibia, Vietnam, Yemen, and Eritrea. First, it is hard to reconcile national and subnational statistics for these countries, which have experienced breakup and unification events during our sample period. Second, as there was no private property in the centrally planned economies, nationalization was not, by definition, possible. We ended

Table 1. Summary Statistics for Nationalizations and Non-Nationalizations

	Nationalization	No nationalization	*t*-statistic	Observations	Nationalizations, out of total
Log real oil price	3.18	3.43	1.32	Years	23/47
Oil price shock	0.046	−0.029	0.80	Years	23/47
Log real oil price	3.310	3.304	0.09	Country-years	96/7567
Oil price shock	0.239	0.005	7.3***	Country-years	96/7567
Executive constraints	2.61	3.99	5.65***	Country-years	95/5759
Executive constraints	2.61	3.18	2.53***	Country-years[a]	95/1718
Executive constraints	3.10	4.31	3.44***	Countries	40/136

[a]Countries with at least one nationalization.
***Significant at 1%.

up with 161 countries and 5759 country-years (36 years per country on average, out of the 47-year period of 1960–2006 we study).

3.2 Summary Statistics

Table 1 presents the summary statistics.

We show the average log oil price in real terms, and the oil price shock for years with and without nationalizations. We also compare the average quality of institutions for countries and country-years with and without nationalizations. Consistent with the model, we find the oil price shock (deviation from the long-term trend) to be higher in the years with nationalizations. This is consistent with the model. The difference in both cases is not significant, which may reflect the fact that we treat years with 1 nationalization and years with 10 nationalizations in the same way. In order to resolve this problem, we compare oil prices in *country-years* with and without nationalization. When using the non-detrended log of the real oil price, there is again no difference. But the oil price shock is now significantly higher in country-years with nationalization.

The summary statistics on institutions are also consistent with our model: nationalizations are more likely to occur in countries and country-years with weaker institutions.

These comparisons are, however, not very informative. In order to capture the relationship between nationalizations and oil prices, we should adjust standard errors for clustering at the year level; even though the nationalizations take place in a given country in a given year, the oil price varies by year only. Similarly, in order to capture the effect of institutions on the probability of nationalizations, we should control for country fixed effects and other relevant variables.

3.3 Empirical Methodology

We use the data described above to study the determinants of the risk of nationalization. Our theory implies that nationalization is more likely when oil prices are high and when the quality of institutions is low.

As we want to control for country fixed effects, we estimate a panel specification:

$$N_{it} = \alpha \text{ OilPriceShock}_t + \beta \text{ Inst}_{it} + \gamma X_{it} + \mu_i + u_{it},$$

where Inst_{it} is a proxy for institutions (executive constraints), X_{it} is a vector of time-varying country controls (logarithm of GDP per capita, regime change), and μ_i denotes country fixed effects. As the fixed-effect specification includes country dummies, it controls for all country-specific factors that do not vary with time such as legal origin, colonial legacies, religion, culture, etc.; all these variables are captured by μ_i. Given that our independent variable OilPriceShock is determined at the year level (rather than at the country-year level), we adjust standard errors for clustering at the year level.[4]

The fixed-effect model is a strong test of the effect of institutions. By definition, institutions evolve slowly. The coefficient β captures the effect of the change in institutions on the change in the risk of nationalization controlling for all country-specific variables.

We choose the linear probability model as our main specification in order to avoid the problems of nonlinear models with fixed effects. Still, in order to check for robustness, we also estimate conditional logit and probit models with country fixed effects. The results turn out to be similar.

3.4 Main Results

The results of fixed-effect estimations are presented in Table 2. The results are consistent with the model. Nationalizations are more likely to occur when the oil price shock is high (Column 1). In Column 2, we show that controlling for the oil price shock and country fixed effects, a higher quality of institutions reduces the risk of nationalization. The magnitudes of the effects are not trivial. Ceteris paribus, a 38% oil price increase, corresponding to the standard deviation (SD) of the oil price shock, raises the probability of nationalization in a given country-year by 1.2%. As we have about 130 countries in the sample, such an increase in oil price increases the number of nationalizations in a given year by 1.6. This is a substantial effect given that oil nationalizations are quite rare; the average number of nationalizations per year in 1960–2006 is 2.0 (with a SD of 3.3).

