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THE POLITICAL ECONOMY OF PUBLIC SECTOR EMPLOYMENT IN RESOURCE DEPENDENT COUNTRIES

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Abstract

In this paper, we propose a political economic explanation for the well documented difference in labor market institutions between high natural resource per capita countries and those that are natural resource dependent but whose populations are large. This dichotomy is widespread but particularly apparent in the oil-rich countries of the Arab world. We argue that the natural resource endowment influences the policy that a dictatorship chooses. It is optimal for governments in countries of the first type to employ a large proportion of the population in the public sector, while it is optimal to set up a repressive security apparatus and employ a smaller proportion of the population when the natural resource endowment is small relative to the size of the population. We provide empirical support for our theory using global data on public wages, rents per capita and other correlates.

JEL classification codes: D72, J45, P48, Q34
Keywords: Public employment; Natural resources; Authoritarian bargain; Dictatorship

ملخص

في هذه الورقة، نقترح تفسيرا سياسيا واقتصاديا للفرق في مؤسسات سوق العمل الموثقة جيدا بين البلدان التى يعلو فيها نصيب الفرد من الموارد الطبيعية وتلك التي تعتمد على الموارد الطبيعية، ولكن عدد سكانها كبير .يوجد هذا الانقسام على نطاق واسع لكنه يتضح لا سيما في البلدان الغنية بالنفط من العالم العربي .نناقش فى هذه الورقة إن الثروة من الموارد الطبيعية تؤثر على السياسة العامة التى يختارها نظام دكتاتوري .فالاختيار الأمثل بالنسبة للحكومات في البلدان من النوع الأول هو تظيف نسبة كبيرة من السكان في القطاع العام، في حين أنه من الأمثل إقامة جهاز أمني قمعي وتوظيف نسبة أصغر من السكان عندما يكون حجم الموارد الطبيعية صغير بالنسبة لحجم السكان . نقدم أيضا دعما تجريبيا لنظريتنا باستخدام البيانات العالمية على الأجور العامة، وايجار لكل الفرد وغيرها من البيانات.

1. Introduction

Relative to the size of their populations, or scale of their economies, oil and other mineral endowed countries (hereafter, resource-rich countries) tend to have large governments, characterized by generous public sector wages and other compensations. For example during 2000-07, the top 15 oil exporting countries received a net annual average per capita income from oil of about (real ppp) $ 20,000 and spent an equivalent of (real ppp) dollars 3,655 per citizen in the form of public sector wage bill per year. This compares with about 586 real PPP dollars of per capita public sector wage bill for other non-resource developing countries. However, this phenomenon is not confined to resource-rich countries, because the advanced industrial economies also have large governments. For example, during the same period the OECD countries spent more than 2,600 real PPP dollars per citizen on the public sector wage bill (Table 1). In these and other open economies, it has been argued that large government expenditures, including on wages and transfers, provide a social insurance function against the risks associated with high economic openness (e.g. Rodrik, 1998).

Though resource-rich, especially oil-rich, countries also have large trade/GDP ratios due to the dominance of the resource exports in their economies, we argue in this paper that the mechanism driving large public sector employment in these countries is entirely different from the one associated with the open but mostly democratic countries analyzed in the received literature. Instead, in the resource-rich and largely authoritarian countries, we would argue, redistributive political economy considerations are likely to be the main culprit. The ruling elites in these countries would attempt to avert a revolt by the public that might lead to regime change by using the labour market to transfer a fraction of the resource rents to the latter. However, the elites are not likely to adopt a pure public sector employment strategy, as they might also rely on political repression for pre-empting or quelling incipient or unfolding revolt. In high resource but population scarce countries the elites are likely to rely more on expanding public employment and less on political repression. Instead, the opposite is likely to happen in moderately endowed but populous countries. The Gulf Cooperation Council (GCC) member countries provide the most notable example of the former, while the other oil-rich but populous Arab economies epitomize the latter. This is clearly borne out by the evidence of Table 2, which compares the public sector wage bill and the extent of political repression between the two groups. The median oil rent per capita in the GCC during 2000-2007 stood at an annual average of 11,898 (in real PPP dollars), which is more than 20 times the average rent for the median country from the populous Arab oil economies. In a similar vein, the median annual public sector wage bill per capita in the GCC, about 6000 (in real PPP dollars), was 15 times the wage for the populous Arab oil economies. On the other hand, compared to the other group, the GCC countries were found to be far less likely to resort to political repression. In a scale from 0 (most politically repressive) to 8 (least repressive), the median GCC country scored 6.1, while the median populous oil Arab country scored 2.8[1].

There is a dearth of empirical work on Middle Eastern labour markets, precipitated by a general unavailability of data. The work that does exist, however, corroborates our observations: that public sector employment is dominant in the labour markets of per capita resource rich countries and that it is significant but relatively less important in those oil-dependent countries in the Middle East with large populations. Said (1996) documents the relative largesse of public sectors in several Arab countries. In Kuwait for example, between 1985 and 1992, 91% of nationals were employed by the government, whereas this figure was significantly lower in non-GCC economies: 56.6% in Algeria in 1990, 34% in Egypt in 1992, and 47% in Jordan in 1991 (Table 1, pages 5-6; Said (1996)). Shaban et al. (1993) note that for the Gulf countries in general, the government sector remains the only sector that the

[1]For definitions of the rent and public wage per capita variables and a description of the index of political repression, see the notes to Table 2.

majority of national new entrants to the labour force would consider and where employment is perceived as a right of the citizen. This perception demonstrates how almost all the national workforce is employed, in some form, by the government.

In terms of the received theoretical literature, we discuss a few papers that model public sector employment as a means through which a dictatorship redistributes resources in an effort to remain in power. This is by no means an exhaustive review of the literature and we continue to introduce studies that are relevant to specific parts of the models we develop below. Perhaps the paper that is closest in spirit to ours, Robinson et al. (2006), presents a model of clientelism where politicians use natural resource rents to buy support through public sector employment in order to win political contests. In a similar approach to ours, they model patronage (redistribution to supporters) as the offer of employment in the public sector (page 449; Robinson et al. (2006)). In defense of this assumption, the authors invoke Auty's (2001) claim that "public employment can be a politically appealing way to redistribute rents". Their results agree with our analysis. More specifically, their proposition 3 (i), which states that "a permanent resource boom increases public sector employment and decreases private sector employment", is precisely what we have proposed in this paper. Gelb et al. (1991) show how a government absorbs workers into the public sector as a result of the political pressure it faces. In their paper, however, there is no role for natural resource wealth. While we propose that as natural resource wealth increases, the propensity of a dictatorship to repress decreases, there are also arguments in the literature that propose the opposite relationship between natural resource wealth and repression. Verwimp (2003), for example, outlines a general model of dictatorship, along similar lines to Wintrobe (1990), the outcome of which is a dictatorship that increases repression as its budget constraint is relaxed. However, the case study of his paper, Rwanda, falls well below our threshold for "natural resource rich" and the comparative statics of repression with respect to natural resource wealth in this case can be explained by the non-monotonic effects we derive in section 4 below.

Section 2 presents the basic game theoretic model, which is extended in the following two sections to, respectively, include perfect (section 3) and imperfect (section 4) state political repression. The latter section solves the game theoretic equilibrium conditions, which will be shown to crucially depend on the size of the per capita resource rents. Section 5 empirically tests our predictions regarding the role of rents as a determinant of the size of public sector employment, conditional on other controls motivated by the model. Section 6 concludes.

2. Basic Model

The following model attempts to explain the differences in labour market institutions between GCC economies - those with high natural resource wealth per capita - and other Middle Eastern economies with some natural resource wealth but large populations. We take a political economic approach, arguing that the attempt of nondemocratic governments to remain in office is an influential factor in the way labour market institutions develop. More specifically, we focus on the size of the public sector as a metaphor for the extent of redistribution from state to citizen that takes place. Alesina et al. (2000) provide a theoretical model as well as empirical support for why politicians use disguised redistributive policies as opposed to blatant transfers. We argue that governments in the Middle East consider public sector employment as a means to redistribute resources to their citizens, thereby "buying" their political allegiance.

We begin with a situation in which the elite and citizens play a two-stage game. The population of the elite has mass 1 while that of the citizens has mass N (where $N > 1$). There is a public sector in which L of the citizens are employed. They receive a constant,

exogenous wage of w (where $w > 0$)[2]. Public sector employment is preferred to employment in the private sector. We capture this feature by assuming that unless a citizen is employed in the public sector, they receive a zero payoff.

The elite determine the size of the public sector - L. Crucially, citizens are randomly assigned public sector jobs. Moreover, they observe the elite's choice of L, so each citizen's expected utility is $\frac{wL}{N}$. Once the elite have chosen L, citizens decide whether or not to revolt. The collective action problem does not arise in this situation because of the symmetry of citizens' preferences. Each citizen privately decides whether or not to revolt. Since citizens are identical, if it makes sense for one citizen to revolt, it makes sense for all. We model the cost and uncertainty associated with challenging the status quo by introducing a probability p. This can be considered as the probability that an attempted revolt succeeds. Other authors have included a `punishment' for citizens in the event of a revolt's failure (Acemoglu and Robinson (2001) for example). Essentially, the role of punishment is to diminish the expected utility from revolt. This same effect can be achieved by decreasing the value of p. For the purposes of this model, it suffices to assume that citizens receive a zero payoff in the event of a revolt's failure. The value of p is fixed in order to restrict the policy instruments through which the elite influence citizens' decision-making to the redistribution of rent in the form of public sector jobs. Moreover, although endogenizing p (for example, making it inversely related to the size of the public sector) may result in a more realistic model, qualitatively, it will say the same thing as the model does now: namely, that higher investments in the size of the public sector reduce the probability of a successful revolt. With p endogenous, the probability of a successful revolt will be reduced continuously over some interval in [0,1], while with a fixed p, the probability of a successful revolt jumps to zero if the elite are able to bribe the citizens and avert a revolt altogether, and is otherwise p.

This approach is one way to analyze a phenomenon that has been often documented but seldom modeled explicitly. For example, Robinson et al. (2006) identify public sector employment as a tool through which politicians gain patronage, noting that "there is a large degree of consensus in the political science literature that patronage refers to the way in which party politicians distribute public jobs or special favors in exchange for electoral support." Alesina et al. (1999) provide empirical evidence of politicians' use of public sector employment as a redistributive device in US cities. These studies, amongst others, point to the importance of public sector employment in rent distribution. Yet we have encountered few attempts to model this role explicitly.

