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Abstract

Resource wealth induces predation incentives but also conflct-deterring third-party involvement. As a result, the relation between resource value and conflict probability is a priori unclear. This paper studies such relation with a flexible theoretical framework involving a potential predator and a powerful third party. First, we show that, if the third party's incentives to intervene are sufficiently strong, conflict probability is hump-shaped in the resource value. Second, we theoretically establish that resource value increases the third party's incentive to side with the resource-rich defendant in case of intervention, providing another mechanism for stabilization when the resource value is high. Third, we explain how our theory relates to policy-relevant case studies involving conflict-ridden areas and powerful third parties, focusing on US and Chinese foreign policies.

JEL classification: F51, Q34, D74, P48.

Keywords: conflict, resource curse, third party, oil, intervention.

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Armed conflict often revolves around the ownership of a resource, such as an oil field, a stretch of land, or access to the sea. Incentives for engaging in war depend on participants' ability to gain from it. On the one hand, high resource value invites conflict by increasing incentives to predate. On the other hand, resource wealth induces stabilizing efforts by powerful third parties interested in safeguarding access to extraction or consumption. Since an increase in resource value induces higher predation but also higher deterrence by third parties, its effect on conflict occurrence is unclear a priori. This paper sheds light on the issue, formulating a theory of resource war in the presence of third parties.

Our work contributes to the understanding of the resource curse and economically-motivated third-party interventions. First, by setting up a simple and flexible model of resource war involving a resource holder, a predator, and a powerful third party, we characterize the relation between conflict probability and resource value. Such relation is *hump-shaped* when incentives for the third party to intervene are sufficiently strong–e.g., if the third party can use the intervention to improve its bargaining position, or if the resource holder's wealth does not fully translate into military capacity against aggression. Second, we show that resource value increases third parties' incentives to form an alliance with the defendant in resource conflict, providing an additional stabilization mechanism when resource value is high. Third, specializing our model, we show that our main results hold in relevant real-world settings, such as superpowers importing resources from other countries and using them in production.

We develop a model of resource war as a sequential game. A country or government controls a scarce resource; a predator state or opposition group decides whether to attack and try to seize it. We first present a simplified version of our model, where the resource holder grants resource access to a powerful third party. A predator can decide to attack the resource holder and steal the resource, but the third party can intervene and back the defendant, securing its control over the resource. Uncertainty in the cost of war induces a probability of conflict, which depends on resource value. The predator attacks only if the probability of intervention is small enough. The probability that the third party intervenes to secure resource access increases with resource value. Further, the marginal benefit of an additional unit of value for the predator is substantial when the value is small, as intervention is unlikely; similarly, the marginal benefit for the predator is small when the value of the resource is large, because the intervention is very likely. So, an additional unit of value has the effect of increasing the probability of conflict when the value is small, and decreasing it when the value is large.

In the general version of our model, (i) we let resource wealth affect military strength, and (ii) we allow the third party to choose her ally–either the resource holder or the predator.[1,2] In case of war, the third party can ex-ante commit to side with either of the two opponents; if the chosen ally loses the war, the third party forfeits access to the resource. This modeling structure captures settings in which alliances are not easily broken and renegotiated, e.g., because of reputation costs. Such situations naturally arise when the third party shares ideological or cultural affinity with one of the opponents, as exemplified in the context of the Cold War.[3]

In this framework, two additional incentives emerge compared to the simplified model. First, higher military strength by the resource holder reduces the need for third-party intervention. Consequently, an increase in resource value creates a trade-off between increased rent and decreased intervention needs. Second, as resource value makes the resource holder comparably stronger, it increases the third party's willingness to side with it. Since the third party has an incentive to side with the stronger player and the resource holder gains strenght with the growing resource value, the third party opts to side with the resource holder when the value is high enough. As a result, the probability of conflict is hump-shaped in resource value provided that the intervention incentives are strong enough when the value is high. If the the payoff of the third party increases with resource vaue more than the relative military strength of the resource holder, the interest of the superpower to secure the resource dominates the incentive of letting the resource-holder deal with the predator alone.

We call the condition explained above "strong interest of the third party" and we show that this is easier to satisfy in the realistic scenario where the third party uses the intervention to obtain improved conditions for resource exploitation.[4] Intuitively, the improvement in bargaining terms resulting from the intervention makes it even more advantageous to support the resource holder when the resource is valuable. In addition, this condition holds true in other real-world scenarios: e.g., if royalty payments are the main revenue source for the resource holder, or if the resource-holder's military expenses grow less than proportionally with GDP.[5]

[1] For example, Collier and Hoeffler (2004) discuss the resource wealth channel as an explanation of Saudi Arabia's internal stability.

[2] Third parties can intervene in favor of challengers and not incumbents. See, for example, the discussion of the case of the Angola civil war in Bove et al. (2016), or the literature on *booty futures*, e.g., Ross (2012).

[3] Also, Chyzh and Labzina (2018) show how the incentive to keep an unprofitable alliance might arise from dynamic incentives.

[4] For example, Berger et al. (2013a) and Berger et al. (2013b) document that CIA interventions during the Cold War created a larger market for US products.

[5] Using data on military expenditure by country by SIPRI we find that the correlation between GDP and military expenses as a fraction of GDP is negative.

Our theory is also general enough to nest other mechanisms explaining a non-monotonicity in conflict probability. This can still emerge when marginal returns from the resource decrease quickly for the third party (or the third party is absent). If the resource value significantly enhances the military strength of the resource holder, and the predator experiences diminishing marginal returns from resource value fast enough, the war incentives for predator decrease for high resource value. In this way, our model nests an alternative explanation for hump-shaped conflict probability discussed in the literature, e.g., proposed by Collier and Hoeffler (2004). Intuitively, if resources increase the ability to fund the military, attacking resource holders is more challenging for predators, ultimately reducing their incentives to predate.

In Appendix A we show that the model's results remain valid under two relaxations of the main assumptions. First we consider a setting with private information on the stochastic costs of war, and show that our results hold in this case. Second, we allow the third party to choose an alliance after the conflict ends, instead of assuming that the third party can credibly commit ex-ante to an alliance in exchange for resource access. In this case, reported in Appendix A.1, the third party can get access to the resource from whichever actor wins the control of the resource ex-post, but war results in a loss of value extracted due to disruption in production or extraction. In this context, intervention is motivated by the desire to avoid production disruption, rather than by the fear of losing access as in the main text. The central intuition of the model remains unchanged, and we obtain the same results hold as long as the share of destroyed resources is sufficiently large. This alternative framework captures well situations in which alliances are mainly based on resource exploitation and war directly affects third party's rent–such as conflicts affecting oil prices, changes in ownership structure, or causing widespread destruction of capital.[6]

In spite of its simplicity, our theory applies to empirically-relevant contexts. We show that our model's assumptions hold in the context of a third party that buys the resource and uses it in production, experiencing disruptions from changes in resource ownership. Such application is relevant for understanding the effects of US oil interests in the Middle East and the impact of the recent increase in Chinese presence in mineral-exporting African countries. Further, this setting provides an accurate description of activities connected to oil extraction.