Changes in institutions have a similar effect. For example, let us consider a change in institutions by 1.9 points (on a scale from 1 to 7)—this is the average within-country variation in institutions during 1960–2006. Such a change in institutions implies a change of 0.8% in the number of nationalizations in a given country-year by. Multiplying by the number of countries in the sample, we obtain 1.0 more nationalizations a year.

In Columns 3 and 4, we check whether the results are similar for the oil price itself and for its year-on-year change. Nationalizations turn out to be correlated

4. We have also estimated all specifications with standard errors clustered at the country level; the results (available upon request) are the same.

Table 2. Regressions for the Nationalization Dummy in 1960–2006

	1	2	3	4	5	6
Oil price shock	0.030	0.038			0.037	0.037
	(0.011)***	(0.013)***			(0.014)**	(0.014)**
Executive		−0.004	−0.004	−0.004	−0.005	−0.005
constraints		(0.001)***	(0.001)**	(0.001)***	(0.002)***	(0.002)***
Log real			0.042			
price change			(0.016)**			
Log real				−0.002		
oil price				(0.005)		
Log GDP					0.000	0.000
per capita					(0.005)	(0.005)
Change in						0.009
government						(0.005)*
Observations	7567	5759	5759	5759	5030	4978
R-squared	0.07	0.08	0.08	0.07	0.09	0.09

All regressions use the linear probability model with country fixed effects; SEs are clustered at the year level. In regressions 1, 2, 5, and 6, we use the oil price shock—the deviation of the log real price of oil from its 50-year trend. In regression 3, we replace oil price shock with change in real oil price. In regression 4, we use log real price of oil. Robust SEs are in parentheses.

*Significant at 10% level.

**Significant at 5% level.

***Significant at 1% level.

with the detrended oil price (the oil price shock or the first difference in price $\ln \frac{p_t}{p_{t-1}}$) but not with the oil price per se. As argued above, such results are consistent with the model.

In Columns 5 and 6, we also control for GDP per capita and for changes in the government. Adding these variables does not affect the coefficients of the oil price shock or executive constraints. The effect of per capita GDP is not significant. A regime change does increase the risk of nationalization.

3.5 Alternative Explanations, Additional Results and Robustness Checks

In this section, we present additional results that show that our findings are not consistent with alternative explanations. We also show that the results are robust to the sample choice and to the choice of empirical methodology.

What are the potential alternative explanations for a correlation between nationalizations and oil price? First, the sharp increase in the oil price and nationalizations in the 1970s could be driven by the same political events—the Yom Kippur War and the West's support for Israel, which were followed by an embargo introduced by the Middle Eastern oil-producing countries. The oil embargo resulted in a sharp increase in the price of oil and was supplemented by nationalizations of foreign companies that belonged to countries that supported Israel. This argument does not imply that Arab countries had to expropriate the assets to raise prices; the same outcome could be achieved through increasing taxes on foreign oil producers. Yet, to rule out this alternative explanation, we reestimated all the regressions excluding years 1973–75 when these events took place (these years also happen to be the years with the

Table 3. Additional Regressions for the Nationalization Dummy in 1960–2006

	1	2	3	4	5	6	7
Oil price shock	0.015	0.058	0.062	0.078	0.124	0.062	0.038
	(0.008)*	(0.026)**	(0.024)**	(0.026)***	(0.045)***	(0.015)***	(0.013)***
Executive constraints	−0.003	−0.006	−0.009	−0.012	−0.012	−0.009	−0.006
	(0.001)***	(0.002)***	(0.002)***	(0.003)***	(0.004)***	(0.004)**	(0.001)***
Change in government	0.014	0.019	0.011	0.011	0.038	0.03	0.014
	(0.004)***	(0.015)	(0.008)	(0.009)	(0.017)**	(0.013)**	(0.008)*
Observations	5334	2253	5478	5255	1718	1744	1718
R-squared	0.06	0.08	0.15	0.2	0.07		