Although this is a two-stage model, there is essentially one period in which the interaction between the elite and citizens takes place. At the beginning of the period, the elite receive a natural resource rent of R. This resource must finance the public sector wage bill, wL, and the remaining amount can be consumed by the elite. The timing of employment is not important for our argument. Indeed, we only adopt this framework because of its tractability. A more accurate description of our idea is an infinitely repeated game where a new group of citizens is offered public sector jobs each period (those offered jobs in previous periods keep them). Each citizen then has a positive probability of getting a public sector job at some point in the future and hence his or her decision, whether or not to revolt, will depend wholly on the size of this probability. Framing the problem in this way addresses the issue of why unemployed citizens do not revolt after public employment has been distributed but it simultaneously complicates the model.

[2]We justify this seemingly restrictive assumption at the end of this section.

We are now ready to fully describe and solve the game being played by the elite and the representative citizen. In the first stage, the elite choose a value for L. Having observed this choice, citizens decide whether or not to revolt. The payoffs are as follows: in the case of a revolt, the elite get an expected payoff of $(1-p)(R-wL)$, while the citizens get $\frac{pR}{N}$ each, where p is the probability that the revolt succeeds. Notice that there is an assumption that if the revolt is attempted and is successful, then the elite can expect to receive a zero payoff. Moreover, if there is a revolt that is unsuccessful, the citizens can expect a zero profit. In addition, in the latter case, the elite still lose an amount equivalent to the public sector wage bill. This serves to characterize the destabilizing effect of social upheaval. The act of a revolt per se results in a loss of income to the elite. This serves as a justification for the elite's preference for avoiding a revolt. If there is no revolt, the elite get the balance of the government budget less the public sector wage bill, $R-wL$, and the citizens each get an expected payoff of $\frac{wL}{N}$. The game is described in Figure 1.

To solve the game, we look for a subgame perfect equilibrium. Proceeding by backward induction, we first analyze the decision of the citizen whether or not to revolt. It is clear to see that a citizen chooses not to revolt if the following condition holds.

$$EU^c(NoRevolt) = \frac{wL}{N} \geq \frac{pR}{N} = EU^c(Revolt) \qquad (1)$$

Although the N term seems redundant at first, its presence on either side of the inequality is important. On the left hand side, $\frac{L}{N}$ describes the proportion of the population in the public sector, namely, the importance of the public sector in the economy. On the right hand side, $\frac{R}{N}$ describes natural resources per capita - the variable we have chosen to distinguish between GCC and non-GCC economies. Through the analysis of the game, we will aim to show how higher natural resources per capita precipitate a swelling of the public sector through the effort of the elite to remain in power and preempt a revolt.

Having established the conditions under which citizens prefer not to revolt (equation 1), we now consider the elite's decision problem. The elite choose the size of the public sector, which subsequently influences the citizens' decision. If citizens do revolt, the elite receive an expected payoff of $(1-p)(R-wL)$ i.e. the probability that the revolt fails multiplied by their expected consumption. If citizens do not revolt, the elite receive a payoff of $R-wL$, the natural resource rent less the public sector wage bill. The choice of L determines whether or not citizens revolt. Namely, there is a critical level L^* such that equation 1 holds for all $L \geq L^*$. The following identity follows trivially.

$$L^* = \frac{pR}{w} \qquad (2)$$

Clearly, if the elite set up a public sector at all, they will choose its size to be L^*. This is because citizens will revolt for all values $L < L^*$. But in that case, since the elite expect $(1-p)(R-wL)$, they might as well choose $L = 0$. In addition, citizens choose not to revolt for all values $L \geq L^*$, however, since the elite then get a payoff of $R-wL$, which they try to maximize subject to a `no revolution constraint' (equation (1)), they will choose $L = L^*$.

Now, the relevant question is whether the elite will set up a public sector at all. It is beneficial for the elite to set one up if the following condition holds.

$$EU^e(L = L^*) = R - wL^* \geq (1-p)(R) = EU^e(L = 0) \quad (3)$$

This is true whenever $pR \geq wL^*$. Substituting for the value of L^* from (2), the condition becomes: $pR \geq w\frac{pR}{w}$. This inequality always holds weakly and hence the elite weakly prefer to avert a revolt by creating a public sector of size L^*[3].

Proposition 1 *If equation 3 holds, there is a subgame perfect equilibrium in which the elite choose* $L = L^*$ *and citizens do not revolt.* [4] *If equation 3 does not hold, the subgame perfect equilibrium is one in which the elite do not set up a public sector (*$L = 0$*) and citizens revolt.*

Having solved the model, we are now in a position to investigate the comparative statics of equilibrium quantities. More specifically, how does the relative size of the public sector change with per capita natural resources? Since equation 3 always holds, the elite always attempt to avert a revolt by choosing $L = L^*$. Using equation 2 and dividing both sides by N, we can get an expression for the relative size of the public sector on the left hand side and per capita natural resources on the right. It is then straight forward to note that the two quantities are indeed proportional. As the value of natural resources per capita increases, so does the relative size of the public sector in equilibrium. This agrees with our initial observation that public sector employment, and the extent of redistribution more generally, in GCC economies (high $\frac{R}{N}$) is substantially more important than in resource rich Middle Eastern economies with large populations (low $\frac{R}{N}$).

$$\frac{L^*}{N} = \frac{p}{w}\frac{R}{N} \quad (4)$$

We need w to remain constant in order to avoid multiplicity of equilibria. The elite would be able to choose between a number of different wage and public sector size pairs that all dissuade the citizens from attempting a revolt (increasing one and decreasing the other would keep the citizens' utility unchanged). However, we will have to motivate this assumption by appealing to the empirical literature or else arguing that the public sector wage provides for a minimum standard of living (and hence is bounded below) and if we assume that the specific public sector jobs we are concerned with are predominantly entry level government jobs, then w is bounded above. Choosing a fixed level for w would then seem less arbitrary.

3. A Model with Perfect State Repression

A noticeable feature of authoritarian regimes in general and Middle Eastern dictatorships in particular is their reliance on a state security apparatus to stifle dissent and repress the opposition. Many economists have modeled dictatorships' use of repression for this purpose (See Wintrobe (1990), Ali (2009)). Nurmikko (2008), for example, studies the repeated interaction between a leader and the army (or state security) in the presence of an opposition that seeks to replace the leader through electoral competition. Similarly to the model presented below, the leader can stay in power through two ways: they could either bribe the opposition (which then redistributes the resources among the population) or else, they could pay the military to repress the opposition. It is shown that in a collusive equilibrium, the

[3] Introducing risk aversion would make the elite strictly prefer to avert a revolt.

[4] Off the equilibrium path, if the elite choose $L < L^*$ then citizens revolt whereas if they choose $L > L^*$, citizens do not revolt.

leader pays the army to repress the opposition. The paper differs from ours in its comparative statics, which say that the leader's use of the army is more likely the larger are the available resources since they would be more willing to remain in power. Although this line of reasoning is convincing for relatively small amounts of natural resources, it simply fails to explain the institutional arrangement in Middle Eastern countries with substantial hydrocarbon reserves. As the value of a dictatorship's natural resource wealth grows, the redistributive policy becomes more attractive as the relative efficiency of repression diminishes in comparison (see Ali (2009)). We will argue in the following model that the formation of a security apparatus enables governments to fund smaller public employment programs, reducing the amount of redistribution from state to citizens required for the dictator to remain in power.

In the following model, the broad structure of the game outlined above remains unchanged. One minor assumption that is introduced is on the payoff citizens expect to get following a successful revolt. Whereas previously it was assumed that citizens expect to get a share of the natural resource wealth ($\frac{R}{N}$), we now replace this with the fixed quantity D denoting the payoff in `democracy'. There are several reasons why this is a reasonable assumption. First, in the previous case, it was assumed that each citizen knew the amount of natural resource rents the government received and, in addition, knew the population with whom these rents would be shared. In reality, we would not expect the average citizen to be mindful of this information. In the case of Saudi Arabia for example, the exact amount of natural resource wealth has been treated as a `state secret'. D represents how much citizens value democracy. This could mean how much they value the political and civil liberties per se, or how much they expect their income to be in a democracy, or a composite of the two. In either case, it represents an expectation of what democracy will be like for each citizen. Indeed it is this expectation rather than any objective quantity that is likely to be the most influential factor in the decision whether or not to revolt. In Burnell and Youngs (2009), empirical evidence is presented showing that although support for democracy is high among citizens of new democracies, satisfaction with the performance of these democracies is low among the same group of citizens. This is clear evidence that citizens' valuation of democracy is distinct from its immediate monetary benefits and justifies the use of an exogenous parameter to describe the expected utility from democracy instead of the payoff each citizen receives when a revolt succeeds[5].

In the game shown in Figure 2, the elite decide whether or not to set up a state security apparatus. If they do set one up, there is no threat of a revolt from citizens and the elite simply consume the remainder of the government budget after having paid for the cost of the set up. We model the cost of setting up the state security apparatus as a fraction, θ, of the natural resource rents. We justify this modeling strategy as follows. The state security apparatus is given some power by the elite. They are likely to employ a large number of people, to be armed and well organized. Indeed, left alone and they may be a potential threat to the elite themselves. To insure against a coup, the elite essentially bribe the security apparatus. This bribe however would need to be proportional to the amount of resource rents that appear each period since the temptation to dislodge the elite is likely to be higher the higher is the potential booty. This is why the amount paid to the state security organ is the fraction θ of natural resource rents, R.

If the elite decide not to set up a security apparatus, they are again faced with the option of creating a public sector in which to employ the citizens. They choose the size of this public

[5]This does not mean that citizens do not value monetary rewards. It could be the case, for example, that citizens do value discounted future monetary rewards, which are perceived to be higher under democratic rule.

sector before citizens decide whether or not to revolt. Similarly to the model above, the size of the public sector influences the citizen's probability of getting a public sector job and hence their expected payoff from not revolting.

We proceed to find the subgame perfect equilibria of this game by backward induction. First, we consider the citizens' decision in the final stage of the game. They decide not to mount a revolt when the following condition holds.

$$EU^c(NoRevolt \mid NSS) = \frac{wL}{N} \geq pD = EU^c(Revolt \mid NSS) \quad (5)$$

The size of the public sector making citizens weakly prefer no revolt is $L^* = \frac{pDN}{w}$. The elite will never choose $L > L^*$ since their payoff in the event of no revolt is $R - wL < R - wL^*$ for all such L. Otherwise, they will choose $L = 0$ since for all other $L^* > L > 0$, citizens revolt and the elite get a payoff of $(1-p)(R-wL) < (1-p)R$, where the right hand side is the elite's payoff when $L = 0$. Exactly like our previous model, the elite's choice reduces to the following dilemma: either they set up a public sector of size L^* or they do not set up a public sector at all. The elite will choose to set up a public sector when the following expression is true.

$$EU^e(L = L^* \mid NSS) = R - wL^* \geq (1-p)(R) = EU^e(L = 0 \mid NSS) \quad (6)$$

Rearranging this equation, we see that the elite will choose to set up a public sector whenever $\frac{R}{N} \geq D$. This expression is more likely to hold the higher are natural resources per capita.