Our theoretical insights provide a compelling explanation for the seminal empirical findings in Collier and Hoeffler (1998; 2004) showing a non-monotonic relation between a country's

[6] As an example, Kilian (2009) shows how political events in the Middle East sensibly affect oil prices.

resource abundance–proxied by primary commodities exports over GDP–and probability of civil war.[7] In a companion paper, Battiston et al. (2024), we provide suggestive evidence of the discussed non-monotonicity, focusing on countries in the USA's sphere of influence. Moreover, we show that US influence in the data proxies for a higher probability of intervention in case of conflict, which may deter predator conflict in countries with large resource value.

We conceptualize the powerful third party as a "superpower" following the terminology of (Fox, 1944), and the resource holder and the predator as countries in the superpower's 'Sphere of Influence' (see Hast (2016) and Etzioni (2015)). For example, Latin America during the US Monroe Doctrine and NATO-affiliated countries during the Cold War are examples of areas in the US sphere of influence. Conversely, Eastern Bloc countries in Europe during the Cold War exemplify countries within Soviet sphere of influence. In these settings, the relevant third party in an area is unambiguously identified.

Related literature

This paper contributes to two branches of the conflict literature: the study of the resource curse in conflict and the analysis of interventions by third parties.

As we explain above, the very first works in the empirical literature using cross-country data recognized a potentially non-monotonic relation between conflict probability and resource value (Collier and Hoeffler 1998, 2004). [8] Subsequent work have empirically investigated the predation incentive, e.g., Caselli et al. (2015) show that oil fields close to country borders are more likely to cause conflicts, and analyzed empirically and theoretically for third parties to intervene to secure resource access (see Bove et al., 2016, for the case of oil).[9] However, previous research did not study the relation between predation and third-party deterrence in resource conflict.

Modelling third parties' incentive to intervene in conflict, we contribute to a literature analyzing third-party interventions, which received large interest starting from the extended deterrence literature in political science, studying how third parties can deter attacks against another actor—see Huth (1989) for a classic reference. Our simplified model of Section 1 is

[7] Collier and Hoeffler (1998) argue that such non-monotonic relation could relate to the increased ability of the resource-holding state to provide security with an increased taxable base. As we explain below, we model this channel in our general framework and show it reinforces third parties' stabilizing role.

[8] See Blattman and Miguel (2010) for a comparison between the two pioneering studies of Collier and Hoeffler (2004) and Fearon and Laitin (2003) and a comprehensive review of the literature on civil wars in political science.

[9] Paine et al. (2022) and Paine (2019), instead, theorize how economic activities such as oil extraction can lead to civil war incentives. They do not consider the effect of third party presence.

an instance of the "deterrence games" reviewed by Quackenbush (2011), where the effective players of the game are the predator and the third party. More precisely, our toy framework is a "perfect deterrence" model (Zagare and Kilgour, 2000)–a dynamic deterrence game solved for subgame perfect equilibria. Chang et al. (2007), too, studies similar games focusing on the relation between the timing of intervention and the equilibrium outcome. Our comparative statics are completely different and focus on how conflict incentives relate to resource value.[10]

We study interventions that are motivated by profits, differently from Meirowitz et al. (2022) and Kydd and Straus (2013) that analyzed 'neutral' interventions with humanitarian or welfare motivations; Levine and Modica (2018), that studies interventions to avoid another player's hegemony in a region; and Grillo and Nicolò (2022), that studies optimal third party interventions, considering military aid, sanctions, or direct military involvement.[11] The literature on 'biased' interventions has looked at their causes and consequences. Rosenberg (2020) shows that external powers can use war between the resource holder and the defendant in resource-rich areas to extract rents. Di Lonardo et al. (2019) uses a theoretical model to establish a stabilizing role of foreign threats for autocracies. Especially with our full-fledged theoretical model, we contribute to these studies by showing that the incentives to side with a particular player, the resource-holder, reinforce the stabilizing role of third parties.

We organize the rest of the paper as follows. In the next section, we illustrate a simplified version of the model to clarify the main mechanisms. In Section 2, we illustrate the full-fledged model. In Section 3, we describe how US oil interests abroad and China involvement in the Democratic Republic of Congo can be seen as an illustration of our mechanism. All proofs are in the Appendix B.

1 Simplified model and baseline result

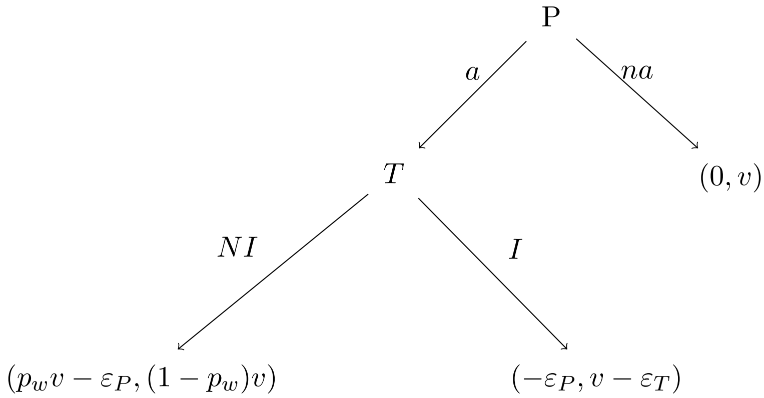
We model the interaction among three countries, R, P, and T. Country R–the resource holder–holds a scarce resource of value v; country P–the predator–can attack and try to seize control of the resource. Country T is a powerful third party interested in exploiting the natural resource.

Countries P and T engage in a sequential game. Country P can attack R and obtain control

[10] Work by de Soysa et al. (2009), instead, studies the moral hazard problem induced by the third-party intervention on the incentives for the resource holder to declare war.

[11] The distinction between neutral and biased interventions is empirically relevant. For instance, Regan (2002) documents that external intervention in civil wars often increases conflict length; however, biased interventions, backing one opponent, result in lower duration compared to neutral interventions.

Figure 1: Game tree of the simplified model



Note: At the terminal nodes are the payoffs respectively of P and T.

of the resource if it wins the confrontation. In this case, R loses control of the resource. If P decides to attack R, T can intervene and back its ally R.[12] If P attacks and there is no third-party intervention, P wins with probability p_w. In such a case, the third party loses all access to the resource, and obtains a payoff of zero.[13] If there is a third-party intervention, R wins for sure. In the general model presented in the next section, we relax the assumption that T always sides with R, and we let p_w vary with the resource value v.

We introduce a stochastic additive cost of war, ε_i for $i \in \{P, T\}$, respectively with uniform distribution on $[0, M]$, paid by contestants if conflict occurs.[14] We assume that these are independent, $\varepsilon_P \perp \varepsilon_T$. These costs are common knowledge.[15] The purpose of modeling this component is twofold. First, we aim to model war costs, including physical, financial, and political costs. Second, random war cost can represent a 'measurement error' faced by the econometrician or external observers perceiving war as a stochastic outcome. We adopt the perspective of this external observer; so, our object of study will be the probability of conflict and how it varies with parameter v.

1.1 Equilibrium

If P attacks and the third-party does not intervene, P wins with probability p_w. Then, if P attacks, the payoffs for the third party, in this case, are:

[12] T cannot be attacked and cannot attack first, for example, because of institutional and international constraints.