Regressions 1–5 use the linear probability model with country fixed effects; SEs are clustered at the year level. Regression 1 reports results for the sample, excluding years 1973–75. Regression 2 restricts the sample to countries with poor institutions (countries with an average score of executive constraints not exceeding 3 on a scale from 1 to 7). Regressions 3 and 4 report results for nationalizations taking place during the time interval $[t-1,t+1]$ and $[t-2,t+2]$, respectively. Regression 5 restricts the sample to countries with at least one oil nationalization in 1960–2006. Column 6 reports marginal effects from a probit regression with country dummies. Column 7 reports marginal effects from conditional logit regression with country fixed effects. Robust SEs are in parentheses.

*Significant at 10% level.

**Significant at 5% level.

***Significant at 1% level.

greatest occurrence of nationalizations). As an additional robustness check of the endogeneity of the price of oil to nationalizations, we also carried out a simple Granger causality test. It turns out that nationalizations do not Granger-cause prices.[5]

In Table 3, we show that our results do not depend on the nationalizations that took place in the wake of the Yom Kippur war. In Column 1, we present the results with the sample excluding years 1973–75. The results stay the same, even though the magnitude and the significance of coefficients decrease. This can be explained by the fact that 1974 is the year with the largest number of oil nationalizations in history (13) followed by 1973 and 1975 (11 and 10, respectively). Together, these 3 years account for a third of the nationalizations in our data set. We also ran the regressions excluding every single year from the sample (not reported) and arrived at similar results.

The correlation between nationalizations and institutions may also be driven by reverse causality. For example, nationalizations may concentrate so much power in the hands of the rulers that institutions are undermined. We believe that our estimates do not suffer from reverse causality as we use the XCONST (and DEMOC) variables. These are based on political procedures that are measured in a rather objective fashion and are not likely to change dramatically within a year or two (Marshall and Jaggers 2006). In the rare cases, when it is difficult to evaluate the quality of institutions, Polity IV does not assign a value and we drop this observation. For example, before the Iranian

5. The equation is as follows:

$$\text{OilPriceShock}_t = \underset{(0.052)}{-0.035} + \underset{(0.17)}{0.08}\text{OilPriceShock}_{t-1} + \\ + \underset{(0.023)}{0.022}\sum_i N_{i,t-1} + \varepsilon_t .$$

revolution, in 1960–78, Polity IV assigns Iran's XCONST the least possible level of constraints, 1. After the revolution, starting from 1982, Polity IV considers Iran's executive constraints to be higher (XCONST = 3). There are no data for 1979–81; thus, we do not use these years in the regressions (which results in losing one instance of nationalization). The anecdotal evidence in Yergin (1991) and Kobrin (1980, 1984b) also suggests that there is no causality between nationalization and institutions.

As an additional test, we use the fact that our proxy for institutions has a lower bound (XCONST varies from 1 to 7). In Column 2, we report the results for countries with executive constraints that scored 1–3 (on a scale from 1 to 7) on average in 1960–2006. In this subsample, it is hard to imagine that nationalizations can cause institutions to decline substantially as the institutions scores were low to start with. The results are similar. We have also checked other thresholds and have obtained similar results.

In Specifications 3 and 4, we check the robustness of our results by replacing the dependent variable "nationalization occurred in country i in year t" with "nationalization occurred in country i in year t, $t-1$, or $t+1$" and with "nationalization occurred in country i in years $t-2$ to $t+2$." This is important as nationalizations often take more than a year. The results are similar.