Finally, we study whether the elite decide to set up a state security apparatus or not. First, we will introduce the following parametric assumption.

$$\theta < p \quad (7)$$

This assumption ensures that in the event that (6) does not hold and that it is optimal for the elite not to set up public sector employment, they would prefer to avert a revolt by setting up a state security apparatus than simply facing a revolt in the hope that it would fail. The only remaining issue to consider is whether the elite will choose the state security route when they can prevent a revolt by redistribution. The elite choose redistribution over the state security route when the following inequality holds.

$$EU^e(L = L^* \mid NSS) = R - wL^* \geq (1-\theta)(R) = EU^e(SS) \quad (8)$$

This simplifies into the condition $\frac{R}{N} \geq \frac{pD}{\theta}$. Notice that this condition is more likely to hold the higher are natural resource rents per capita which is consistent with our explanation and agrees with the observation that GCC governments, those with the highest natural resource rents per capita, consistently choose the redistribution strategy over the state security one.

Proposition 2: *If (6) holds, there is a subgame perfect equilibrium in which the elite choose NSS and $L = L^*$, and citizens do not revolt*[6]*. If (6) does not hold, the subgame perfect equilibrium is such that the elite choose SS*[7]*.*

[6] Off the equilibrium path, if the elite choose $L < L^*$, citizens revolt whereas if they choose $L > L^*$, citizens do not revolt.

[7] Off the equilibrium path, the elite choose $L = 0$ and citizens revolt. Moreover, citizens revolt for all values of $L < L^*$ and do not revolt for all values of $L \geq L^*$.

4. A Model with Imperfect State Repression

In the above model, we assumed that state repression (setting up the state security apparatus) was perfectly effective. Namely, that once a state security apparatus is set up, citizens simply cannot revolt. Governments, as a result, do not institute public sector employment. However, this is far from the reality. Public sector employment in the Middle East, amongst non-GCC economies (those with the most active state security apparatuses), is substantial. In Algeria, Egypt and Jordan, public sector employment as a percentage of total employment was 56.6% (1990), 34% (1992), and 47% (1991) respectively (Said (1996)).

In the following framework, we consider the case when the state security does not repress citizens perfectly. Instead, setting up the state security apparatus makes it more difficult for citizens to effect regime change. We model the effect of the state security apparatus as a reduction in the probability that a revolt succeeds. letting $q < p$, we now have the situation in Figure 3.

The set up is analogous to the one in the previous section. However, now when the elite set up a state security apparatus, they must again choose a level of public employment, L_s in order to avert a revolt by the citizens. The level of public employment necessary to dissuade citizens from revolt in the case where the elite do not set up a state security apparatus is the same as before: $L^* = \frac{pDN}{w}$. The elite prefer to set up a public sector with this level of employment when (6) holds. If the elite do set up a security apparatus, the minimum level of public sector employment necessary to avert a revolt is $L_s^* = \frac{qDN}{w}$. Their expected utility from choosing the state security route and employing L_s^* citizens in the public sector is then: $EU^e(L_s = L_s^* \mid SS) = (1-\theta)R - qDN$. They prefer this course of action to the one where they set up a state security apparatus but do not avert a revolt ($L_s = 0$) whenever the following condition, analogous to (6), holds.

$$\frac{R}{N} \geq \frac{D}{(1-\theta)} \qquad (9)$$

Notice that whenever (9) holds, so does (6). Suppose (9) holds, i.e. the elite always choose to avoid a revolt by distributing public employment. The question now is whether the elite will set up a state security apparatus or not. They will choose the state security path whenever the $EU^e(L_s = L_s^* \mid SS) \geq EU^e(L = L^* \mid NSS)$, which simplifies to the following condition:

$$\frac{(p-q)D}{\theta} \geq \frac{R}{N} \qquad (10)$$

Clearly, this condition is more likely to hold when θ is smaller. Indeed, θ is the proportion of natural resources that the elite sacrifice in order to set up the state security apparatus. The smaller it is, the cheaper is the cost of repression. More interesting however is the fact that, ceteris paribus, the condition is more likely to hold when the ratio $\frac{R}{N}$ is smaller. This condition, together with (9), represents the constraint that the ratio $\frac{R}{N}$ needs to satisfy for the elite to prefer to set up a state security apparatus and employ a proportion of the citizens in the public sector.

$$\frac{(p-q)}{\theta}D \geq \frac{R}{N} \geq \frac{1}{1-\theta}D \qquad (11)$$

This range of values for $\frac{R}{N}$ is nonempty whenever $\frac{1-\theta}{\theta} > p-q$. Whenever $\frac{(p-q)}{\theta}D < \frac{R}{N}$, and $\frac{R}{N} \geq D$, the elite prefer to set up a large public sector in the absence of a state security apparatus. The equilibria of this game crucially depend on the value that the ratio $\frac{R}{N}$ takes in addition to a number of parametric relationships. The following proposition summarizes these conditions.

Proposition 3: *The subgame perfect equilibria of this game depend on the size of* $\frac{R}{N}$.

Case 1: $0 < \frac{R}{N} < D$:

The elite choose (SS, $L_s = 0$) whenever $(1-\theta)(1-q) > (1-p)$. Citizens choose to revolt.

Case 2: $D \leq \frac{R}{N} < \frac{D}{1-\theta}$:

The elite choose (SS, $L_s = 0$) whenever $\frac{R}{N} \leq \frac{pD}{1-(1-\theta)(1-q)}$[8]. Citizens then choose to revolt. Otherwise, the elite choose (NSS, $L = L^*$) and citizens choose not to revolt.

Case 3: $\frac{D}{1-\theta} \leq \frac{R}{N} < \frac{(p-q)D}{\theta}$:

The elite choose (SS, $L_s = L_s^*$) and citizens choose not to revolt.

Case 4: $\frac{R}{N} > \frac{(p-q)D}{\theta}$:

The elite choose (NSS, $L = L^*$) and citizens choose not to revolt.

Proposition 3 is summarized in figure 4. Below a certain level of natural resources per capita ($\frac{R}{N}$), there is some ambiguity about the optimal policy of the elite. However, with some parametric assumptions, the model is consistent with our theory for how the elite choose their policies in order to remain in power. In case 1, we can assume that $(1-p) < (1-\theta)(1-q)$ and that the elite do set up a state security apparatus but do not employ any citizens in the public sector. In case 2, we can assume that for all levels of natural resources per capita in this region, $\frac{R}{N} > \frac{pD}{1-(1-\theta)(1-q)}$, and that the elite continue to maintain the state security apparatus, however, now they employ some of the citizens in the public sector. In case 3, there is no longer any ambiguity about the policy of the elite and they always set up a state security apparatus and employ L_s^* citizens in the public sector. In case 4, the elite always choose not to set up a state security apparatus and employ a larger proportion of the citizens

[8] If $(1-\theta)(1-q) > (1-p)$, then $\frac{p}{1-(1-\theta)(1-q)} > 1$

in the public sector ($L^* > L_s^*$). If these parametric assumptions hold, we can see that below a certain level of natural resources per capita ($\frac{(p-q)D}{\theta}$), the elite choose to deal with a revolutionary threat from the citizens by setting up a state security apparatus, whereas above that level, they choose, instead, to redistribute natural resource wealth to the citizens through public sector employment. Moreover, we can see that for very low levels of natural resources per capita ($\frac{R}{N} < D$), the elite do not employ any citizens in the public sector and are forced to face a revolt.

These parametric assumptions enable us to neatly apply the model to Middle Eastern labour markets. We argue that the populous, natural resource dependent countries fall in cases 1, 2 and 3, whereas the GCC economies fall in case 4. For governments in the former group, it is then optimal to set up a state security apparatus and employ a (relatively) small proportion of citizens in the public sector. This is confirmed by the figures of the proportion of workers in the public sector for Algeria, Egypt, Jordan and Kuwait in Said (1996). Around the early 1990's the proportion of workers in the public sector in Kuwait, a member of the GCC, was between almost double (compared to Algeria) to almost three times as large (compared to Egypt) as the same proportion in non-GCC economies.

5. Taking the Model to the Data

The theoretical model suggests that elites in resource rich countries would, under broad conditions, prefer to expand public sector employment in order to avert a revolution. However, they would also prefer to combine carrots with sticks by also building a coercive capacity to minimize the potential of successful regime change. Figure 5 contains the profile of rents per capita for the major oil and mineral producing regions, which shows the oil-rich, population scarce GCC group leading the way. Moreover, out of the 26 leading oil and mineral exporters, there are 14 Arab and African countries. These countries, as the model predicts, have some of the largest public sector employment per citizen in the world[9]. However, the advanced OECD countries also tend to have even larger public sector employment. As discussed in section 1, the large public sectors in these countries might be attributed to their high degree of openness (Rodrik, 1998). Moreover, to the extent that public sector wages and other social outlays are influenced by private sector wages, democracy might also be of relevance to this phenomenon, if indirectly. In a follow-up paper Rodrik (1999) finds that, controlling for productivity and the level of development, among others, democracies tend to pay higher wages in the manufacturing sector. We will probe further into these issues later in this section in the context of the formal empirical regression analysis.

Though the model is developed in terms of the share of public sector labor force to national population, data on public sector employment is rather limited and is not available for many countries, especially resource-rich ones. Instead, we use the more available data on public sector wages and compensation per capita (w_pc). In fact this variable, we would argue, is a more appropriate measure of resource commitment to public sector employment. To see this we write $w\_pc = \frac{w}{N} = \frac{w}{L_p}\frac{L_p}{N}$, which decompose public sector wage per capita into two multiplicative components: public sector wage bill per public sector labor and the share of public sector labor to total national population. This accounts for both the wage rate as well as the size of public sector employment relative to total national population. As such, it is a

[9]For the GCC countries, rents and wages per capita are based on national populations, which exclude the sizable migrant population in these countries. In 2004, for example, the share of nationals in total population accounts for 80% in Oman; 73% in Saudi Arabia; 62% in Bahrain; 36% in Kuwait; 30% in Qatar; and only 19% in the UAE.

more encompassing measure of how much the elites are willing to spend a share of the rents on public sector employment.