[13] The result would go through also if the third party loses only part of the resource in case its partner loses. Indeed, in the Appendix Theorem 2.1 is proven under this more general assumption.

[14] As we clarify in the next section, we keep the uniform assumption to ease the exposition, but all results hold under general assumptions spelled out in the Appendix.

[15] Private war costs give analogous results: details are available in section A.2.

a) $(1-p_w)v$ if T does not intervene;

b) $v-\varepsilon_T$ if T intervenes.

So, the third party wants to attack if $p_w v > \varepsilon_T$. Four possible equilibria realize, depending on the parameters:

1. if $p_w v < \varepsilon_P$, P never wants to attack and there is no war;
2. if $p_w v > \varepsilon_T$ then T would intervene in case of conflict, hence P does not attack;
3. if $p_w v > \varepsilon_P$ and $p_w v < \varepsilon_T$ then there is no intervention and P attacks;
4. if $\varepsilon_P < 0$, P always attacks.

Given the equilibria listed above, we compute the ex-ante probability that the SPE of the game involves an attack before the ε_i are drawn. This is:

$$\mathbb{P}(war; v) = \begin{cases} \frac{p_w v}{M}\left[1-\frac{p_w v}{M}\right] & v < \frac{M}{p_w} \\ 0 & \text{otherwise} \end{cases} \tag{1}$$

The expression is the sum of the terms corresponding to equilibrium (4)–the predator attacks no matter the possibility of intervention–and equilibrium (3)–the predator attacks if the cost of war for the third party is high enough to avoid intervention. The probability of war is hump-shaped in v, having a maximum in $\frac{M}{2p_w}$.

Intuitively, an increase in resource value results in a higher incentive to go to war for the predator only if the realization of the cost for the third party is sufficiently high to imply no intervention. Then, the predation effect dominates when the value is small, while the deterrence effect dominates when it is high. If the value is small, the third party will almost surely not intervene. An increase in the value will incentivize the predator to attack for many realizations of the errors; so, the predation effect dominates the deterrence. On the contrary, if the value is high, the third party will intervene almost surely; so, an increase in the resource's value will increase the incentives to attack for very few realizations of ε_P, implying that the deterrence effect dominates.

2 Full model: endogenous alliances and military strength

We now analyze the full-fledged model, generalizing payoffs from the control of the resource and relaxing two important assumptions.

We allow for the value of the natural resource to generate different profits or rents for the third party and the predator, for example the economic or political benefits arising from resource access, profits from selling the resource or the benefit of using it in the production of another good.

We define $\Pi_P(v)$ and $\Pi_T(v)$ as the payoffs from having access to a resource of value v for P and T, respectively. We do this to remain agnostic on the specific origin of these payoffs or the value index v. We assume that both $\Pi_P(v)$ and $\Pi_T(v)$ are increasing and unbounded. In addition, we assume $\Pi_P \leq \Pi_T$.[16] Namely, the economy of the predator country is not more developed than the third party, and so it cannot much more efficiently convert the resource in wealth. This is consistent with our focus on third parties that are powerful countries, at least regional powers, and hence have larger endowments of capital, know-how, and technology. All these assumptions, for instance, hold if the payoffs from the resource are constituted by a monetary rent v, with the third party earning the fraction ηv, and the player controlling the resource obtaining the fraction $(1-\eta)v$. Finally, we normalize $\Pi_i(0) = 0$. This is without loss of generality because we allow the errors ε_i to be negative and have different distributions; the threshold 0 retains no special interpretation.

We modify the structure of the previous game in two ways with respect to the previous section. First, we allow for the possibility that the third party can intervene in favor of both contenders P and R, consistently with our framework, where the third party only serves her economic interests. Resource-dependent countries have incentives to provide military support to resource holders.[17] However, third parties may side with the predator due to its higher chances of victory or honoring a previous alliance.

Second, we let the relative military strength of P and R (measured by p_w) depend on the resource value. Past literature has highlighted the role of specific natural resources, such as oil, in increasing military expenditures and arms imports–see, for instance, Ali and Abdellatif

[16]Actually, the condition we need is even weaker; we can even allow Π_P to be larger than Π_T, as long as their difference does not grow too fast. Formally, there is a constant $C > 0$ such that $\Pi_P \leq C\Pi_T$. This is what in the Appendix is called Assumption EE - "Economic efficiency of the third party": all the proofs use this more general Assumption.

[17]For instance, Bove et al. (2018) shows how oil producers are more likely to receive support.

(2015) and Vézina (2020). This interacts with the predator's incentives to attack the resource holder and the third party's incentives to intervene.

The game still has two players, the third party T and the predator P. Player T moves first and chooses to be allied with the resource holder, R, or with the predator, P. In both cases, the predator then chooses whether to attack or not. Finally, the third party decides whether to intervene or stay out. If the third party intervenes, the player it backs wins; otherwise, if it does not intervene, T retains resource access only if the ally wins, and loses all resource access if the ally loses. In the proof of the Theorem 2.1 in the Appendix, we actually allow for more generality, assuming that in case of a victory of the predator the third party still retains the capacity to extract some wealth from the natural resource, but only a fraction α of the status quo Π_T, capturing, e.g., higher royalties by the new resource owner, and renegotiation costs. The results are not affected.

Differently from the simplified model, now we assume that p_w is a decreasing function of v, to capture the fact that, as v grows, R has a larger amount of resources to devote to military investment.

Tullock-like – TL p_w is decreasing in v, differentiable, p_w' is bounded, and $p_w(0) > 0$.[18]

An example of functional form satisfying the above assumption is the Tullock contest success function (CSF), commonly used in the literature (see, for instance, Beviá and Corchón (2010) and Jackson and Morelli (2007)):

$$p_w(v) = \frac{w_P^\gamma}{w_P^\gamma + (w_R + v)^\gamma}$$

where w_P and w_R represent the baseline financial strengths of P and R, to which R can add the funds obtained through the resource.

If the third party does not intervene, it can enjoy the payoff from the resource, $\Pi_T(v)$, only if the ally wins. So, if the third party chooses to back R, it has an expected payoff $(1-p_w)\Pi_T(v)$ from not intervening; if it decides to back P, but it does not intervene in the actual conflict, the payoff is $p_w\Pi_T(v)$.

To make the exposition easier, we maintain the assumption that the costs of war are additive and stochastic ε_T and ε_P, and their distribution is uniform. All the results presented hold

[18] A way to think about the bounded derivative assumption is that R has some amount of wealth to devote to war that does not depend on v, and v can increase this wealth. Indeed, this is what happens in the Tullock CSF example in the text.

under more general, non-parametric regularity conditions, spelled out in condition RC, in the Appendix. In particular, we can allow the support to be $[m, M]$, with $M > 0$ and potentially infinite, and $m \leq 0$, allowing a player to have "preference for war". For this reason, in the equilibrium discussion below we include the case where $\varepsilon_P < 0$. The term ε_T could also implicitly capture the reputation cost of the third party not intervening when having committed to do so. The proofs use these general conditions. We are going to assume that these costs are realized after the alliance choice but before any attack decision. This follows the interpretation that the alliance decision is stable over time and potentially occurs well before the actual conflict, while the realization of the war costs may depend on political and military contingencies.

