APPENDIX I

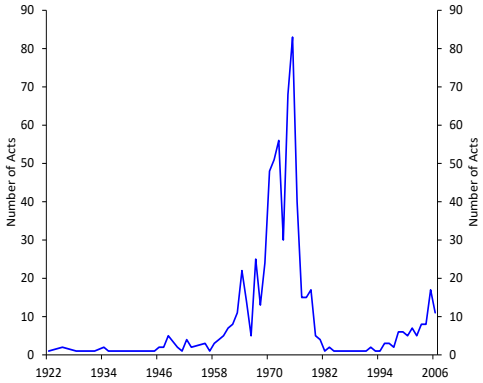
a. Historical Trends in Expropriation Acts across the World

Data: The unit of analysis is an act.[56] My data set includes 703 acts that occurred in 102 developing countries over 1922-2006. The data is primarily from Tomz and Wright (2010) [62].[57] They construct a new data set on occurrences of expropriation from 1900 to 1960 by considering a broad definition of expropriation following S. Kobrin. Then, they combine their newly collected data set with the existing inventories by Kobrin (1984) [38] for the period 1960-1979, Minor (1994) [51] for the period 1980-1991, and finally Hajzler (2007) [31] for the period 1993-2004. I combine Tomz and Wright (2010)'s [62] data set with Hajzler (2012)'s [32], which covers 2004-2006. Moreover, while examining expropriations in the oil industry, I combine the data provided by Kobrin (1984b) [39] with the data provided by Guriev et al (2011) [30], and use this combined data set to investigate the oil industry. Therefore, I present a set of facts for the occurrence of expropriation over an extensive period.[58]

Trends: Over half of the acts occurred during 1970-1976, and the acts peaked during 1974-75.[59] This pattern is similar to the time trend presented by Kobrin, although my figure covers a longer time horizon including earlier and more recent expropriations. In the literature, this time-pattern has been attributed to national security concerns, changing commodity prices, or gaining independence.[60] Kobrin (1980) [37] argues that it is also consistent with a secular bargaining power shift from investors to the host countries. In the 1970s, maintaining local-national ownership is important in terms of national security. Also, the late 1970s are a period of relatively high commodity prices.[61]

Vulnerability to forced divestment varies by sector. Table 4 presents sectoral distribution of acts as a percentage in total acts during 1922-2006. Not surprisingly, investments in natural resources, infrastructure, and banking & insurance are more vulnerable to expropriation than others. In total, these sensitive sectors account for around 64% of all acts. The extractive sector alone accounts for around 41%. Hajzler (2014) [33] discusses possible reasons for extractive sector being more

Figure 12: Time Pattern of Expropriations in the World, 1922-2006



vulnerable to forced divestment, such as widespread sunk costs, volatile prices, relatively easy technologies to operate, and national security concerns. In general, governments prefer to control these sectors, possibly because the sectors dominate their economies and thereby make foreign ownership intolerable.

Table 4: Sectoral Distribution of Expropriation Acts in the World, 1922-2006

		% of total acts
Total Extractive		40.8
	Agriculture	10.8
	Mining	12
	Petroleum	18
Manufacturing		24.1
Infrastructure		13
Banking and Insurance		10
Trade		4.3
Construction		2
Other		5.8

b. The Effect of Expropriation on Productivity in the Oil Industry

Data: Crude oil production data are from the British Petroleum Statistical Review of World Energy and OPEC historical data series. Employment data in the petroleum industry are from United Nations Industrial Development Organization (UNIDO) Statistics and International Labour Organization (ILO) sectoral activities report.[62] The countries in my sample are major oil-producing

Table 5: Algerian Oil Employment, by occupation and nationality

Occupation	**1962**	**1966**	**1971**
		Algerians	
managers and engineers	9	82	970
technical mastery employees	370	1718	9382
workers	3757	2772	5420
		Foreigners	
managers and engineers	562	413	381
technical mastery employees	2590	1242	431
workers	1482	286	0

Source: Brogini (1973) [12]

countries that expropriated foreign-owned assets in the oil industry from the late 1960s to the 1970s.[63] My sample countries include Algeria and Venezuela (OPEC members), and Colombia and Peru (non-OPEC members producing more than $100,000$ barrels per day).[64] I include the United States as a benchmark for comparison.

Algerian oil employment data presented in the right panel of Figure 1 is from Brogini (1973) [12]. Table 5 presents the oil employment by occupation and nationality. Prior to 1967, oil industry employment was mostly private in Algeria. It began to fall in 1966. Public sector employment, on the other hand, began to increase significantly. The share of public employees was 17% in 1965, increasing to about 70% in 1971.