As regards the model's prediction that elites in resource rich-countries also rely on building state security for repressing potential revolts, there is also some supporting evidence to this effect. There is ample evidence on the large shares of the military and security budgets in authoritarian oil and other resource-rich countries. However, most of this evidence might also reflect other considerations, such as external threats (e.g. Ross, 2009). We avoid this ambiguity by using a direct measure of government repression, available in the recently developed Cingranelli-Richards dataset (2008). This measure, called *Physical Integrity Rights*, constructs an annual variable that ranges from 0 (most repressive) to 8 (least repressive) and accounts for the incidence of torture, extrajudicial killing, political imprisonment, and disappearances that are attributable to the government. According to the physical integrity variable (PI), the resource rich economies appear to be among the leading repressive countries (Table 1), again consistent with the theory developed in this paper.

Moreover, most, but certainly not all, resource rich countries do not extend the franchise, as reflected by their deplorable median polity (Table 1). The Polity IV Index is based on two concepts: "institutionalized democracy" (DEM) and "institutionalized autocracy" (AUT). The DEM score is coded according to four measures of regime characteristics: competitiveness of executive recruitment; openness of executive recruitment; constraints on the chief executive; and competitiveness of political participation. These measures, along with regulation of participation, contribute to the AUT score. The Polity score (POL) is computed by subtracting the AUT score from the DEM score, resulting in a score from -10 (strongly autocratic) to 10 (strongly democratic).

Furthermore, non-democratic resource-rich countries are among some of the most extreme examples of authoritarianism. To measure this we construct the democracy gap index (DemocGap), which is a standardized distance from the democracy frontier for country c in period t:

$$DemocGap_{ct} = \frac{\{Max(Polity_{it}) - Polity_{ct}\}}{\{Max(Polity_{it}) - Min(Polity_{it})\}} \qquad (12)$$

This variable ranges between 0 (when a country is exactly at the frontier of Polity= the maximum value of 10) and 1 (when a country is exactly at the bottom of the Polity scale at the minimum of -10). This index is aimed at capturing the democratic aspirations of the public in the society, which also reflects the extent of ñsacrificeî the elites had to incur in resource-rich countries in terms of forgone rents in order to satisfy the public without extending the franchise. As the model suggests (proposition 3) a high enough ÒaugmentedÓ democracy gap (adjusting for the model parameters) that exceeds available rents per capita would lead to a choice of low public employment by the elites, because even if they decide to spend the entire rents on public employment it will not avert a revolt. As such, the model predicts a negative association between a wide democracy gap and public sector employment.

For the elites, avoiding successful regime change is the key objective of the game. We measure regime change by a binary variable, which assigns a value of 1 for the regime change year, where regime change in year t is defined by an absolute change of 3 or more in the Polity scale relative to the previous year $(t-1)$. The data suggests that regimes in resource-rich countries do not seem to have faced significantly higher risk of regime change than other non-resource developing countries (Table 1). We estimate the probability of regime change, p, as a function of resource rents (R_pc) and the degree of political repression (PolRep: as measured by Physical Integrity), among other controls:

$$P = P(R\_pc, SQ.R_pc, PolRep, Controls) \quad (13)$$

The estimates from this probability model assess whether resource-rich countries are different from other countries in terms of the hazard of regime change due to their being resource-rich (i.e. the marginal impact of R_pc). Moreover, as suggested by the theory of the previous section, the above model allows for testing whether there is a non-monotonic effect for the resource rents. Specifically the testable implication of this would be to check if there exists a per capita resource rent threshold below which the ruling elites will prefer not to share the rents in order to avoid a revolt and possible loss of power. Also the model allows testing whether or not political repression reduces the likelihood of successful regime change. On the other controls we follow Morrison (2009), who analyzes the impact of non-tax revenue per capita on regime change conditional on a host of controls deemed to be important additional explanatory variables. These controls include past regime instability[10], initial polity, initial level and growth of per capita income, ethno-linguistic fractionalization[11] and the share of urban population.

We estimate the above probability model using a panel data set of 3249 country years over 1970-2007 and covering 187 countries. Appendix Table A.1 provides the definitions of the variables used in the estimation of the probability model and the subsequent one for the public wage; Table A.3 contains country by country averages for public wages and resource rents; and Table A.2 presents the overall summary statistics for the regression variables. In applying the fixed-effects estimator to models with qualitative dependent variables based on panel data, the conditional logit model seems to be the preferred choice. However, it requires strict exogeneity of the regressors, and stationarity over time. Because these conditions are frequently violated in economic data, the random-effects estimator is an attractive alternative. In the panel data context, the probit model is computationally tractable while the logit model is not. The only limitation of probit models is that they require normal distributions for all unobserved components, a feature that may characterize most unobserved, random components but that is notoriously absent in cases where variables are truncated (e.g., prices must be positive)[12]. In light of this, we choose the discrete choice random-effects probit for estimating the probability of regime change.

The results are contained in Table 3. We find that both of resource rents and political repression are robustly and negatively associated with the likelihood of regime change, thus confirming the two key predictions of our hypothesized regime change model. Moreover, the resource rents effect was actually accounted for by those countries belonging to the top quartile of the resource-rich countries in the sample (regressions 3 & 4 of Table 3). According to this finding only those ruling elites in countries generating real (PPP) per capita rents at $ 317 or more will be willing to use rents as an instrument for fending off an impending revolt. This threshold is slightly above the real rents per capita of Egypt in 2007; hence even populous oil economies like Syria, Algeria and Iraq are well above this threshold (Table 2). We also find that regimes with a history of political instability are likely to experience higher probability of regime change, while initial democracy tends to reduce the likelihood of regime change. These above four pivotal findings are robustly significant across

[10]This is accounted for by the number of times the country experiences regime changes in the past up to the year/period in question.

[11]The index of ethnic fractionalization is a measure of latent conflict in a society and is given by $FRACT_j = 1 - \sum_{i=1}^{N} S_{ij}$, where S_{ij} is the share of group i $(i = 1,..., N)$ in country j. This index gives the probability that two randomly selected individuals from a population belonged to two different groups.

[12]See Elbadawi, Schmidt-Hebbel and Soto (2011) for a more detailed discussion of the econometric properties of logit and probit estimators in panel data estimation for the case of qualitative dependent variables.

the four regressions of the table. However, there is only weak evidence that economic growth tends to reduce the likelihood of regime change (regressions 1 of Table 3). Moreover, we also find the other controls analyzed by Morrison, including the share of urban population, population density and ethno-linguistic fractionalization to be uniformly insignificant (regression 1); hence we dropped them from subsequent regressions. We also dropped the lagged income per capita variable because it is very highly correlated with rents (Figure 6).

The random probit results of Table 3 hold with a remarkable degree of similarity when the model is estimated using simple pooled probit regressions (reported in the appendix Table A.4). A more important robustness check is provided by the results of Table 4, which is based on a restricted sample of only those countries with an initial Polity score of 6 or less. This results in a smaller sample of only 1942 country years derived from 87 countries over 1970-2007. Despite the much smaller sample and the consequent reduced variability for key variables, the results of Table 4 broadly corroborate the findings of the full sample regressions. However, when per capita growth is included rents becomes only weakly significant (regression 1) but regains its significance when the former is removed from subsequent regressions[13]. However, the political repression variable becomes less significant in all four regressions of Table 4. Though the restricted sample is more consistent with the theoretical model, since it is premised on the absence of full functioning democracy, we prefer the results of the full sample. This is because the results from the latter are broadly similar to those of the restricted one. In addition, it has the advantage of accounting for the theoretically important political repression effect. Therefore, we use the full sample regressions to construct the predicted probability of regime change (p^H). We interpret this predicted probability as an empirical proxy for the theoretical term $(p-q)$ in the equilibrium solution of the game. This constructed variable will be among the controls in the empirical estimation of the rent per capita effect on public sector wages and compensation per capita.

5.1 Hypothesis testing

As the theoretical model suggests, assuming that the elites in resource-rich societies decide to set up a public employment sector $(L > 0)$ in order to avert a revolution, the condition is that they also build a state security system (SS) and employ a proportion of the citizen $L_S = L_S^*$ (compared to the alternative of an expanded public sector employment system without state security $(L = L^*)$) is given by: $\frac{(p-q)D}{c} - \frac{R}{N} \geq 0$ (from equation 10), where c is the cost of setting up state security. Hence we can state the following probability function:

$$Pr(L \geq L_S^*) = 1 - G\{\frac{(p-q)D}{c} - \frac{R}{N}\} \qquad (14)$$

The above equation motivates the following empirical model:

$$ln(w\_pc) = a_1 + a_2 ln(R\_pc) - a_3 p^H - a_4 DemocGap + a_5 ln(GDP\_pc) \qquad (15)$$

In the above equation 15, we proxy the share of public sector labor to total population $(\frac{L}{N})$ by public wage bill per capita (w_pc); $p-q$ by the predicted probability of regime change conditional on political repression (P^H); the democratic aspiration of the public (D) by the democracy gap index (DemocGap); and the cost of setting up a state security apparatus (c) by real GDP per capita. Finally, we enter per capita variables in logarithmic form to bring their

[13] It appears that, like lagged per capita income, growth and rents might be multi-collinear as well.

scales to closer conformity to those of P^H and DemocGap, which also allows for direct estimation of elasticities.

Moreover, proposition 3 of section 4 suggests a non-monotonic effect for R_pc, where there exists a threshold level of rents per capita, beyond which R_pc is positively associated with w_pc. To account for this we also estimate the following extended version of equation 15

$$ln(w\_pc) = a_1 - a_2 ln(R\_pc) + a_3 ln(R\_pc)^2 - a_4 p^H - a_5 DemocGap + a_6 ln(GDP\_pc) \quad (16)$$

We estimate equations 15 and 16 using a global panel data set composed of 1109 country years covering 87 countries during 1970-2007 and include most of the oil and mineral exporting countries[14]. The results of the fixed-effects regressions strongly corroborate the theoretical model predictions (Table 5). Starting with the estimation of equation 15 (regression 1 of Table 5) we find rents per capita to be positively associated with public wage per, where an increase of one dollar (in real ppp terms) of rents per national would lead to a increase of about 10 cents in the public sector wage bill per national. Moreover, other model predictions are also borne out by the evidence, where high conditional probability of regime change or democracy gap exerts a negative influence on the public wage rate. As discussed earlier to the extent that private wage setting is likely to influence wages in the public sector, especially in advanced industrial democracies, our results on the negative effect of the democracy gap index also coheres with other evidence in the literature, most notably that of Rodrik (1998). He finds that, controlling for productivity, income levels and other controls, there is a robust and statistically significant association between democracy and wages in manufacturing. He argues that this is attributed to the fact that democracy entails greater freedom of association and collective bargaining. Moreover, the process of political participation, competition and contestation may increase the bargaining power of workers.