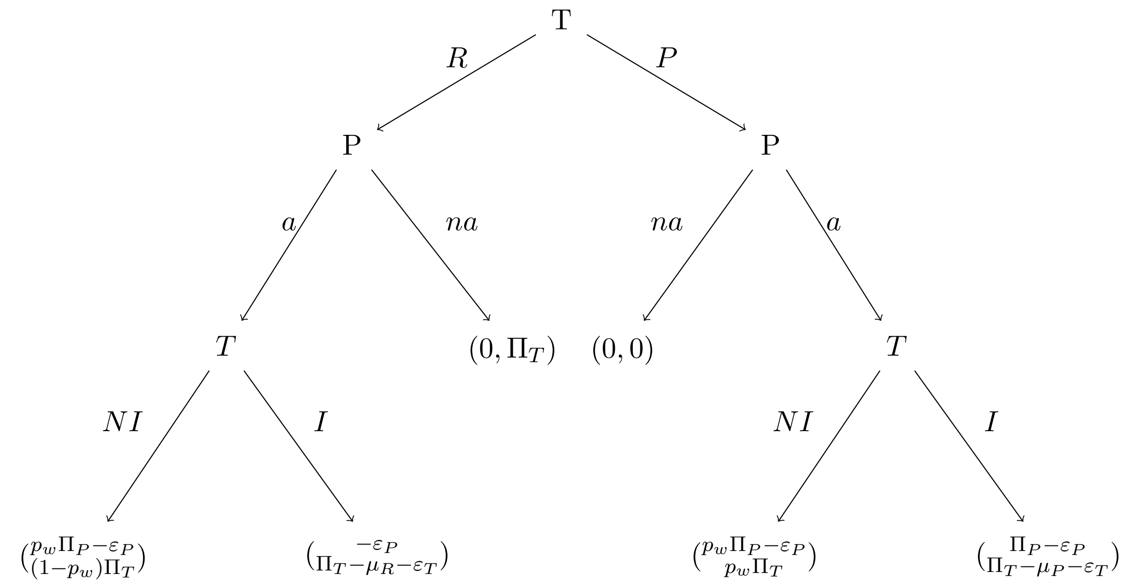
We also introduce a non-stochastic shifter of the costs of war, $\mu_R(p_w)$ if the third party is backing R and $\mu_P(p_w)$ if the third party is backing P. We think of μ_P and μ_R as incorporating, beyond the average military cost of intervention, baseline political preferences, reputation costs of changing alliance, the cost of renegotiating contracts or royalties, and the cost of changing resource ownership in terms of lost physical, human or organizational capital.[19] Given the variety of possible interpretations, we remain agnostic on the precise shape of $\mu_T(p_w)$ and $\mu_P(p_w)$. We only assume that, whatever the other effects, it is always less costly for T to intervene in favor of a stronger contender. Since the relative military strength is captured by p_w, this means that the cost of backing the resource holder μ_R increases in p_w and that the cost of backing the predator μ_P decreases in p_w. Formally:

Costs of war – CW μ_P and μ_R are differentiable, $\mu'_P < 0$, $\mu'_R > 0$.

Our model now features two ways of modeling costs of war, the deterministic cost-shifters μ_i and the random shocks ε_i; both are common knowledge at all stages of the game, driving the alliance choice and the probability of the intervention. The random shocks are realized after the alliance choice by the third party; so, they are stochastic from the perspective of the third party at the first stage. So, we can think of ε_i as material and political costs of war that may be difficult to forecast in the long run, such as the cost of military equipment or the popular support for a specific conflict. Cost-shifters μ_R and μ_P, instead, represent long-term institutional and cultural factors affecting the cost of alliances and war, such as institutional, cultural and ideological proximity to the potential ally and relative military strength of players. They incorporate the consensus for an alliance in the population; this feature is particularly

[19] The interpretation of costs as political preferences is consistent with the framework of Eguia (2019), analyzing military interventions motivated by a noxious policy in the target country.

Figure 2: Game tree of the full model



Note: At the terminal nodes are the payoffs of P and T, respectively.

relevant for democratic superpowers, such as the US, where the political process can inform T and P about trends in public opinion (Schultz, 2001). Introducing deterministic cost-shifters increases the flexibility of our modeling framework also in other ways. Our simplified modeling structure, where a single powerful third party plays a strategic role, is well-suited to model an area unambiguously inside the sphere of influence of one superpower. However, the richer framework presented in this section extends to areas where the spheres of influence of two third parties overlap, and one of the two third parties is very likely to back one of the opponents. Political preferences embedded in war cost functions incorporate this strategic interaction; the presence of a third party that is sure to intervene increases the relative strength of the two opponents, raising the cost of war for the other third party.

2.1 Equilibrium and main result

The analysis of the game proceeds by backward induction as in the previous section, keeping in mind that now the third party plays twice and so has four strategies, (R, I), (P, I), (R, NI), and (P, NI), representing alliance-intervention choices. In particular, if the third party chooses to be allied with the resource holder, after the realization of ε_T and ε_P, the ensuing subgame is identical to the model of the previous section, augmented with the cost function μ_R. Details on the equilibrium characterization are provided in the Appendix.

In case the third party chooses to be allied with the predator P, the equilibria in the subgame are as follows:

1. if $\varepsilon_P < 0$, P always attacks;
2. if $(1 - p_w)\Pi_T - \mu_P < \varepsilon_T$, then the third party does not intervene in case of conflict, so P attacks if $p_w\Pi_P > \varepsilon_P$;
3. if $(1 - p_w)\Pi_T - \mu_P > \varepsilon_T$, then the third party intervenes in favor of P in case of conflict, so P attacks whenever $\Pi_P > \varepsilon_P$.

The third party at the first stage decides whom to ally with. Two forces shape its decision. First, when the third party is allied with the resource holder, the (credible) threat of intervention is sufficient to avoid war and its costs. Second, being allied with the stronger party means that, even without intervention, the likelihood of a favorable outcome of the conflict increases. These incentives imply that when the resource is very valuable and the resource holder is stronger, the third party finds it optimal to side with it. Further, the incentive to intervene increases in resource value. Hence, when v is large, the game is similar to the baseline case where T had to back R.

When v is small, the probability of conflict is increasing in v: the third party has low incentive to intervene and the predation effect prevails. Instead, when v is large, two incentives for T are now in competition. First, the higher the resource value, the higher the incentive to intervene to secure a favorable outcome, as in the baseline model. Second, the higher the value of the resource, the higher the military capacity of the resource holder, implying that an intervention is *less* necessary. The latter effect directly follows from resource-dependent military capacity and is not present in the baseline model.

The balance of these incentives is represented by the behavior of $p_w\Pi_T$ when v is large. In the simplified model, p_w was constant; hence, this product was growing to infinity (it is sufficient that it grows larger than M, the upper bound of the support of the ε_i). Now, p_w is decreasing to 0. For the intervention effect to prevail, hence the probability of conflict to decrease for large v, the growth in the third party payoff must offset the decrease in the probability of victory of the predator. We formalize this behavior as follows.

Strong Interest of the third party – SI_T For v large enough, $p_w\Pi_T$ must be increasing, and

$$\lim_{v\to\infty} p_w\Pi_T \geq M,$$

where M is the upper bound of the support of ε_i, and can be finite or infinite.