Another potential alternative explanation is related to the conjecture that the nationalizations in the 1970s were driven by a significant increase in the human capital of oil-producing countries, which could then be able to run the assets themselves (Kobrin 1980). If an increase in countries' capabilities coincides with an increase in oil prices, the relationship between the likelihood of oil-producing companies' nationalizations and oil price shocks might be spurious. Notice that the direction of the effect of human capital on nationalizations is not obvious. In his later article, Kobrin (1984a) explained the *decline* in oil nationalizations by improved "administrative, managerial, and technical capabilities of the host countries." Kobrin argued that as such capabilities improve, countries are more competent in regulating (and taxing) foreign oil companies, so (value-reducing) nationalization is no longer needed. We control for this explanation by including GDP per capita as a broad proxy for development. One can also try to find a better proxy for human capital in the oil-producing countries. Unfortunately, the most relevant variables such as number of engineers or tertiary educations per capita are not available for most non-Organization for Economic Cooperation and Development countries for the whole period from 1960 on. As a proxy for human capital, we can only use literacy rates. In our working paper version, Guriev et al. (2009), we include literacy rates and find that our main results remain valid. Interestingly, the effect of human capital on nationalizations is uniformly negative: the higher the skills are in the country, the more capable it is to regulate and tax rather than expropriate.

Another alternative explanation is based on the state-capture theory. As oil prices rise, private owners of oil companies have higher rents, which increases their weight in the political process. Thus, nationalizations might be caused by the desire to curb this influence (see a discussion in Rajan and Zingales

[2003]). This theory, however, does not explain why the government should expropriate rather than raise taxes. As global oil price is observable and verifiable, taxing oil revenues is certainly technically feasible.

We also study the robustness of the results of the choice of the model specifications. Instead of running a linear probability model, we also estimate probit and conditional logit specifications (Columns 6 and 7 report marginal effects). As these are discrete choice models, the probit and conditional logit estimations with country fixed effects can only be run for the subsample of countries with at least one nationalization. In order to provide a comparable benchmark, we reran the linear probability model for this subsample and present the results in Column 5. In all specifications, the results were similar and even the magnitudes of the coefficients of oil price shock and institutions were similar.

We have also tested the robustness of our results of replacing our proxy for institutions with alternative measures (in particular, Polity IV's measure of democratic institutions, DEMOC). We again obtained similar results: the coefficients of oil price shock and institutions are significant. The results are available upon request; some of them are presented in the working paper version of this article, Guriev et al. (2009).

In order to understand which country-specific factors contributed to a higher risk of nationalization, we also ran pooled regressions with country-specific time-invariant variables (such as country size, geography, oil endowment, initial conditions, etc.). The coefficients of oil price shock and institutions were similar; the results are available in the working paper, Guriev et al. (2009).

4. Conclusions

Recent large-scale nationalizations of foreign-owned oil assets in several countries have generated renewed interest in the political economics of nationalizations. Unlike previous studies of nationalizations in the 1970s, we can now use a much better panel data set on socioeconomic indicators and political institutions and can study the determinants of nationalization while controlling for country fixed effects. The data allow us to test the conventional wisdom that nationalizations are more likely to occur during periods of higher oil prices and in countries with poorer institutions.

We back this idea by developing a dynamic model with limited commitment on behalf of both the government and a (foreign) oil company. In this model, nationalizations emerge in equilibrium when oil prices are high and political institutions are weak. We then take the model to the data and show that nationalizations are indeed more likely to occur during periods of high oil prices and in countries where and when political institutions are weak. These results hold, even though we control for country fixed effects.

Appendix A

Proof of Proposition 2.

Let us assume that the government can force the firm to choose any investment level that provides the firm with a nonnegative profit; then, we shall show that this investment level can be implemented using some tax schedule.

We will denote the expected payoffs of the firm and the government at the beginning of the period as V_F and V_G, respectively. We will first consider the government's maximization problem. The government maximizes V_G as a function of the firm's payoff V_F. Maximizing the resulting function $V_G(V_F)$ over V_F will give us the maximum possible $\overline{V}_G$. Let us denote $\overline{V}_F$ to be the maximum possible expected payoff of the firm in any self-enforcing contract. Thus, the control variables are tax T, investment level K, and continuation payoff to the firm $\widehat{V}_F(p)$ conditional on the realized price of oil. The government's problem can be written as

$$V_G(V_F) = \max_{T,K,\widehat{V}_F(p)\in[0,\overline{V}_F]} T + \int \max\{\delta V_G(\widehat{V}_F(p)), pK^\alpha - C + \delta U_{\exp}\} dF(p)$$

subject to

$$V_F = -K - T + \int_{\delta V_G(\widehat{V}_F(p)) \geqslant pK^\alpha + \delta U_{\exp} - C} (pK^\alpha + \delta \widehat{V}_F(p)) dF(p) \tag{1}$$