However, regressions 2 and 3 of the Table suggest that there is no direct non-monotonic effect for rent per capita. In regression 2 the square of rents is highly insignificant, while the estimated coefficients due to the first quartile, middle 50 percent; and top quartile of the rents variable are all significant and have similar orders of magnitude. Moreover, these estimates are not statistically significantly different from the estimated linear effect of regression 1. This clearly suggests that the non-monotonic effect predicted by the model is rather indirect and operates through the probability of regime change channel. The results of the full sample regressions are strongly corroborated by those of the restricted sample (Table 6), with only one exception regarding the democracy gap (DemoGap), which became insignificant. As in the case of the probability of regime change estimation this is due to the reduced variability and the smaller sample, which dropped to 701 country years covering only 65 countries, for which initial Polity was equal to or less than 6.

5.2 Robustness checks

Resource-rich economies, especially oil-rich ones, tend to be highly open economies due to their heavy reliance on resource exports. In a widely quoted paper Dani Rodrik (1999) finds strong empirical evidence linking large governments, including large public sector employment, to exposure to trade openness. He also provides a theoretical explanation for this phenomenon in that large government expenditures in open economies acts as a social insurance against the ensuing external risks associated with openness. Therefore, to the extent that resource-rich countries tend to be open economies, the observed large public sector employment in these counties might be the product of openness rather than their being resource-rich. In this case the theoretical underpinnings behind the large public sectors in

[14]However, due to multicollinearity between rents and lagged GDP per capita the results worsen considerably when both variables are included in the same regression; hence we dropped the latter from all of the wage regressions.

resource-rich economies will be very different from that of this paper's model. We check the robustness of our results against this competing theory by adding openness to the fixed-effects regressions of Tables 5 and 6. We use two measures of openness: one is total trade ratio to to GDP (OPEN); and the other is an adjusted measure (*Adj_OPEN*), which is derived as a residual from the OLS regression of $(Exports + Imports)/GDP$ on log of population, log of area, Landlocked and oil exporter dummies. The results are reported in regressions 4 & 5 of the two tables. For all four regressions the rent per capita effect remains highly significant and positively associated with public wages. Moreover, the direct trade openness variable (OPEN) was also positively and highly significantly associated with public wage as predicted by Rodrik's theory. However, this measure is problematic because it does not adjust for country characteristics. Instead, the adjusted openness measure (*Adj_OPEN*) was significant but implausibly negative. In view of the fact that the adjusted openness measure is more appropriate for assessing the policy impact of openness, the above results make clear that the observed phenomena of large public sectors in resource-rich economies appears to be better explained by the "authoritarian bargain" as modeled in this paper than by the other competing argument of social insurance against the risks associated with trade openness.

6. Summary and Conclusion

In the preceding text, we proposed an explanation for the widely documented difference in labour market institutions between resource dependent countries with high per capita rents (as a result of small populations) and those with large populations. With reference to the Middle East's authoritarian regimes, we identified the strategic interaction between government and citizens as the driving factor behind this difference. We argued that authoritarian regimes with access to substantial natural resources who rule over small populations have a policy tool that is simply unavailable to other authoritarian governments. In their effort to remain in power, these governments have the wherewithal to redistribute enough resources to their populations to effectively remove the incentive to revolt. In addition, we argue that the public sector is the mechanism of choice for governments to effect this redistribution. Public sector jobs essentially become funnels channeling income to the citizens of the country.

In section 2, we set up the basic model - a game theoretic environment where the government (elite) and citizens play a 2-period sequential game. The only available policy instrument the elite have is the size of the public sector labour force. We assume there is no private sector employment. After observing this choice, citizens can stage a revolt which succeeds with a certain probability p. The elite always prefer to set up public sector employment (equation (3)). What emerges is that the relative size of the public sector workforce set up by the elite is proportional to the value of natural resources per capita in the economy. In section 3, we enriched the modeling environment by introducing another policy alternative for the elite - they can repress the population of citizens by paying a proportion θ of the natural resource rents they receive. We also alter the set up slightly by making the citizens' expected value in democracy an exogenous parameter. In this new model, we again derive the required relationship between natural resources per capita and the size of the public sector labour force. Specifically, there is a level, D, of natural resources per capita such that the elite set up public sector employment for all levels of natural resources per capita above D and choose to repress the population of citizens for all levels of natural resources per capita below it.

Finally, we relax the assumption that repression is perfectly effective. Now, choosing repression does not guarantee that the elite are unchallenged but, instead, decreases the size of the public sector needed to be set up by the elite in order to avoid a revolt. It is this final set up that yields our most interesting results. We find that only for some parameter values do we get a monotonic relationship between the size of the public sector workforce and natural

resources per capita. For low levels of natural resources per capita, the government sets up a state security organ and public sector employment is kept low. Beyond a threshold level, the optimal policy for the elite becomes setting up a large public sector work force in the absence of a state security organ.

In section 5 of the paper, we investigate empirically some of the claims made in the preceding sections. We use public sector wages and compensation per capita as a measure of the extent of redistribution, denoted in the model by the relative size of the public sector work force. This latter measure is unavailable for most countries of interest and, in addition, we argue that public sector wages and compensation per capita are a more appropriate measure for what we are attempting to quantify - how much elites are willing to spend a share of the rents on public sector employment. We first construct the predicted probability of regime change, which according to our theory should be negatively associated with public wage. This variable is based on a behavioral probit regression estimation that accounts for rents and the degree of political repression. We make use of the recently developed physical integrity variable (PI) due to Cingranelli-Richards dataset (2008) to measure government repression. According to this measure, the populous resource-rich countries are among the leading repressors. We find that both resource rents and political repression are negatively and robustly associated with the probability of regime change. However, the resource rents effect is non-monotonic, where ruling elites will only use rents to avert a potential revolt when the rents are in excess of about (real PPP) $ 317 per capita. Instead, in societies with lower rents than this threshold elites are likely to exclusively resort to political repression as a one track strategy. This is consistent with the evidence that populous resource-rich countries tend to be highly repressive.

More importantly, our main theoretical result regarding the positive impact of rents on public sector wages was very strongly corroborated by the empirical findings. Using a global panel data set composed of 1109 country years covering 128 countries, we estimate fixed-effects regressions and find that a one dollar increase in rents per capita leads to about 10 cents rise in the public wage per capita. Moreover, as the model predicts, we find that regime change and democracy gap have had negative and significant impacts on public wage, suggesting that, other things equal, public wages are likely to be smaller in resource-rich countries with extreme autocracy or when the ruling elites are faced with a high probability of regime change. However, we do not find support for a direct non-monotonic rent effect on wage, though there exists an indirect non-monotonic rent effect through the probability of regime change channel.

Although the results of the theoretical model hold with only natural resources in the government budget, there may be an argument for including an explicit private sector in the model with the elite's income becoming $R+Y$ where Y is the elite's income from non-natural resources. First, the private sector is more important than the natural resource sector in non-GCC economies. Moreover, the `non-lootable' nature of the private sector may act as a disincentive to revolt as well as a disincentive for using repression. Whereas presently, the payoff from private sector employment (zero) is the same as the payoff following a failed revolt, in the presence of an explicit private sector, the payoff in the former case could be positive, making revolt more costly and perhaps explaining the lack of an association between regime change and resource rents. It is uncertain, at this stage, how much of the analysis this will change. So far, the model is very simple, which lends to empirical testing and this extension could be the work of future research.

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Figure 1: The Extensive Form of the Game between the Elite and Citizens

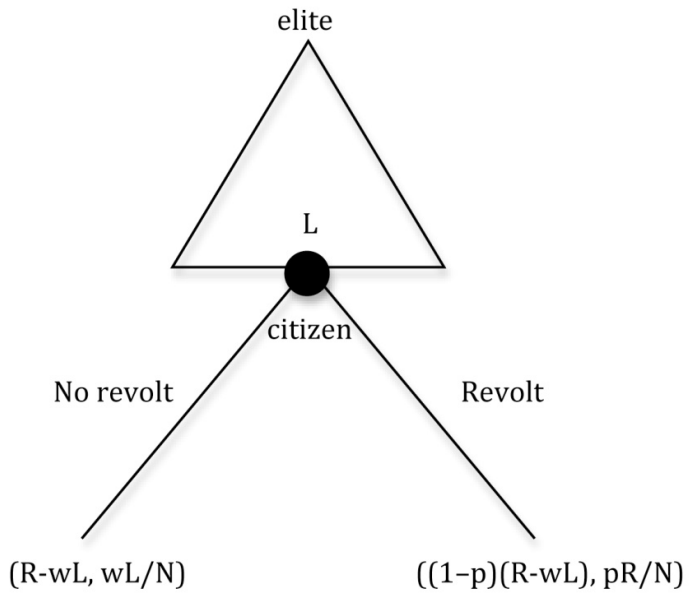


Figure 2: The Extensive Form of the Game between the Elite and Citizens When the Elite Have an Option to Form a State Security Apparatus that Removes the Option of Citizens to Revolt

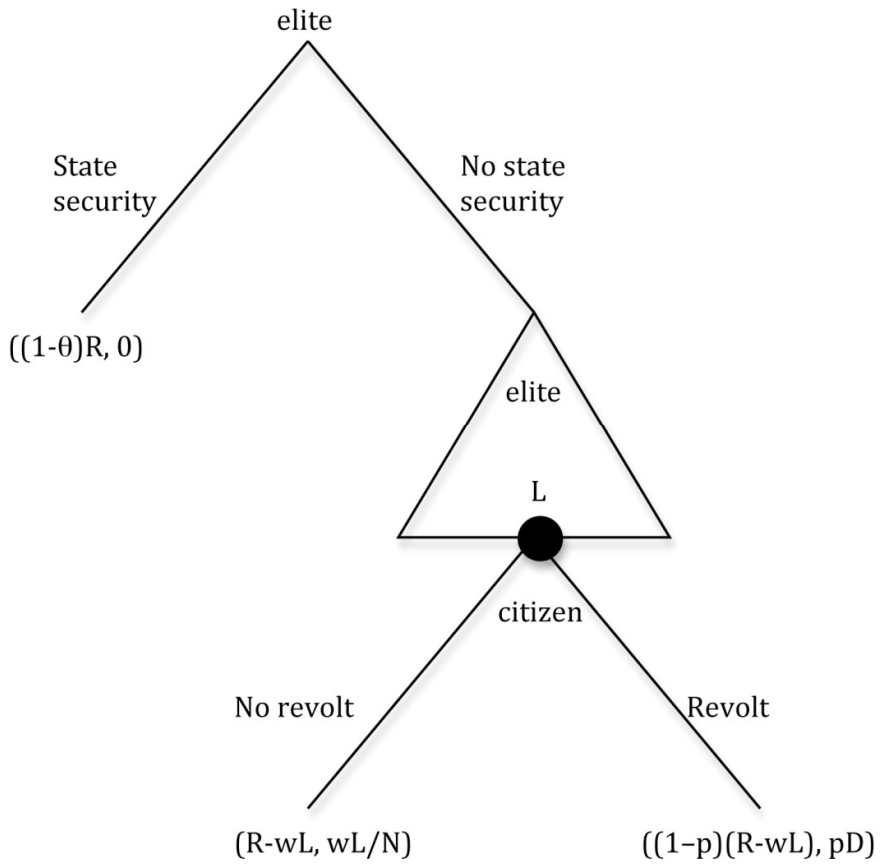


Figure 3: The Extensive Form of the Game between the Elite and Citizens With Imperfect Repression