The condition that $p_w\Pi_T$ is increasing can be re-expressed as imposing that the elasticity of Π_T is larger than the elasticity of p_w.[20] In other words, an additional unit of the resource value increases the payoff more than it decreases the probability that the predator wins. Below, we discuss when this condition is likely to be satisfied.[21]

If SI_T is not satisfied, the probability of conflict may or may not display a hump shape. Non-monotonicity could also arise *without* the third party (a special case of violation of SI_T), depending on the behavior of p_w and Π_P. Specifically, this depends on whether the analog of condition SI_T is true for the predator, namely, if $p_w\Pi_P$ grows to M or not:

Strong Interest of the predator – SI_P For v large enough, $p_w\Pi_P$ is increasing, and

$$\lim_{v\to\infty} p_w\Pi_P \geq M$$

If this is satisfied, then the spoils of war grow in value enough to offset the decreased military force of the predator, and the incentive for war, absent third-party intervention, becomes stronger the larger v. Hence, in this case, absent a third party, the probability of conflict grows in v. If instead $p_w\Pi_P$ falls for large v, the strength of the predator becomes small enough with respect to the payoff from resource ownership, creating a disincentive to attack. This effect reinforces the hump shape of the conflict probability. In this last case, if the incentive to attack for the predator decreases enough with value, the non-monotonicity could also arise in the absence of intervention (or if the intervention incentive was not strong enough, and $p_w\Pi_T$ were decreasing). One such situation is when the resource holder is very efficient at extracting surplus from its supply of resources and financing an effective army. This type of mechanism is discussed in Collier and Hoeffler (2004) in relation to the case of Saudi Arabia.

Formally, the result is the following.[22]

Theorem 2.1. *Assume TL and CW. The probability of conflict is increasing for small v.*

[20]Because:

$$(p_w\Pi_T)' = \frac{p_w\Pi_T}{v}\left(\frac{\Pi'_T v}{\Pi_T} + \frac{p'_w v}{p_w}\right) > 0$$

if and only if $\frac{\Pi'_T v}{\Pi_T} > -\frac{p'_w v}{p_w}$.

[21]In the Appendix, we explore the results of this section in the more general case in which in case of victory of the predator, the third party can retain access to a fraction α of the resource payoff $\alpha\Pi_T$, rather than losing all access, as we assume in the main text.

[22]Here and in the following we say that a property holds 'for small v' to mean that there exist a threshold v_* such that the property holds for all $v < v_*$, and similarly 'for high v' to mean that there exist a threshold v^* such that the property holds for all $v > v^*$.

If SI_T holds, then the probability of conflict is decreasing for large v.

If SI_T does not hold (e.g., if the third party is absent), then the probability of conflict is decreasing for large v only if SI_P is not satisfied.

In other words, our model's empirical prediction is that a non-monotonic relation between conflict probability and resource value can emerge regardless of third-party presence, but third-party presence makes it more likely. In our empirical section, we (i) provide indirect evidence for the assumption SI_T in presence of US influence, and (ii) we provide evidence that assumption SI_P is satisfied, when measuring military strength with military expenditure.

2.2 When is the Strong Interest condition satisfied?

Condition SI_T states that the growth in the third party payoff offsets the decrease in the probability of victory of the predator. In this section, we outline some examples that clarify when we should expect so.

Example 2.1 (**Third party improving its bargaining position after the intervention**). A natural extension of our model is to allow the bargaining position of the third-party to improve if it intervenes. The literature on third-party interventions draws a connection between intervention by third parties and a better ability to extract surplus from the party in conflict they defend, both theoretically (Di Lonardo et al., 2019; Rosenberg, 2020), and empirically (Berger et al., 2013a).[23] We can capture such effect in reduced form by assuming that, if the intervention takes place, the payoff of the third party becomes $(1 + \beta_T)\Pi_T$ and the predator's payoff–when the third party backs the predator–becomes $(1 - \beta_P)\Pi_P$ with $\beta_T, \beta_P \in (0, 1)$.[24]

In this situation, condition SI_T requires that $(\beta_T + p_w)\Pi_T$ grows larger than a constant at the limit. So, if $\beta_T > 0$, SI_T is easier to satisfy. Intuitively, in this case, the improvement in bargaining terms after the intervention counterbalances the increase in power of the resourece-holder. For a formal proof, see the Proposition B.1 in the Appendix.

Example 2.2 (**Third party finances military expenses of the resource holder**). We can conjecture that, in many real world settings, there is a direct connection between third

[23] For instance, the latter shows that after CIA interventions helped USA obtain better trade conditions from targeted countries.

[24] For instance, this situation emerges when the profit from exploitation of the resource is Π, a fraction η goes to the current party controlling the resource as a royalty, and after intervention the third party is able to obtain a better split of surplus $\eta' < \eta$. In this case, if the third party is allied with the predator, after the predator successfully seizes the resource without intervention, the payoffs are $\Pi_T = \eta\Pi$ and $\Pi_P = (1 - \eta)\Pi$. If, instead, the third-party intervenes in favor of the predator, the payoffs are $\Pi_T = \eta'\Pi$ and $\Pi_P = (1 - \eta')\Pi$, so that $\beta_T = \beta_P = \eta - \eta'$.

party resource profits and the resource-holder's military strength, especially when revenues from exporting the resource make a large fraction of the resource-holder's budget. Indeed, Snider (1984) and Bove et al. (2016) provide evidence that arms trade is used to offset the cost of importing the resource.

Suppose, for instance, that the revenues from the sale of the resource are Π, and the resource holder can obtain a fraction η as a royalty. Third party's payoffs are now given by $\Pi_T = (1-\eta)\Pi$, $\Pi_R = \eta\Pi$. Further, assume that p_w has a functional form as described above, with $\gamma < 1$. Then:

$$p_w \Pi_T = \frac{w_P^\gamma}{w_P^\gamma + (\eta\Pi)^\gamma}(1-\eta)\Pi,$$

which is increasing, verifying SI_T. Intuitively, the military strength of the resource holder is now connected to the benefit the third party has from the resource; then, it cannot grow indefinitely.

Example 2.3 (**Resource-holder military expenses as a decreasing fraction of wealth**). In the general formulation expressed above, resource value can fully translate in military power. In reality, military power returns to resource-holder's resource wealth may be decreasing.[25] For instance, consider the setting of the previous example, where the wealth of the resource holder was a fraction of the profit. Assume that the amount of wealth allocated to military expenses is $f(\eta\Pi)$, with f concave. Condition SI_T is now satisfied more easily, as:

$$(p_w \Pi_T)' = p_w(1-\eta)\Pi' \left(1 - \gamma f' p_w\right),$$

and by concavity if v is large enough $f' < 1$. So depending on f SI_T is satisfied for a larger set of values of γ.

3 Third party as resource buyers: US and oil, China and cobalt

The strategic interest of preserving access to resources used in production, particularly for hydrocarbons, was proposed as a driver of the foreign policy of several high-income economies, e.g., the US involvement in the Middle East, and the Italian and French presence in Libya and Algeria (Grigas, 2018; Prontera, 2018).[26] In this section, we discuss two cases of third-party

[25]Using data on military expenditure by country by SIPRI we find that the correlation between GDP and military expenses as a fraction of GDP is negative.