Substituting T from the constraint equation (A1) into the government's objective function, we immediately obtain $V_G(V_F) = \overline{V}_G - V_F$. This is a straightforward implication of the risk neutrality of both agents. Then, we substitute $V_G(\widehat{V}_F(p)) = \overline{V}_G - \widehat{V}_F(p)$ into equation (A1) and find that the government's optimization problem is equivalent to

$$\max_{K,\widehat{V}_F(p)\in[0,\overline{V}_F]} -K + PK^\alpha + \int_{\delta(\overline{V}_G - \widehat{V}_F(p)) < pK^\alpha + \delta U_{\exp} - C} (\delta U_{\exp} - C - \delta \overline{V}_G) dF(p)$$

We have assumed that private production is optimal *ex ante*, that is, $\overline{V}_G > U_{\exp}$. This implies that the expression $\delta U_{\exp} - C - \delta \overline{V}_G$ is negative, hence optimal $\widehat{V}_F(p) = 0$. Hence, the optimization problem becomes

$$\overline{V}_G = \max_K -K + PK^\alpha - (\delta(\overline{V}_G - U_{\exp}) + C)\left(1 - F\left(\frac{\delta(\overline{V}_G - U_{\exp}) + C}{K^\alpha}\right)\right)$$

Let $\widetilde{K}$ be a solution to this maximization problem, then the optimal tax $\widetilde{T}$ can be found from equation (A1) where both V_F and $\widehat{V}_F(p)$ are set equal to 0:

$$\widetilde{T} = -\widetilde{K} + \widetilde{K}^\alpha \int_{p \leqslant \frac{\delta(\overline{V}_G - U_{\exp}) + C}{\widetilde{K}^\alpha}} p dF(p)$$

Let us now denote $\widetilde{p} = \frac{\delta(\overline{V}_G - U_{\exp}) + C}{\widetilde{K}^\alpha}$, the threshold for oil price; whenever $p > \widetilde{p}$, the government expropriates.

The level of investment $\widetilde{K}$ can be implemented using tax $\widetilde{T}$ if the investment level is $\widetilde{K}$ and sufficiently high tax otherwise.

Let us now conduct an analysis of comparative statics. First, $\widetilde{K}$ is less than K^* since setting $\widetilde{K}$ higher than K^* lowers the expected profit $-K + PK^\alpha$ and increases the probability of costly expropriations.

Second, $\widetilde{K} \to K^*$ as $C \to \infty$. If $\overline{p} < \infty$, then when C is large enough, condition (1) holds, hence $\widetilde{K} = K^*$. Let us now consider the case of unbounded support $\overline{p} = \infty$. The government nationalizes only if nationalization brings a higher payoff than NPV of tax revenues $\overline{V}_G > \frac{\widetilde{T}}{1-\delta} = \frac{-\widetilde{K} + \widetilde{K}^\alpha \int_{\underline{p}}^{\widetilde{p}} p dF(p)}{1-\delta}$. On the other hand, $\overline{V}_G$ cannot be greater than the first-best payoff: $\overline{V}_G < \frac{1}{1-\delta}\frac{1-\alpha}{\alpha}K^*$. Notice that $\widetilde{p} \to \infty$ as $C \to \infty$, hence if the government sets $\widetilde{K} = K^*$, then $\frac{-\widetilde{K} + \widetilde{K}^\alpha \int_{\underline{p}}^{\widetilde{p}} p dF(p)}{1-\delta} \to \frac{1}{1-\delta}\frac{1-\alpha}{\alpha}K^*$. If the government sets $\widetilde{K} \neq K^*$, then expected payoff to the government would converge to a level strictly below the first-best level, hence $\widetilde{K} \to K^*$ as $C \to \infty$.

Finally, $\widetilde{K}$ and $\widetilde{p}$ decrease in both C and γ if $p^2 f(p)$ is decreasing at $\widetilde{p}$. There can be two cases:

1. $\widetilde{p} < \overline{p}$.