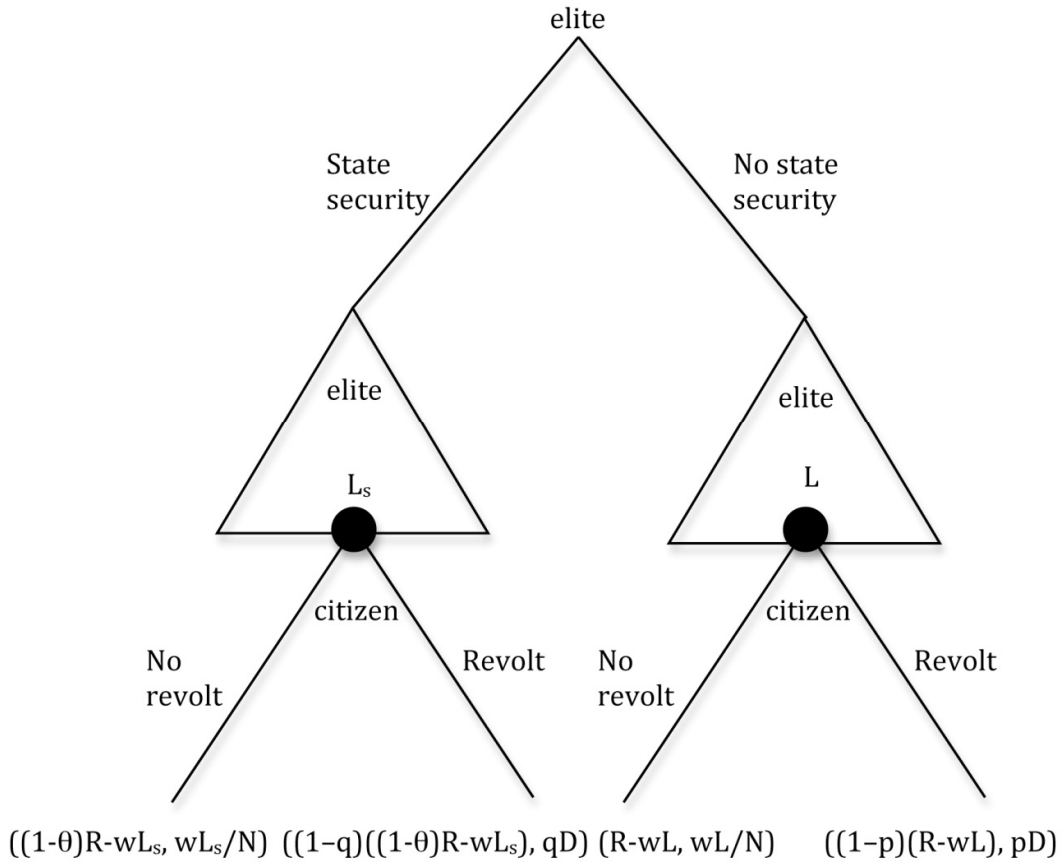


Figure 4: The Optimal Policy of the Elite as R/N Increases

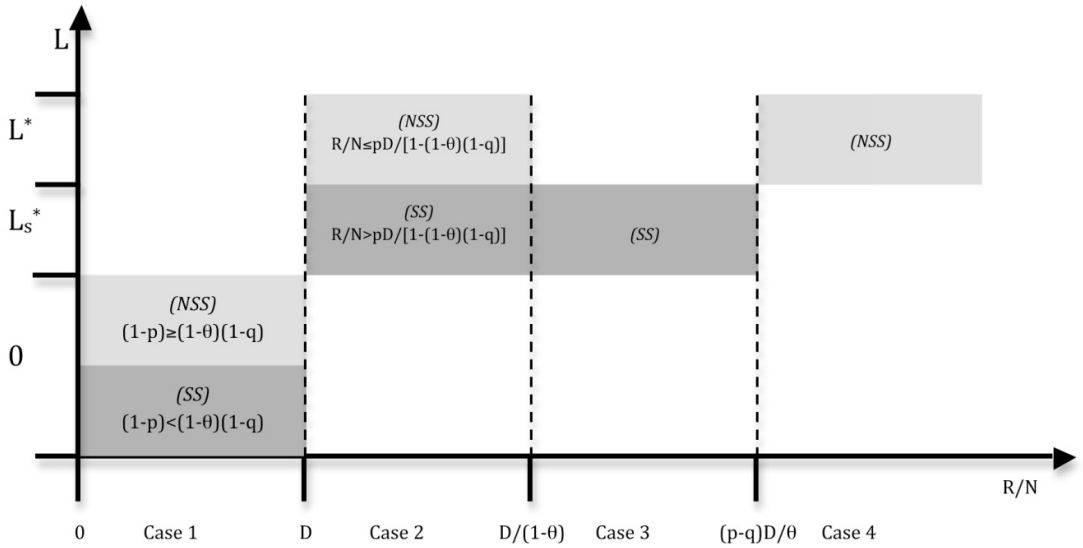
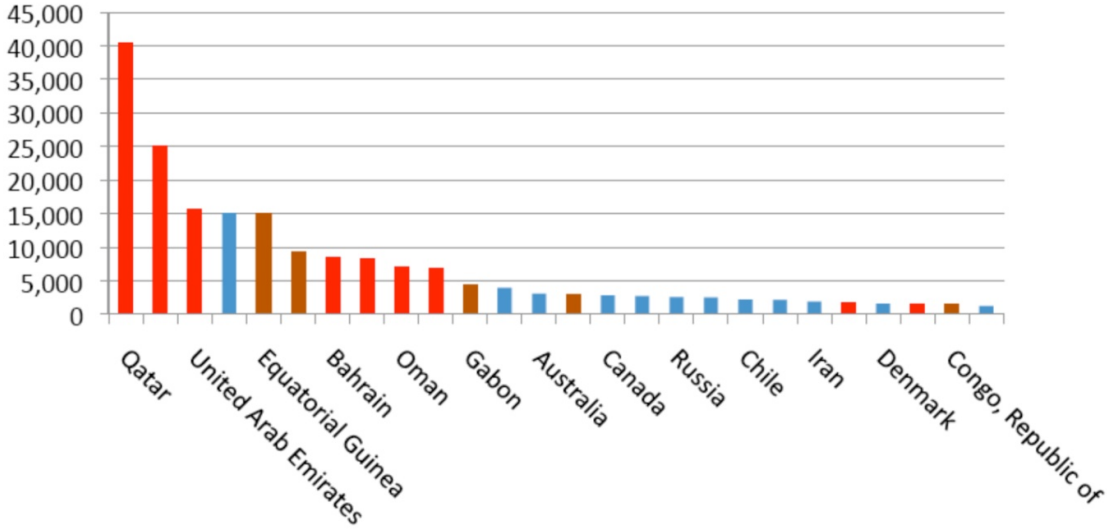


Figure 5: Resource Rent Per Capita Across the Globe (in current US dollars: average 2000 - 2007)



Source: see notes to table 2

Figure 6: The Income and Resource Rents Scatter

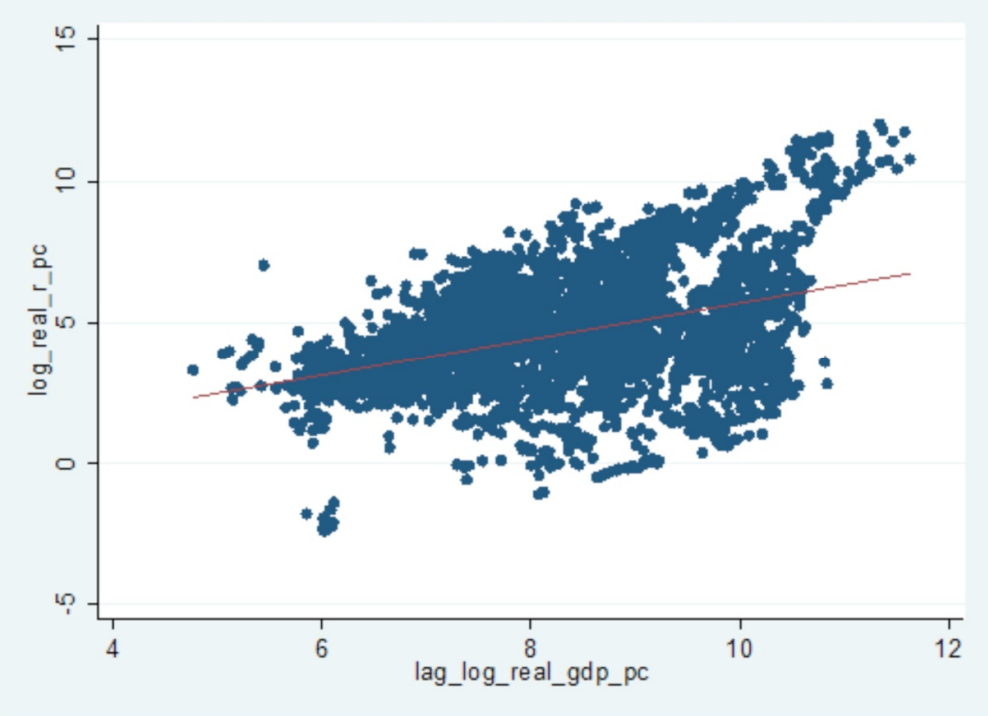


Table 1: Public Wage and Correlates in Resource Rich and other Countries

Country Grouping	Real Rent Per capita (PPP $)	Real Wage Per capita (PPP $)	Physical Integrity	Democracy Gap	Dummy for Regime Change	Polity
Top 15 Oil exporting	19,992	3,655	3.9	0.7	0.03	-3.9
Other oil exporting ($\geq$ 150,000 bpd)	3,000	790	3.4	0.5	0.02	0.4
Top mineral exporting ($x \geq 50\%$ of exports)	115	298	4.9	0.3	0.03	4.5
Other mineral exporting ($15 \leq x \leq 50\%$ of exports)	281	343	4.7	0.4	0.04	1.4
OECD	586	2,607	6.6	0.0	0.0	9.3
Other developing countries	170	642	5.1	0.3	0.0	3.4

