European Economic Review 56 (2012) 1714–1729

Contents lists available at SciVerse ScienceDirect

European Economic Review

journal homepage: www.elsevier.com/locate/eer

War and natural resource exploitation

Frederick van der Ploeg [a,b,*], Dominic Rohner [c]

[a] University of Oxford, OxCarre, Department of Economics, Manor Road, Oxford, OX1 3UQ, United Kingdom
[b] VU University Amsterdam, Tinbergen Institute, CEPR and CESifo
[c] University of Lausanne, Department of Economics, Quartier UNIL-Dorigny, Internef, 1015 Lausanne, Switzerland

ARTICLE INFO

Article history:
Received 13 March 2011
Accepted 5 September 2012
Available online 13 September 2012

JEL classification:
D45
D74
L71
Q34

Keywords:
Conflict
Natural resources
Voracious extraction
Private resource exploitation
Exploration investment
License fee
Rebels

ABSTRACT

We build a theoretical framework that allows for endogenous conflict behaviour (i.e., fighting efforts) and for endogenous natural resource exploitation (i.e., speed, ownership, and investments). While depletion is spread in a balanced Hotelling fashion during peace, the presence of conflict creates incentives for rapacious extraction, as this lowers the stakes of future contest. This voracious extraction depresses total oil revenue, especially if world oil demand is relatively elastic and the government's weapon advantage is weak. Some of these political distortions can be overcome by bribing rebels or by government investment in weapons. The shadow of conflict can also make less efficient nationalized oil extraction more attractive than private extraction, as insecure property rights create a holdup problem for the private firm and lead to a lower license fee. Furthermore, the government fights less intensely than the rebels under private exploitation, which leads to more government turnover. Without credible commitment to future fighting efforts, private oil depletion is only lucrative if the government's non-oil office rents are large and weaponry powerful, which guarantees the government a stronger grip on office and makes the holdup problem less severe.

1. Introduction

Natural resource abundance and exploitation fuel political unrest if different factions in society try to get control of the resource rents.[1] Natural resource wealth thus increases the potential gains of controlling political power. However, conflict also affects natural resource extraction. Political instability pushes governments to rapacious resource depletion, but also reduces the incentive of especially private oil companies to explore and extract. Conflict thus influences economic decisions with respect to the method and intensity of natural resource extraction. So far the two directions of causality have been analyzed largely independently. While the literature on conflict and rent seeking has mostly treated natural resource extraction as exogenous and has focused on explaining appropriation efforts and outcomes (e.g., Torvik, 2002; Collier and Hoeffler, 2004; Fearon, 2005; Mehlum et al., 2006; Besley and Persson, 2011; Rohner, 2011), the literature on resource economics has investigated the impact of insecure property rights on extraction rates without taking into account the effects of natural resources on fighting decisions (e.g., Tornell and Lane, 1999; van der Ploeg, 2010).

Our objective is to investigate the two-way interaction between natural resource extraction and conflict. We therefore construct what to the best of our knowledge is the first unified framework with both endogenous fighting decisions and an endogenous choice of method and intensity of extraction. This enables us to derive predictions on the relative and absolute

* Corresponding author at: University of Oxford, OxCarre, Department of Economics, Manor Road, Oxford, OX1 3UQ, United Kingdom. Tel.: +44 1865 281 285; fax: +44 1865 271 094.
E-mail addresses: rick.vanderploeg@economics.ox.ac.uk (F. van der Ploeg), dominic.rohner@unil.ch (D. Rohner).

[1] In this paper we focus on exhaustible natural resources, and in particular petrol and minerals. We will often refer to natural resources as simply oil.

0014-2921/$ - see front matter © 2012 Elsevier B.V. All rights reserved.
http://dx.doi.org/10.1016/j.euroecorev.2012.09.003

levels of fighting effort, the odds of victory, the method of and investment level in resource extraction, the speed of depletion, the size of license fees, as well as the total amounts and payoffs from extraction received by the government, rebel factions and international extraction companies.

Our analysis generates a rich set of interesting and empirically relevant predictions. The primary distortion in our setting is that the government and the rebels cannot credibly commit to a cooperative outcome with both groups renouncing fighting and committing to transfers. To address this distortion, second-best policies become optimal. First, the *speed of resource extraction* is affected. While in a first best world without political instability it would always be optimal to extract resources in a balanced way that spreads out depletion over all periods, in a world of anarchy it is optimal to engage in rapacious over-extraction in order to reduce future rents and the incentives for rebel fighting, especially if the elasticity of world demand for resources is high and the government's weapon arsenal is small.