APPENDIX II

a. Oil Industry Facts

Data: My data set covers from the early 1940s to 1995. Venezuelan oil industry statistics are from the Republic of Venezuela, Ministry of Mines and Hydrocarbons, Oil and Other Statistical Databooks (MMH Databooks). Annual industry-level time series data on various variables, such as proved reserves, new reserves, completed wells, number of workers, wages and salaries, gross investment in fixed assets, royalties, income taxes, etc., are recorded from these databooks. Micro data on the composition of labor force in the oil industry are obtained from Michelena, Agustin, and Soublette (1976) [49] and the Census of Mineral Industries, U.S. Department of Commerce, Bureau of the Census Databook, 1987. Evidence on world oil industry trends are obtained from several publications by the International Labor Organization, the Programme of Industrial Activities; Chase Manhattan Bank, Energy Economics Division publications, and others mentioned in the text. GDP price deflator and exchange rate data are obtained from the Penn World Tables used to convert nominal domestic values into constant U.S. dollars. For the Venezuelan aggregate economy, the Conference Board, Total Economy Database, and the Economic Commission for Latin America Database are used.

b. Quantitative Analysis

Reserve Additions Data

The source of my data is MMH Databooks for the years 1953-1994. In the data, new reserves in a given year consist of three components: discoveries, extensions, and revisions, in millions of barrels.

New discoveries in existing fields, discoveries of new fields, and extensions of existing fields rely heavily on well drilling. However, revisions occur more or less randomly and are not the result of well drilling. Revisions include corrections in reserves estimates; hence, they historically show highly erratic movements. For instance, the mean value of revisions is more than two times the mean value of discoveries plus extensions in the Venezuelan data, and the volatility of revisions is

much higher than the volatility of other components. Because of these factors, Pindyck (1978) [54] constructs series for reserve additions by multiplying data on discoveries plus extensions by the ratio of the mean value of reserve additions to the mean value of discoveries plus extensions.[65] I construct the reserve additions data series representing the $G(\cdot)$ variable in the model by following Pindyck's approach.

Labor Input Data

To construct the labor input and corresponding wages series, I need demographic characteristics of workers in the oil industry. As oil industry employment data over 1948-1995 is very limited and not digitally available −even for the United States historical data is quite limited−, I manually collect data and anecdotal evidence on oil industry employment allowing me to construct these series.

From 1948 to 1995, MMH Databooks present annual data on the total number of workers and earnings in the petroleum industry in Venezuela. Earnings are annual total wages and salaries charged to operations in current million Bolivares. I convert them into millions of 1990 U.S.$. Michelena, Agustin, and Soublette (1976) [49] present occupational profiles in the petroleum industry in Venezuela for the year 1974, and present detailed data on foreign personnel employed in the oil industry in 1970.

I construct the labor input series for extraction and exploration and their corresponding wages in several steps following an approach similar to Krusell, Ohanian, Rios-Rull, and Violante (2000) [40]. In the first step, several hundred demographic groups are recorded and these few hundred groups are sorted into three categories: (i) professionals, which includes three sub-categories: managers, administrative workers, technical workers; (ii) mid-level workers; and (iii) unskilled workers. In the second step, I sort these groups into two categories: foreign and national.

In the third step, I classify these groups into extractive and exploratory and construct total labor input measures for extractive foreign and domestic workers, exploratory foreign and domestic workers, and their corresponding wages. To aggregate group measures into these classes, I first assume that groups are time-invariant. For instance, groups that belong to the extractive skilled

Table 6: Occupational Profile, Petroleum Industry, Venezuela

Categories of Personnel		**Percentage (%)**
University Professionals		10
	Management	1.13
	Technical	6.13
	Administration	1.94
	Research	0.064
	Others	0.74
Technologists		3.06
Operators		25
Others		61.94

Source: Michelena, Agustin, and Soublette (1976) [49].

category are always the same. Second, groups within a class are assumed to be perfect substitutes. I use the group wages in 1970 as the weights.

Next, I describe how these groups are constructed, what criteria are used, and how the group variables are aggregated to construct the measures of extractive and exploratory foreign and domestic labor input and wages used in the paper.