Notes: Definition of variables: For rent per capita; political repression and real public wage per capita, see notes to Table 2; and for the definitions of polity, democracy gap and regime change dummy see section 5. Top 15 Oil Exporting: GCC , Algeria, Angola, Iran, Iraq, Kazakhstan, Libya, Nigeria, Russia, Venezuela. Other Oil Exporting (³150,000 ppd): Argentina, Azerbaijan, Belarus, Brunei, Chad, China, Colombia, Congo, Republic of, Ecuador, Egypt, Equatorial Guinea, Gabon, India, Indonesia, Malaysia, Sudan, Syria, Thailand, Trinidad &Tobago, Vietnam, Yemen. Top Minerals Exporting (x ³50 % of exports): Botswana, Congo, Dem. Rep., Guinea, Jamaica, Namibia, Niger, Sierra Leone, Zambia. Other Minerals Exporting (15² x< 50 % of exports): Armenia, Bolivia, Central African Republic, Cuba, Ghana, Guyana, Jordan, Kyrgyzstan, Mali, Mauritania, Mongolia, Morocco, Papua New Guinea, Peru, South Africa, Suriname, Tanzania, Togo, Ukraine, Uzbekistan. OECD: Australia, Austria, Belgium, Canada ,Chile, Czech , Republic, Denmark, Estonia, Finland, France ,Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Japan, Korea, Luxembourg, Mexico, Netherlands, New Zealand, Norway, Poland, Portugal, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Turkey, United Kingdom, United States.

Table 2: Public Sector Employment vs. Political Repression (annual average: 2000-2007)

Country	Rent per capita	Public Wage Bill per capita	Index of Political Repression
GCC Countries			
Qatar	40,446	11.9	6.8
Kuwait	25,007	8.1	5.9
United Arab Emirates	15,556	9.2	6.4
Bahrain	8,584	3.5	5.9
Saudi Arabia	8,239	3.9	4.5
Oman	6,975	2.1	7.3
GCC Mean	11,898	6.0	6.1
Populous Arab Oil exporters			
Iraq	1,775	0.5	0.3
Algeria	1,563	0.4	3.3
Syria	532	0.1	2.9
Egypt	313	1.9	2.8
Sudan	288	0.1	0.6
Yemen	--	0.1	2.9
Non-GCC Median	532	0.2	2.8

Notes: Units: Rent per capita is in thousands of current US dollars. Public Wage Bill per capita is in thousands of real PPP dollars. 1. We extend the resource rents data base of Collier and Hoeffler (2009), who use data from the World Bank's adjusted savings project. We calculated the rents for each commodity by subtracting the cost from the commodity price. Rents per unit were then multiplied by the amount extracted and summed across the different commodities. Rent per capita was then calculated by dividing rents in current US dollars by population; while real rent per capita was obtained by first converting current rents into real (PPP) values and then dividing by population. Natural resources for which rent data were available are: oil, gas, coal, lignite, bauxite, copper, iron, lead, nickel, phosphate, tin, zinc, silver and gold. The data are described in Hamilton and Clemens (1998) and available from http://lnweb18.worldbank.org/ESSD/envext.nsf/44ByDocName/GreenAccountingAdjusted Net Savings. 2. Political repression is measured by the index of Physical Integrity Rights, which ranges from 0 (most repressive) to 8 (least repressive) and accounts for the incidence of torture, extrajudicial killing, political imprisonment, and disappearances that are attributable to the government (Cingranelli-Richards dataset, 2008). 3. Public wage bill per capita is given by total government expenses on compensation of employees (from the IMF World Economic Outlook data base) divided by population.

Table 3: Probability of Regime Change (full sample)

Variable	REP [1] Coefficient	Z	REP [2] Coefficient	Z	REP [3] Coefficient	Z	REP [4] Coefficient	Z
Real GDP_ pc Growth Rate	-0.68	-1.11	-	-	-	-	-	-
Log Rent_pc	-0.09	-2.75	-0.10	-3.42	-	-	-	-
Past Instability	0.11	3.88	0.11	3.75	0.11	3.63	0.11	3.61
Polity (-1)	-0.04	-5.20	-0.05	-5.96	-0.05	-5.87	-0.05	-5.91
Political Repression	-0.04	-1.76	-0.04	-1.96	-0.05	-2.05	-0.05	-2.02
Share of Urban POP	0.00	-0.54	-	-	-	-	-	-
ELF	-0.18	-0.85	-	-	-	-	-	-
POP Density	0.00	-0.53	-	-	-	-	-	-
Dum_25*log Rent_pc	-	-	-	-	0.01	0.13	-	-
Dum_25-75*log Rent_pc	-	-	-	-	-0.04	-0.64	-	-
Dum_75*log Rent_pc	-	-	-	-	-0.07	-1.87	-0.06	-3.21
Constant	-1.26	-4.99	-1.39	-7.52	-1.63	-6.16	-1.73	-12.84
Observations	3218	-	3249	-	3249	-	3249	-
LR statistic	3.45	-	3.90	-	4.16	-	4.65	-
Value	0.032	-	0.024	-	0.021	-	0.015	-
Log Likelihood	-492.15	-	-499.04	-	-498.15	-	-499.62	-

Note: ELF = Ethnolinguistic fractionalization, REP=Random Effect Probit

Table 4: Probability of Regime Change (Restricted sample: initial Polity ≤ 6)

Variable	REP [1] Coefficient	Z	REP [2] Coefficient	Z	REP [3] Coefficient	Z	REP [4] Coefficient	Z
Real GDP_ pc Growth Rate	-1.41	-1.96	-	-	-	-	-	-
Log Rent_pc	-0.05	-1.18	-0.08	-2.36	-	-	-	-
Past Instability	0.10	2.53	0.09	2.31	0.09	2.25	0.08	2.17
Polity (-1)	-0.04	-3.51	-0.04	-3.98	-0.04	-3.97	-0.04	-3.93
Political Repression	-0.02	-0.79	-0.03	-1.32	-0.03	-1.36	-0.03	-1.35
Share of Urban POP	0.00	-0.54	-	-	-	-	-	-
ELF	-0.07	-0.32	-	-	-	-	-	-
POP Density	0.00	1.11	-	-	-	-	-	-
Dum_25*log Rent_pc	-	-	-	-	-0.02	-0.19	-	-
Dum_25-75*log Rent_pc	-	-	-	-	-0.05	-0.71	-	-
Dum_75*log Rent_pc	-	-	-	-	-0.06	-1.43	-0.04	-2.10
Constant	-1.55	-5.16	-1.40	-6.20	-1.53	-4.71	-1.69	-10.38
Observations	1923	-	1942	-	1942	-	1942	-
LR statistic	0.81	-	1.83	-	1.95	-	2.34	-
Value	0.185	-	0.088	-	0.082	-	0.063	-
Log Likelihood	-388.18	-	-396.62	-	-396.45	-	-397.23	-

Note: ELF = Ethnolinguistic fractionalization, REP=Random Effect Probit

Table 5: Public Sector Wages Per Capita (Log_pw_pc) (Full Sample)

	FE [1]		FE [2]		FE [3]		FE [4]		FE [5]	
Variable	**Coeff**	**t**	**Coeff**	**t**	**Coeff**	**t**	**Coeff**	**t**	**Coeff**	**t**
Log Rent_ pc	0.10	4.61	0.07	1.34	-	-	0.06	2.86	0.08	3.24
Sqr Log Rent_ pc	-	-	0.00	0.48	-	-	-	-	-	-
Prob Regime Change	-2.93	-3.76	-2.98	-3.79	-3.02	-3.85	-3.09	-4.01	-3.16	-3.63
DemocGap	-0.22	-2.42	-0.22	-2.37	-0.21	-2.26	-0.13	-1.34	-0.18	-1.73
Trade Openness (OPEN)	-	-	-	-	-	-	0.00	4.74	-	-
Adjusted Trade Openness (*Adj_OPEN*)	-	-	-	-	-	-	-	-	-0.08	-2.13
Dum_25*log Rent_pc	-	-	-	-	0.10	2.95	-	-	-	-
Dum_25-75*log Rent_pc	-	-	-	-	0.09	3.49	-	-	-	-
Dum_75*log Rent_pc	-	-	-	-	0.10	4.43	-	-	-	-
Constant	5.69	49.19	5.74	36.22	5.70	44.09	5.51	45.67	5.83	44.38
No of Observations	1109	-	1109	-	1109	-	1109	-	935	-
R-Squared	0.0739	-	0.0741	-	0.0748	-	0.0941	-	0.0670	-
Adj R-Squared	-	-	-	-	-	-	-	-	-	-
F	26.73	-	20.09	-	16.22	-	26.08	-	14.95	-

Note: FE = Fixed Effect, Coeff=Coefficient

Table 6: Public Sector Wages Per Capita (Log_pw_pc) (Restricted sample: initial Polity ≤ 6)

	FE [1]		FE [2]		FE [3]		FE [4]		FE [5]	
Variable	**Coeff**	**t**	**Coeff**	**t**	**Coeff**	**t**	**Coeff**	**t**	**Coeff**	**t**
Log Rent_ pc	0.09	3.46	0.13	1.76	-	-	0.05	1.85	0.08	2.71
Sqr Log Rent_ pc	-	-	0.00	-0.59	-	-	-	-	-	-
Prob Regime Change	-3.16	-3.52	-3.11	-3.44	-3.23	-3.57	-3.49	-3.93	-3.45	-3.54
DemocGap	-0.16	-1.39	-0.17	-1.45	-0.15	-1.26	-0.04	-0.35	-0.09	-0.70
Trade Openness (OPEN)	-	-	-	-	-	-	0.01	4.63	-	-
Adjusted Trade Openness (*Adj_OPEN*)	-	-	-	-	-	-	-	-	-0.13	-2.83
Dum_25*log Rent_pc	-	-	-	-	0.07	1.57	-	-	-	-
Dum_25-75*log Rent_pc	-	-	-	-	0.07	2.19	-	-	-	-
Dum_75*log Rent_pc	-	-	-	-	0.09	3.04	-	-	-	-
Constant	5.43	37.05	5.34	25.28	5.49	32.69	5.18	33.77	5.49	34.29
No of Observations	701	-	701	-	701	-	701	-	632	-
R-Squared	0.0682	-	0.0687	-	0.0697	-	0.0987	-	0.0736	-
Adj R-Squared	-	-	-	-	-	-	-	-	-	-
F	15.49	-	11.69	-	9.48	-	17.35	-	11.24	-