Also the *ownership of resource production* is distorted. In a world without threat from rebellion it is optimal to sell exploitation rights of natural resources to the technically most efficient company, which typically is a big private multinational. In contrast, if rebels fight for taking over the state and in case of victory renege on the past government's oil contracts, this creates a hold-up problem for private investors. The bad property rights protection depresses their initial drilling investment, and also the licence fees that private companies are willing to pay are lower, especially if the government has bad weaponry and the spoils from office are small. This in turns makes private extraction relatively less attractive for the national government, even if on purely economic grounds private depletion by an international oil company would be the first best.

In fact, if the government can commit in advance to future fighting efforts, it can reduce the political instability's negative impact on private extraction. But if the government is bound to its exploitation contracts and treats received licence fees as sunk, it always has incentives to fight less. This time inconsistency problem of the government implies that if extraction is delegated to a private company, the government's perceived stakes of keeping power are smaller than the stakes for the rebels, as the latter aim not only to appropriate rents from office, but also to expropriate the private exploitation company. This asymmetry of stakes implies that rebels fight harder than the government under private extraction, while the stakes and fighting efforts are symmetric under nationalized depletion. Hence, we predict *government turnover* to be higher under private than under nationalized resource depletion. These results might contribute to our understanding of the trend towards nationalized oil companies and the demise of the big multinational oil enterprises (the 'Seven Sisters') despite strong empirical evidence that private international oil companies are typically much more efficient than national oil firms.[2]

Besides characterizing the optimal fighting efforts and resulting winning probabilities for the various extraction speed and ownership options, and deriving what extraction speed and method is selected in equilibrium, our paper analyses more complex oil contracts, endogenizes oil exploration and shows that social transfer policies that "bribe" the rebels to work rather than fight can reduce conflict. As discussed in detail below, our results can address various empirical puzzles.

Our paper builds on the economic literature on contests and conflict pioneered by Hirshleifer (1991a), who has established that conflict efforts are increasing in the stakes of contest and the decisiveness of conflict technology. Further, poorer or less productive groups tend to fight harder and hence can have a higher winning probability than richer or more productive groups (e.g., Hirshleifer, 1991a,b; Skaperdas, 1992). Favourite (respectively, underdog) groups with a probability of winning above (respectively, below) 1/2 will select a higher (respectively, lower) effort level if they can pre-commit and move first as Stackelberg leader compared to a simultaneous Nash Equilibrium without commitment (Dixit, 1987). Whether governments can pre-commit or not and the timing of decisions thus has a decisive influence on outcomes. With endogenous choice of the timing of moves, the underdog will always move first in equilibrium, so that there will always be under-commitment of efforts with respect to the benchmark without commitment (Baik and Shogren, 1992).[3] An excellent survey of the literature on contests is provided by Konrad (2009).

There are few theoretical papers linking natural resource exploitation and civil war. Most focus on how larger natural resource stocks increase the incentives for rent seeking and appropriation by boosting the "prize" to be appropriated (Torvik, 2002; Grossman and Mendoza, 2003; Olsson and Fors, 2004; Maxwell and Reuveny, 2005; Hodler, 2006).[4] The geographic location of resource deposits also affects conflict. For example, civil wars are more likely if resources are relatively abundant in the homelands of ethnic minorities, especially if these groups are geographically concentrated (Morelli and Rohner, 2011). Also, two countries with a shared border engage more often in inter-state war if one of them has its oil deposits close to the border and the other has no oil or deposits located far away from the border (Caselli et al., 2011).

However, none of these studies endogenizes resource extraction. Natural resource exploitation is not modeled and resources are simply treated as exogenous lump-sum rents that can be appropriated. Extraction method, ownership and speed of extraction are all abstracted from. Our main objective is to endogenize natural resource depletion in a conflict

[2] There is substantial empirical evidence that international oil companies are more efficient on a variety of indicators and yield higher returns than nationalized oil companies (Al-Obaidan and Scully, 1991; Victor, 2007; Wolf, 2009; Eller et al., 2011).

[3] Asymmetric information can also lead to asymmetric information contests (Hurley and Shogren, 1998).

[4] Fearon (2005) argues that natural resources can foster conflict by weakening state capacity. Acemoglu et al. (2012) show that price-taking firms fail to internalize the impact of their extraction on military action, which increases war incentives if resource demand is inelastic. They also link resource extraction to trade and inter-state wars. Esteban et al. (2011) argue that mass killings of unarmed civilians have a strategic component if group sizes matter for future rent sharing and that they are more likely if a large part of appropriative wealth is independent of the population size (e.g., when natural resource rents take up a large share).