   The first-order condition for this case implies

   $$\widetilde{K} = (\alpha(P - \widetilde{p}^2 f(\widetilde{p})))^{\frac{1}{1-\alpha}},$$

   thus since $p^2 f(p)$ is decreasing at $\widetilde{p}$, $\widetilde{K}$ and $\widetilde{p}$ move in the same direction when parameters change. If C increases, then from the equation for $\widetilde{p}$ we find that $\widetilde{p}\widetilde{K}^{\alpha}$ increases in C (keeping $\overline{V}_G$ constant). Thus, $\widetilde{p}$, $\widetilde{K}$, and $\overline{V}_G$ are increasing in C and γ.
2. $\widetilde{p} = \overline{p} < \infty$, but $\widetilde{K} < K^*$.

This case is characterized by the following Kuhn-Tucker conditions:

$$0 < -1 + \alpha P \widetilde{K}^{\alpha-1} \leqslant \alpha \widetilde{p}^2 f(\widetilde{p}) \widetilde{K}^{\alpha-1}$$

In this case, $\widetilde{K} = \left(\frac{\delta(\overline{V}_G - U_{\exp}) + C}{\overline{p}}\right)^{\frac{1}{\alpha}}$, and both $\widetilde{K}$ and $\overline{V}_G$ are increasing in both C and γ.

Appendix B

Nationalizations of Oil Companies in 1960–2006.

Table B1. List of Oil Nationalizations in 1960–2006

1962	Algeria	1974	Ecuador	1972	Kuwait	1972	Qatar
1967	Algeria	1976	Ecuador	1973	Kuwait	1974	Qatar
1970	Algeria	1977	Ecuador	1974	Kuwait	1976	Qatar
1971	Algeria	1979	Ecuador	1975	Kuwait	1977	Qatar
1974	Algeria	2006	Ecuador	1977	Kuwait	2006	Russian Federation
1976	Algeria	1961	Egypt	1969	Libya	1972	Saudi Arabia
1976	Angola	1962	Egypt	1970	Libya	1974	Saudi Arabia
1977	Angola	1964	Egypt	1971	Libya	1975	Saudi Arabia
1978	Angola	1975	Ethiopia	1972	Libya	1976	Sudan
1963	Argentina	1973	Gabon	1973	Libya	1969	Trinidad and Tobago
1974	Bahrain	1976	Gabon	1974	Libya	1974	Trinidad and Tobago
1977	Bahrain	1974	Ghana	1973	Malaysia	1979	Trinidad and Tobago
1979	Bahrain	1976	Guyana	1975	Morocco	1981	Trinidad and Tobago
1975	Bangladesh	1975	India	1976	Mozambique	1970	Uganda
1969	Bolivia	1981	India	1973	Nepal	1971	United Arab Emirates
2006	Bolivia	1960	Indonesia	1971	Nigeria	1972	United Arab Emirates
1962	Burma	1965	Indonesia	1973	Nigeria	1973	United Arab Emirates
1968	Cambodia	1973	Iran	1974	Nigeria	1974	United Arab Emirates
2006	Chad	1979	Iran	1976	Nigeria	1975	United Arab Emirates
1972	Colombia	1961	Iraq	1979	Nigeria	1971	Venezuela

Continued

Table B1. *Continued*

1974	Congo-Brazzavile	1972	Iraq	1972	Oman	1975	Venezuela
1975	Congo-Brazzavile	1973	Iraq	1974	Pakistan	2006	Venezuela
1969	Ecuador	1975	Iraq	1968	Peru	1969	Yemen
1972	Ecuador	1977	Iraq	1985	Peru	1980	Zambia
1973	Ecuador			1973	Philippines		

References

Acemoglu, Daron, and James Robinson. 2001. "A Theory of Political Transitions," 91 *American Economic Review* 938–63.

Baker, George, Robert Gibbons, and Kevin J. Murphy. 1994. "Subjective Performance Measures in Optimal Incentive Contracts," 109 *Quarterly Journal of Economics* 1125–56.