[26]A Politico article covering the recent French foreign policy in North Africa can be consulted at `https://archive.md/IzOQ5`.

involvement likely deterring resource conflict. In both cases, we deal with third parties buying a resource and using it in production. We first discuss the case of US involvement in oil-reach areas. Second, we analyze the role of cobalt for Chinese interests in the Democratic Republic of Congo, and its consequences on resource conflict. Finally, we provide a simple formalization of this cases, naturally fitting our general model.

3.1 Oil interests and US foreign policy

Hydrocarbon dependence has been discussed as a key determinant of US foreign policy (Jones, 2012; Little, 2008). The US was a net oil importer throughout the second half of the 20^{th} century (EIA, 2021), and it has intervened directly or indirectly in a number of oil-rich countries over the years, such as Guatemala, Indonesia, and Angola, where civil conflict potentially threatened the interest of US oil companies such as Chevron (Bove et al., 2016). However, US involvement in the Middle East is probably the case where US foreign policy is more often linked to oil-import dependence.

Access to oil resources was a key driver of US involvement in the Middle-East during WWII, when the US started to gradually substitute the British as the main protector of the Saud's interests (Rubin, 1979). Since then, stability of the Middle East and its resource wealth played a central role in defining US international relations in the region (Jones, 2012), culminating in the Carter Doctrine–the commitment by President Carter to the use of force against any "attempt by any outside force to gain control of the Persian Gulf region" expressed during the State of the Union in 1980. While such commitment arose from the intention to deter Soviet expansion in the Middle-East around the USSR's invasion of Afghanistan, the US kept its commitment in 1990, during the first Gulf War, intervening to defend oil-rich Kuwait–a strategic partner–from the invasion by Iraq. Saddam Hussein's choice to invade aimed to preserve market power in the face of high oil extraction by Kuwait (Gause III, 2002), during a severe economic crisis that made resource wealth especially attractive (Chaudhry, 1991), and it caused a spike in the market price of oil.

In addition to increasing cost of US oil imports, the invasion represented a potential security threat to Saudi Arabia, by then a long-standing US partner (Gause III, 2009; Metz, 1993). Such relation facilitated the intervention–the deployment of US troops could exploit Saudi ports and airfields (Freedman and Karsh, 1991). Incidentally, this and the use of US military bases across the Middle East to enforce the Carter doctrine (Gause III, 2009) motivate one of our main measures of US influence, military personnel in a country or its neighboring region. Most importantly, US strategic interests may have contributed to Saudi Arabia experiencing relatively low levels of conflict, despite having access to large oil reserves.

3.2 Chinese interests in Cobalt in the DRC

In this section, we discuss how similar mechanisms may be at work in the context of mineral extraction of cobalt Democratic Republic of Congo (DRC) and its potential impact on the extraction area.

Cobalt ore is a key input in the production of lithium-ion batteries, used in smartphones, laptops and tables. The mass adoption of electronic devices in the last years (Pew, 2016) has caused global production to quadruple between 1995 and 2020 (Gulley, 2022), with the DRC single-handendly exporting 86% of the world trade volume in 2019. On the demand side, China imports 69% of the total (Simoes and Hidalgo, 2023) and uses it in the production of technological products. Mineral interests render the DRC a strategic partner for the Chinese government and economy, and the China-DRC relation has resulted in the 2008 agreement that established Sicomines, a joint venture between Chinese firms and the government, granting Chinese access to Congolese minerals in exchange for public infrastructure.[27]

Despite the large increase in value, cobalt-rich areas in the region of Katanga, in the South of the DRC, have not suffered extensive conflicts in the time span in which cobalt value increased, differently from mineral-rich areas in the East of the country. While an explicit test of resource-induced third-party deterrence is not possible in this case, anecdotal evidence suggest that Chinese involvment had role in stabilizing the area. China has been directly involved in the financing and training of the armed forces of DRC, the FARDC (Clément, 2009), and supported their reform (Baaz and Stern, 2017), contributing to the construction of new FARDC Headquarters, and the acquisition of individual equipment, weapons, and ammunition (Buda and Szunomár, 2022).[28,29] Also, Chinese firms made the extensive use of Private Security Companies (PSC) to avoid looting and disruptions of their operations–even though use of PSCs have caused concern as a covert form of military presence.[30,31]

It is also instructive to compare cobalt and coltan. Coltan is another key mineral for the

[27] New investments have also been announced recently as reported by Reuters `https://archive.is/nt4Kn`.
[28] See also the following report from Oxfam `https://archive.is/a952J`.
[29] See also `https://archive.is/lvmRW`.
[30] See `https://archive.is/1AulJ`.
[31] See `https://archive.is/4i1YV` and `http://archive.is/O2MKj`.

production of electronic devices, present in DRC and extensively imported by China. Differently from cobalt, coltan is listed among the "conflict minerals" defined by the Dodd-Frank act. The price of its main product, tantalum, exploded in 2000, with a average price up 647% compared to 1999 price.[32] DRC became a main exporter of coltan and the sudden price increase led to the so-called "coltan fever," during which many local communities and farmers in DRC turned to artisanal mining of the now precious metal. The sudden increase in the price arguably induced an outburst in violence (Usanov et al., 2013) during the Second Congo War (1998-2003) (König et al., 2017), with different factions fighting to obtain control over mining areas.[33] Since 2014, coltan has contributed to an increase in violence and fatalities in the East of the country.[34] While DRC is the major producer also in this case, based on USGS data the production of tantalum is less concentrated in the country, allowing coltan producers like China to diversify its suppliers and arguably rendering the DRC extraction sites less strategic for its economy. In 2019, China obtained obtains 97% of its cobalt ore imports from the DRC in 2019, but only 16.5% of its tantalum, vandadium, and niobium ores (Simoes and Hidalgo, 2023). Differential levels of violence in coltan-rich and cobalt-rich areas depend on several factors and cannot be explained by Chinese interests alone. Nonetheless, our theory suggests that Chinese presence does not contribute to close the gap.

To sum up, China in the DRC acts as the powerful third party of our model, adopting various strategies to discourage violence in resource-rich areas and supporting the resource holder in exchange for economic advantage from the valuable input extraction.

Conclusions

An extensive literature in economics and international relations has analyzed the resource curse of conflict, studying whether and how resource presence in an area induces conflict incentives. Resources controlled by a state actor or group can represent a honey pot, potentially prompting predation by other countries or parties. However, predation incentives are not enough to make for an increasing relation between resource abundance and conflict. In fact, this relation can be decreasing if we introduce conflict-stabilizing third parties in the analysis.

In this work, we develop a simple sequential game that considers third-party involvement

[32]The figure was obtained from USGS data.

[33]See, for instance the reports at `https://archive.ph/wip/RYtK0` and `https://archive.ph/U1Kwd`.