Individual Variables and Construction of Groups

I record demographic characteristics of each foreign individual employed in the Venezuelan petroleum industry in 1970 by company in different federal states. Individual variables include age, education level (branch and number of years), office held (i.e. occupation), years of experience in the profession, and basic renumeration. I have these variables for several hundreds of different offices across different companies. To group these few hundred occupations into broader categories, I use the profile presented in Table 6 as a benchmark. This table presents the occupational profile in the Venezuelan Oil Industry in 1974, which includes both oil and petrochemical industries.[66] However, oil industry workers account for more than 76% of this profile, so I use it as a benchmark for the oil industry in Venezuela. Here, "Others" in the University Professionals category includes lawyers, doctors, sociologists, educators and other professionals. Technologist is equivalent to a mid-level technical education graduate. And "Others" in the last category consists of secretaries, clerical and unskilled workers. Given this profile, I define three groups: professionals, mid-level workers, and unskilled workers. **Professionals** include managers, administrative workers, and technical workers, where technical workers include technical, research, and others categories. Technologists

and operators are regarded as **mid-level workers**, and finally, "Others" in the last category are considered **unskilled workers**. I assume that this occupational profile of the Venezuelan oil industry represents the industry at any time t.

Given these definitions, I group my records of foreign workers according to their education level (Primary, Secondary, Tertiary, University, Superior) and occupation (office held, job title), and obtain an occupational profile for foreigners presented in Table 7.[67]

Table 7: Occupational Profile of Foreign Workers in the Venezuelan Oil Industry

		Percentage (%)
Professionals		70.6
	Technical	46.7
	Management	9.3
	Administrative	14.6
Mid-level		24
Unskilled		5.4

The percentage distribution presented in Table 6 is assumed to represent the oil industry's occupational profile in Venezuela. The occupational distribution calculated and presented in Table 7 is assumed to represent foreign workers' profile in the Venezuelan oil industry.

MMH Databooks report four categories of labor in the Venezuelan oil industry from 1948 to 1995: domestic employees, domestic laborers, foreign employees, and foreign laborers.[68] In the second step, using total domestic and foreign labor data and the occupational profiles presented above, I construct time series data for the number of professionals, mid-level workers, and unskilled workers by nationality.

MMH Databooks only report total wages paid in the oil industry. To construct corresponding wage series for different occupational groups by nationality, in addition to total wages paid, I use individual renumeration data for foreign workers employed in the oil industry from Michelena, Agustin, and Soublette (1976) [49], and also use evidence from Tennassee (1979) [61]. First, I calculate average basic remuneration for foreign managers, administrative workers, technical workers, mid-level workers, and unskilled workers. I find that among foreigners, mid-level workers and administrative workers were paid similarly, about 2.5 times an unskilled worker's salary; technical workers were paid around 20% higher than mid-level workers; and managers, as expected, were

paid the highest, more than double the mid-level worker's salary. These suggest a *skill-premium* in the range of 2.5 and 5.8 across different occupational groups. I assume that these represent the Venezuelan oil industry *skill-premium*.

Table 8: Salaries of Venezuelan and Foreign Workers in the Petroleum Industry, in Bolivares, 1932-1935

Profession	Daily Wage of a Foreigner	Daily Wage of a Venezuelan
Tool Pusher	42.50	18
Driller	42.75	18
Welder	35.75	14
Drawer	32.50	15
Derrick-man	32.50	16
Mechanic	32.00	16
Clerk	22.75	15

Source: Michelena, Agustin, and Soublette (1976) [49].

Tennassee (1979) [61] argues that during the structuring of the oil industry in Venezuela, the recruitment was done abroad, leaving Venezuelan nationals in occupations lower in the hierarchical order largely due to the regime in Venezuela and the very low educational level of the population. Moreover, he claims that since the beginning of the oil industry, domestic workers did not have the same opportunity to achieve better positions or the same wage treatment as foreign workers and that disparities in wage levels were maintained throughout the development of the oil industry. So, not surprisingly, there is a *nationality-premium* in the Venezuelan oil industry. For instance, over 1959-70, the average annual salary of a foreign employee was 62.071 bolivars, while for a Venezuelan employee, it was 27.110, Tennassee (1979) [61]. This implies a ratio of 2.3 between average foreign salary and average domestic salary in the Venezuelan oil industry. Table 8 also presents a *nationality-premium* not so different from that ratio during 1932-35. The disparity between wages across different occupations range between 1.5 and 2.6. I assume that professions presented in Table 8 except "Clerk" are mid-level jobs, and considered the average differential across these jobs to represent *nationality-premium* for mid-level workers in the Venezuelan oil industry, which is 2.25.[69] I assume "Clerk" represents unskilled jobs, so the *nationality-premium* for unskilled workers is equal to $\frac{22.75}{15} = 1.52$. Finally, for technical workers, administratives, and managers, I assumed a *nationality-premium* of 2.3 following Tennassee (1979) [61].