Bohn, Henning, and Robert T. Deacon. 2000. "Ownership Risk, Investment, and the Use of Natural Resources," 90 *American Economic Review* 526–49.

Bull, Clive. 1987. "The Existence of Self-Enforcing Implicit Contracts," 102 *Quarterly Journal of Economics* 147–59.

Coyle, Thomas. 2003. "Not Dead Yet: An Update of Expropriations 1993–2002," Mimeo, University of Texas-Pan American.

Eaton, Jonathan, and Mark Gersovitz. 1983. "Country Risk: Economic Aspects," in R.J. Herring, eds., *Managing International Risk*, 75–108. New York, NY: Cambridge University Press.

Glaeser, Edward L., Rafael La Porta, Florencio Lopez-de-Silanes, and Andrei Shleifer. 2004. "Do Institutions Cause Growth?" 9 *Journal of Economic Growth* 271–303.

Guriev, Sergei, Anton Kolotilin, and Konstantin Sonin. 2009. "Determinants of Expropriation in the Oil Sector: A Theory and Evidence from Panel Data." Available at SSRN: http://ssrn.com/abstract=1103019. Accessed June 12, 2009.

Henisz, Witold Jerzy. 2000. "The Institutional Environment for Economic Growth," 12 *Economics and Politics* 1–31.

Jodice, David. 1980. "Sources of Change in Third World Regimes for Foreign Direct Investment, 1968–1976," 34 *International Organization* 177–206.

Kobrin, Stephen J. 1980. "Foreign Enterprise and Forced Divestment in LDCs," 34 *International Organization* 65–88.

———. 1984a. "Expropriation as an Attempt to Control Foreign Firms in LDCs: Trends from 1960 to 1979," 28 *International Studies Quarterly* 329–48.

———. 1984b. "The Nationalization of Oil Production: 1919–1980," in D. W. Pearce, H. Siebert, and I. Walter, eds., *Risk and the Political Economy of Resource Development*, 137–64. New York, NY: St. Martin's Press.

———. 1985. "Diffusion as an Explanation of Oil Nationalization: Or the Domino Effect Rides Again," 29 *Journal of Conflict Resolution* 3–32.

Levin, Jonathan. 2003. "Relational Incentive Contracts," 93 *American Economic Review* 835–57.

Llana, Sara Miller. 2007. "Bolivia's Vice President on Indigenous Rights, Coca Crops, and Relations with the US." *Christian Science Monitor*, March 27.

Marshall, Monty G., and Keith Jaggers, 2006. "Political Regime Characteristics and Transitions, 1800–2004." Center for International Development and Conflict Management, University of Maryland.

Megginson, William L. 2005. *The Financial Economics of Privatization.* New York, NY: Oxford University Press.

Minor, Michael S. 1994. "The Demise of Expropriation as an Instrument of LDC Policy, 1980–1992," 25 *Journal of International Business Studies* 177–88.

Moran, Theodore H. 1973. "Transnational Strategies of Protection and Defense by Multinational Corporations: Spreading the Risk and Raising the Cost for Nationalization in Natural Resources," 27 *International Organization* 273–87.

Mouawad, Jad. 2006. "As Profits Surge, Oil Giants Find Hurdles Abroad." *New York Times*, May 6.

Pindyck, Robert S. 1999. "The Long-Run Evolution of Energy Prices," 20 *Energy Journal* 1–27.
Pirog, Robert, 2007. "The Role of National Oil Companies in the International Oil Market." Congressional Research Service Report for the Congress, August 21.
Rajan, Raghuram, and Luigi Zingales. 2003. *Saving Capitalism from Capitalists.* Princeton, NJ: Princeton University Press.
Thomas, Jonathan, and Tim Worrall. 1994. "Foreign Direct Investment and the Risk of Expropriation," 61 *Review of Economic Studies* 81–108.
Williams, M.L. 1975. "The Extent and Significance of the Nationalization of Foreign-Owned Assets in Developing Countries, 1956-1972," 27 *Oxford Economic Papers* 260–73.
Yergin, Daniel. 1991. *The Prize.* New York, NY: Simon and Schuster.