[34]Find a report by the US Governmenst Accountability Office at `https://archive.is/w3QAb` and an article by RFI at `https://archive.is/TqH9P`.

in describing the relationship between conflicts and resource value, showing that third-party involvement creates a non-monotonic relationship between resource value and the probability of war. Our model also allows us to analyze the effects of resource value on alliance formation between profit-maximizing powerful third parties and resource-rich countries. We find that the ability of third parties to select their ally reinforces the stabilizing role of superpowers, strengthening our main result. Resource presence increases resource holders' military strength and the third party's incentive to side with them in conflict, further discouraging predator intervention.

Our results may provide an explanation for seemingly inconsistent results in the literature about the effect of resources on conflict, with some works finding an empirical association between conflict and resource presence (see, e.g., Collier and Hoeffler, 2004; Caselli et al., 2015) and others finding no relation (see, e.g., Fearon, 2005; Brunnschweiler and Bulte, 2009).

Our results on the relation among resource value, third-party influence, and conflict are particularly relevant given the fast pace of technological and environmental changes. In the last years, portable devices, such as smartphones, have become widespread globally; demand for lithium-ion batteries' raw materials, such as cobalt ore, has surged as a consequence. Such changes in global demand for minerals have likely shifted the incentives of engaging in conflict to control extraction areas. In addition, they probably induced third-party involvement in new resource-rich regions by advanced economies producing portable devices or intermediate products. At the same time, in high-income countries, challenges raised by climate change have induced divestment of carbon-emitting technologies and investment in renewable energy. While the long-run consequences of this process are hard to grasp at the moment, demand for fossil fuels–and their price–will likely decrease in the future. Given the concentration of hydrocarbon extraction in the Middle East, this may impact the area's stability through predation incentives and stabilization incentives for third parties currently interested in oil price stability.

Our framework can be extended in many directions, to study the causes and consequences of third-party interventions. First, in our framework, third parties decide on alliances and interventions based on resource presence, taking as given their 'Sphere of Influence.' Future research could investigate how third parties decide on their involvement in the first place. On the one hand, geographical proximity, and cultural and ideological ties–e.g., during the Cold War–historically shaped incentives for third-party involvement. On the other hand, reliance on natural resources and their geographical concentration in some areas might make some alliance schemes more stable in the long term. Our model provides a valuable starting point to try and rationalize the formation of spheres of influence of different superpowers.

Second, in our theoretical framework, we study the relationship between resource presence and conflict, holding fixed the resource holder's ability to extract and sell the resource. Endogenizing investment in resource exploitation by third parties provides an interesting avenue for further research. In our static framework, a value-enhancing technological transfer or human capital by the third party would increase its incentive to side with the resource holder, reinforcing our main theoretical mechanism. A dynamic framework may provide other more interesting implications of this case, relevant in settings like cobalt exploitation in the DRC, where extraction is often directly performed by Chinese firms, or by joint ventures.

Finally, as we notice in the introduction, powerful third parties can act as enforcers of property rights at the international level. The overall normative implications of resource-induced third-party influence depend on the trade-offs between the benefits of property rights enforcement and the cost of dependence and third-party reource rents. Nonetheless, our results suggest that third parties are key mediators of the resource curse in conflict.

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Appendix

A Additional theoretical results

A.1 Intervention motivated by avoiding production disruptions

In this section, we explore a variant of the model in which the third party does not form a stable alliance with one of the contenders, but can costlessly form a trade relationship with whichever among the predator and the resource owner is the winner of the war. Hence, intervention cannot be motivated by the loss of access to the resource. Instead, we are going to assume that war without intervention entails a higher risk of destruction of natural resource (or capital and infrastructure needed for extraction), unless the third party intervenes, quickly resolving conflict. The goal of this section is to show that the main result carries through also in such an alternative setting.

Formally, we assume that, if there is no intervention, the payoff of the third party is $\alpha(p_w)\Pi_T$, where $1 - \alpha \in [0, 1)$ represents the fraction of resource lost in conflict. The simplest case is in which this fraction is constant but, consistently with allowing variation in military strength, we allow α to depend on p_w, to reflect the fact that the balance of forces may affect the amount of destruction due to war.[35] If α is constant or decreasing in p_w, that is a stronger predator means (weakly) higher destruction, the probability of conflict is decreasing for large v because the increase in resource increases also the destruction, thus increasing the incentives to intervene. In general, though, we might expect α to have different shapes, for example could be u-shaped: there exist a p^* such that α is decreasing for $p < p^*$ and is increasing for $p > p^*$. This corresponds to a case in which the highest destruction appears for a relatively balanced conflict. If this is the case (or, more in general, if α is increasing for small p_w) the result still holds if $\alpha(0) < 1$, that is there is some destruction even if the predator is very weak. The intuition is that, in this case, even if destruction decreases as v grows, because the predator is weaker, it does not decrease enough to offset intervention incentives. If $\alpha(0) = 1$ instead, our result carries through, provided condition SI_T holds: namely, if the destruction becomes null when v is large enough, whether the third party has enough incentive to intervene or not depends on the strong interest condition, as in the main text. We are going to assume that α is differentiable and its derivative

[35] We can of course expect some fraction of resource to be lost in conflict even with intervention. If we define this baseline rate of loss ζ and the fraction of resource lost without intervention as $\zeta\alpha$, all the results follow through. We set $\zeta = 1$ in the main text for simplicity.

is bounded.

The timing of the game is as follows:

1. the predator decides if to attack or not;

2. the third party decides if to intervene in favor of the predator (I_P), intervene in favor of the resource holder (I_R), or not intervene.

Moreover, we are going to add some structure to the costs of war:

Costs of war 1 – CW1 μ_P and μ_R are differentiable, bounded, $\mu'_P \leq 0$, $\mu'_R \geq 0$. Moreover:

1. if P wins for sure intervention in favor of P is less costly: $\mu_P(1) < \mu_R(1)$;

2. if R wins for sure intervention in favor of R is less costly: $\mu_P(0) > \mu_R(0)$.

The assumption above has the consequence that $\mu_P - \mu_R$ is monotonic, so there are no multiple regions with changes of alliance; the increase of p has the unambiguous effect of making it more convenient to support P. Note that the case in which both are constant (or even zero, as in the simplified model) is a special case of the above assumption.

If P does not attack, the intervention choice is immaterial. Instead, if P attacks, different equilibria emerge based on the value of v. Under the above assumptions, if v is high enough, so that p_w is close enough to 0, T intervenes in favor of the resource holder R. This is because if p_w is small enough, by the above assumption, $\mu_P > \mu_R$. The behavior when v is close to 0 instead depends on the relative military investments of R and P absent the natural resource, that is $p_w(0)$. If $p_w(0)$ is sufficiently close to 1, we have that $\mu_R(p_w(0)) > \mu_P(p_w(0))$; so, for small v, the intervention might be in favor of P, otherwise it is always in favor of R.

All the other assumptions on payoffs and error terms are as in the previous section.

The key mechanism is that the preferred ally of the third party in case of intervention is still given by the relative size of μ_P and μ_R, that means that it is still the case that intervention is in favor of P for v small, and in favor of R for v large. If v is small, there is no intervention regardless of the shape of α. If v is large, the shape of α matters: if asymmetry is destructive then as the resource holder grows powerful this might trigger more intervention, and less conflict via deterrence. If asymmetry is not destructive, as the resource holder grows powerful the incentive to intervene decreases and it has to be balanced with the increase in value, in a way very similar to what discussed in the previous section. The proof is in Appendix Section B.