Table 9: Relative Wages in the Venezuelan Oil Industry

category	***nationality-premium*** *(np)*	***skill-premium*** *(sp)*
Management (m)	2.3	5.78
Technical (tech)	2.3	3.13
Administrative (a)	2.3	2.51
Mid-level (mid)	2.25	2.58
Unskilled (u)	1.52	1

Table 9 summarizes the relative wages of domestic and foreign workers in each category in the second column and wages in each category relative to the unskilled category in the third column. Then, I obtain the labor income of domestic unskilled workers as

$$w_{du,t} = \frac{W_t}{\sum_{i\in\{d,f\}} \sum_{j\in\{u,mid,a,tech,m\}} n_{ij,t} sp_{ij} np_{ij}}$$

where W is total real wages, n is number of workers, i shows nationality, and j shows occupational category. sp is skill-premium such that $sp_{dj} = sp_{fj}$ presented in the third column of Table 9 with $sp_{iu} = 1$ for all i. np is nationality-premium such that np_{fj}'s are presented in the second column of Table 9 and that $np_{dj} = 1$ for all j. Domestic wages for other categories, $j \in \{mid, a, tech, m\}$, would be

$$w_{dj,t} = w_{du,t} sp_{dj}.$$

Hence, I have wage series for each domestic occupational group. Multiplying wages of domestic workers in each category by corresponding *nationality-premium* parameter, I obtain wage series for each foreign occupational group, i.e.

$$w_{fj,t} = w_{dj,t} np_{dj}$$

for all j. Now, I have labor input and wage series for different occupational groups by nationality, i.e. foreign and domestic.

Aggregation of Groups into Exploration and Production

I aggregate occupational categories into broad classes of extraction and exploration and obtain

measures of labor inputs and their wages. In doing so, I assume that broad classes of exploration and production (extraction) include all five occupational groups and this partition is time invariant. That is, both exploration and extraction classes include occupational groups $\{u, mid, a, tech, m\}$. To aggregate groups into these two classes, I also assume that groups within a class are perfect substitutes, i.e. they simply add. For the aggregation, I use adjusted group wages of 1970 as weights. Then, the total labor input (in number of workers) for the two classes is

$$N_{ik,t} = \sum_{j \in \{u,mid,a,tech,m\}} (\mu_{k,t} n_{ij,t})\, \bar{w}_{ij,70}$$

where t represents the year; $i = d, f$; $k = e, p$ represents exploration or production; μ_k is the share of k in total employment explained below; $\bar{w}_{ij,70} = \frac{w_{ij,70}}{average(w_{dj,70}, w_{fj,70})}$ so that it would be unitless and an appropriate skill index. The wages are therefore

$$W_{ik,t} = \frac{\sum_{j \in \{u,mid,a,tech,m\}} (\mu_{k,t} n_{ij,t})\, (\zeta_{k,t} w_{ij,t})}{N_{ik,t}}$$

where $\zeta_{k,t}$ represents the wage differential between exploration and production segments in the oil industry.

My data on occupations in the Venezuelan oil industry do not provide enough information on the segments of the industry in which the individuals were employed. To get estimates for the shares of production and drilling and exploration workers in total oil industry employment, I use U.S. Census of Mineral Industries 1958 [63] and 1987 [64] publications and the American Petroleum Institute (API) 1975 Data Book [2].[70] Using the data available from these sources, I obtain the following shares of oil and gas extraction employment in production and drilling and exploration for the years 1958 and 1972:

	production	drilling & exploration
1958	0.63	0.37
1972	0.57	0.43

I consider the 1958 shares as a proxy for the Venezuelan oil industry prior to 1961 ($\mu_{p,t} = 0.63, \mu_{e,t} =$

0.37 where $t \leq 1960$), and the 1972 shares as a proxy for the Venezuelan oil industry for post-1960 ($\mu_{p,t} = 0.57, \mu_{e,t} = 0.43$ where $t > 1960$). Similarly, using payroll data reported in U.S. Census of Mineral Industries 1958 [63], I calculate the wage ratio between production and exploration workers as 1.2. That is, production workers are paid 20% higher than exploration workers ($\zeta_{p,t} = 1.2$, $\zeta_{e,t} = 1$).