Note: FE = Fixed Effect, Coeff=Coefficient

Appendix: Data Description and Summary

Table A1: Definition of Variables

Public Wage Bill per capita	General government expense, compensation of employees (ppp) per capita
Incidence of regime change	If the absolute value of [Polity (t)- polity (t-1)] is equal to three or more, the variable regime change in year t = 1, while if it is less than three, the variable regime change in year t = 0
(predicted) probability of Regime change	Predicted using probit model in table (É..)
Past Instability	Past regime instability in year t = sum of the variables regime change for all years T that are less than t
Rent_pc	Resourcerent per capita (ppp)
Index of Political Repression	Political repression is measured by the index ofPhysicalIntegrity Rights, which ranges from 0 (most repressive) to 8 (least repressive) and accountsfor the incidence of torture, extrajudicial killing, political imprisonment, and disappearances that are attributable to the government (Cingranelli-Richards dataset, 2008).
Real GDP_pc Growth Rate	log Real GDP per capita ppp (t) - log Real GDP per capita ppp (t-1)
Real GDP_pc(-1)	Open-period lagged Real GDP per capita ppp
Initial Polity	Polity in year 1970, the scale ranges from +10 (strongly democratic) to -10 (strongly autocratic), See: Polity IV Project: Dataset UsersÕ Manual
Democracy Gap	Constructed index based on polity score = (10-(polity)/20)
Trade Openness (OPEN)	Openness in Current Prices, % in Current Prices
Adjusted Trade Openness (Adj_OPEN)	Constructed as the residuals of reg (exports+imports)/GDP on lnapop (log of average population), landlocked, inland (log of area), oilx (dummy for oil exporters)
Share of Urban POP	People living in urban areas as defined by national statistical offices., see: World Bank database
POP Density	People per sq. km of land area, see: World Bank database
ELF (Ethno-linguistic Fractionalization)	ELF Indice, Pilip Roeder (we used ELF 85), see Ethnolinguistic Fractionalization.doc

Table A2: Data Summary (1970 - 2007)

	Mean	Median	Minimum	Maximum
Public Wage Bill per capita	1197	469	0.16	14141
Incidence of regime change	0.04	0.03	0	0.29
(predicted) Probability of Regime change	0.04	0.03	0.003	0.17
Past Instability	1.04	0.92	0	7.08
Rent_pc	1687.37	100.42	1.02	62623.83
Index of Political Repression	5.14	5.31	0.32	8.0
Real GDP_pc Growth Rate	0.003	0.01	-0.10	0.12
Real GDP_pc(-1)	9030	4941	381	62386
Initial Polity	-1.29	-5.00	-10	10
Democracy Gap	0.45	0.47	0	1
Trade Openness (OPEN)	0.83	0.76	0.17	3.49
Adjusted Trade Openness (Adj_OPEN)	0.01	-0.09	-0.84	3.20
Share of Urban POP	48.7	48.6	6.0	100.0
POP Density	228.3	53.0	1.3	12597
ELF (Ethno-linguistic Fractionalization)	0.46	0.47	0.0	0.98

Table A3: Public Wage and Resource Rents by Country (1970-2007): in real PPP dollars

Country	Rent per capita	Public wage bill per capita	Country	Rent per capita	Public wage bill per capita	Country	Rent per capita	Public wage bill per capita
Afghanistan	32	44	Cote d`Ivoire		149	Kazakhstan	1,884	413
Angola	1,512	316	Cameroon	169	127	Kenya	20	147
Albania	140	233	Congo, Republic of	708	197	Kyrgyzstan	16	207
United Arab Emirates	62,624	11,151	Colombia	247	482	Cambodia	269	-
Argentina	475	1,129	Comoros	14	149	Kiribati	-	-
Armenia	19	433	Cape Verde	5	769	St. Kitts & Nevis	-	1,775
Antigua and Barbuda	-	1,746	Costa Rica	104	1,037	Korea, Republic of	7	-
Australia	908	-	Cuba	126	-	Kuwait	37,279	10,518
Austria	144	3,239	Cyprus	5	4,981	Laos	95	99
Azerbaijan	1,836	239	Czech Republic	65	1,280	Lebanon	2	808
Burundi	23	56	Djibouti	13	724	Liberia	256	-
Belgium	10	-	Dominica	4	705	Libya	4,849	1,335
Benin	44	71	Denmark	284	-	St. Lucia	-	1,071
Burkina Faso	30	-	Dominican Republic	83	342	Sri Lanka	27	-
Bangladesh	25	-	Algeria	993	366	Lesotho	35	279
Bulgaria	113	378	Ecuador	801	-	Lithuania	184	-
Bahrain	12,246	4,461	Egypt	332	1,632	Luxembourg	-	4,966
Bahamas	35	1,839	Eritrea	18	97	Latvia	216	-
Bosnia and Herzegovina	51	598	Spain	34	2,617	Macao	-	-
Belarus	202	1,719	Estonia	193	-	Morocco	31	-
Belize	62	832	Ethiopia	27	50	Moldova	3	265
Bermuda	-	-	Finland	320	-	Madagascar	19	42
Bolivia	381	-	Fiji	62	-	Maldives	-	456
Brazil	240	906	France	41	3,652	Mexico	722	-
Barbados	100	2,602	Micronesia, Fed. Sts.	-	-	Marshall Islands	-	-
Brunei	25,166	7,094	Gabon	3,767	596	Macedonia	16	-
Bhutan	401	-	United Kingdom	470	-	Mali	17	56
Botswana	121	907	Georgia	15	228	Malta	-	-
Central African Republic	37	42	Germany	56	2,288	Montenegro	-	-
Canada	1,408	3,620	Ghana	51	101	Mongolia	173	-
Switzerland	21	-	Guinea	100	122	Mozambique	27	69
Chile	661	934	Gambia, The	16	63	Mauritania	174	204
China	75	-	Guinea-Bissau	25	65	Mauritius	1	1,131
Malawi	16	61	Equatorial Guinea	2,468	113	Panama	21	445
Malaysia	840	-	Greece	40	-	Peru	218	356
Namibia	-	790	Grenada	-	1,497	Philippines	56	234
Niger	16	35	Guatemala	118	210	Palau	-	-
Nigeria	331	-	Guyana	285	260	Papua New Guinea	563	-
Nicaragua	60	110	Hong Kong	-	-	Poland	99	1,138
Netherlands	578	3,030	Honduras	141	291	Puerto Rico	-	-
Norway	3,527	-	Croatia	178	1,414	Portugal	54	2,257
Nepal	46	53	Haiti	22	56	Paraguay	109	-
New Zealand	440	-	Hungary	254	-	Qatar	61,819	14,141
Oma	5,572	1,737	Indonesia	295	192	Slovenia	50	2,083
Pakistan	56	-	India	47	-	Sweden	244	-
Romania	323	1,289	Ireland	77	2,958	Swaziland	171	783
Russia	3,637	664	Iran	1,904	669	Seychelles	-	1,799
Rwanda	31	50	Iraq	1,897	533	Syria	455	104
Saudi Arabia	7,331	3,473	Iceland	-	-	Chad	102	73
Sudan	136	53	Italy	53	2,881	Togo	60	48
Senegal	23	101	Jamaica	433	-	Thailand	103	551
Singapore	-	-	Jordan	21	271	Tajikistan	7	85

Table A3: Continued

Country	Rent per capita	Public wage bill per capita	Country	Rent per capita	Public wage bill per capita	Country	Rent per capita	Public wage bill per capita
Solomon Islands	154	-	Japan	17	-	Turkmenistan	5,343	0
Sierra Leone	47	92	Serbia	78	753	Timor-Leste	-	-
El Salvador	50	-	Sao Tome and Principe	-	351	Tonga	7	-
Somalia	21	-	Suriname	646	1,085	Trinidad &Tobago	3,965	1,129
Vanuatu	50	-	Slovak Republic	48	37	Tunisia	271	875
Samoa	95	-	Uzbekistan	891	-	Turkey	27	573
Yemen	-	105	St. Vincent& Grenadines	-	577	Tanzania	34	29
South Africa	176	854	Venezuela	1,874	-	Uganda	43	49
Congo, Dem. Rep.	41	15	Vietnam	155	-	Ukraine	225	760
Zambia	229	108	-	-	-	Uruguay	46	573
Zimbabwe	9	8	-	-	-	United States	549	4,165

Table A4: Probability of Regime Change (Full sample)

	PP [1]		PP [2]		PP [3]		PP [4]	
Variable	Coefficient	Z	Coefficient	Z	Coefficient	Z	Coefficient	Z
Real GDP_pc Growth Rate	-0.70	-1.20	-	-	-	-	-	-
Log Rent_pc	-0.08	-2.92	-0.09	-3.68	-	-	-	-
Past Instability	0.13	5.61	0.13	5.60	0.13	5.53	0.12	5.47
Polity (-1)	-0.04	-5.31	-0.04	-6.21	-0.04	-6.09	-0.04	-6.13
Political Repression	-0.03	-1.68	-0.04	-1.83	-0.04	-1.92	-0.04	-1.89
Share of Urban POP	-0.00	-0.60	-	-	-	-	-	-
ELF (Ethno-linguistic Fractionalization)	-0.18	-1.01	-	-	-	-	-	-
POP Density	-0.00	-0.65	-	-	-	-	-	-
Dum_25*Log Rent_pc	-	-	-	-	0.01	0.06	-	-
Dum_25-75*Log Rent_pc	-	-	-	-	-0.04	-0.75	-	-
Dum_75*Log Rent_pc	-	-	-	-	-0.06	-1.97	-0.05	-3.36
Constant	-1.30	-6.02	-1.43	-9.05	-1.64	-6.94	-1.74	-14.82
Observations	3218		3249		3249		3249	
LR Chi^2	94.91	-	95.93	-	97.44	-	94.00	-
Prob $> Chi^2$	0.00	-	0.00	-	0.00	-	0.00	-
Pseudo R^2	0.088	-	0.087	-	0.089	-	0.086	-

Note: PP = Pooled Probit