Proposition A.1. *Assume $CW1$. The probability of conflict is increasing for small v.*

If $\alpha' < 0$ for small p_w, or $\alpha(0) < 1$, then the probability of conflict is decreasing for large v. If $\alpha(0) = 1$ and $\alpha' > 0$ for large p_w, then the probability of conflict is decreasing for large v if and only if SI_T is satisfied.

A.2 Private information on war costs

In this section, we explore the robustness of our baseline result if the costs ε_i are players' private information. This captures the idea that the different parties may not be able to perfectly observe each other's military capacity, internal consensus, and other factors that might contribute to the war cost. This different assumption also provides a context in which there is intervention on the equilibrium path.

We stick to the simplified model of Section 1 for the strategic structure, namely we consider the alliance between the powerful third party and the resource holder fixed. However, we consider general functional forms for the payoffs Π_T and Π_P satisfying the Assumptions AI, RC and EE detailed in B. For simplicity, now assume $\varepsilon_P > 0$, and $M < \infty$.

The game formally becomes a dynamic bayesian game. We look for the Perfect Bayesian Equilibrium; this is a simple task in this context because the cost of P does not affect the payoffs of T directly. Hence, the decision of T will depend only on the attack choice. Therefore, we can neglect beliefs of T about the cost–players do not need to do bayesian updating.

Now, we can closely mimic the analysis done for the baseline, and the results go through. The intuition is a close analog to the baseline, the difference being that now P takes into account the expected probability of an intervention rather than the intervention itself. As in the baseline, if the value is small, the third party almost surely will not intervene. Hence, an increase in the value will incentivize the predator to attack for many realizations of ε_P, so that the predation effect dominates the deterrence. If the value is high, the third party will almost surely intervene, so an increase in the value of the resource will increase the incentives to attack for very few realizations of ε_P, so the deterrence effect dominates.

Formally, we can state the following proposition, with proof in Appendix Section B.

Proposition A.2. *In the model with asymmetric information, the probability of conflict is increasing for small v and decreasing for high v.*

A.3 Theoretical representation of the examples in Section 3

Think about the usual players in the model as representative agents of the respective economies. For simplicity, we assume that the third party T has no endowment of the resource, and its firms need to buy it on the market to produce consumption goods. In particular, the third party behaves as a representative neoclassical firm and it maximizes the following profit function:

$$\pi_T = \Omega_T g_T^{\alpha} - p g_T, \tag{2}$$

where Ω denotes the resource-specific productivity, g is the amount of resource bought, and p is the market price of the resource.

The value of the resource is determined on the competitive international market. Also, we assume that T is the only buyer of the resource to avoid useless algebraic complications. The owner of the resource P or R sells the resource to T. In addition, there is an international supply R_M from the market. The profits coming from the ownership of the resource for players P and R are:

$$\pi_i = pR_i, \tag{3}$$

where R_i is the amount of resource sold by i.

Extraction operations and trade are negatively affected by a war. Then, conflict results in a higher price for the resource: if a war occurs, production drops by a fraction η. Hence, the third party stands to lose from the war in two ways: the quantity available is smaller, and the price will be higher due to the supply-side shock. Through this channel, the third party has a clear interest in maintaining peace since higher prices hurt its economy.

We define a market equilibrium of this model as a price-quantity vector $(p^*, g_T^*, g_R^*, g_M^*)$. Any player is choosing the resource amount g^* optimally given price p^* and such that the market-clearing condition $g_T = g_M + g_R$ is satisfied.

In this context, if we interpret the amount of resource owned by the resource holder as the value parameter, $R_R = v$, the model described here is an instance of the model described in 2.1. In particular, solving for the market equilibrium, the payoff from resource access for the predator and the resource holder are:

$$\Pi_P(R_R) = \frac{\alpha\Omega}{(R_M + \eta R_R)^{1-\alpha}}\eta R_R$$
$$\Pi_T(R_R) = (1-\alpha)\Omega\left((R_M + R_R)^\alpha - (R_M + \eta R_R)^\alpha\right) \quad (4)$$

So, we can now map this model to the model of the previous sections and state the following Corollary, whose derivation is detailed in the appendix.

Corollary 1. If the payoffs Π_P and Π_T are as in 4, by Proposition 2, the probability of conflict is hump-shaped under the simplified model.

If, moreover, the probability of victory of the predator is given by a Tullock CSF with parameter $\gamma < \alpha$, then also SI_T is satisfied, and by Theorem 2.1 the probability of conflict is hump-shaped also under the full model.

B Proofs

For an orderly exposition of the proofs, we sum up here the assumptions that are used in the proofs.

Aligned Interests - AI Π_T and Π_P are both increasing in v, and they can become high enough to offset any cost of war, namely

$$\lim_{v\to\infty} \Pi_P = \lim_{v\to\infty} \Pi_T = +\infty$$

Furthermore, we use the normalization $\Pi_T(0) = \Pi_P(0)$.[36]

Economic efficiency of the third party - EE the rents extracted by the predator are not too large with respect to the rents extracted by the third party: there is a constant $C > 0$ such that $\Pi_P \leq C\Pi_T$.

Similarly, the general regularity conditions under which our results hold are as follows.

Regularity conditions - RC Assume that payoffs Π_T and Π_P are differentiable, and that the limit $\lim_{v\to\infty} \Pi'_T/\Pi'_P$ exists. Moreover, assume that the densities are positive in the

[36]This is without loss of generality: the payoffs are meant to capture the payoffs obtained *from the exploitation of the resource*, hence without the resource they are zero.

interior of the support, that is $f_i(x) > 0$ for any $x \in (m, M)$. Assume also that the following holds:

1. if $\lim_{x\to M} f_T(x) = 0$ (as has to be if, e.g., $M = \infty$), there is a left neighborhood of M such that $x^2 f_T(x)$ is strictly decreasing and $\lim_{x\to M} x f_P = 0$
2. if $m = 0$ and $\lim_{x\to m} f_P(x) = 0$, there is a right neighborhood of m such that f_P is strictly increasing and $\lim_{x\to m} x f_T = 0$

Condition *RC* is general enough to be satisfied by many commonly used probability distributions on the positive reals, such as the gamma, the chi-squared, the lognormal, and any standard distribution on the whole real line restricted to $[m, M)$.

B.1 Proofs of Section 2.1

We are going to need the following Lemma.

Lemma B.1. *Under assumptions AI, and EE,* $\lim_{v\to\infty} \frac{\Pi'_P}{\Pi'_T} \le C$

Proof. By assumption AI we have $\lim_{v\to\infty} \frac{\Pi_P}{\Pi_T} = \frac{\infty}{\infty}$. By Assumption RC the limit $\lim_{v\to\infty} \frac{\Pi'_P}{\Pi'_T}$ exists, and so by De l'Hôpital's theorem, $\lim_{v\to\infty} \frac{\Pi_P}{\Pi_T} = \lim_{v\to\infty} \frac{\Pi'_P}{\Pi'_T}$, and by Assumption EE the former is less that C, which gives our thesis.

□

Proof of Theorem 2.1

Generalized Strong Interest condition We prove the theorem under the more general assumptions that the third party, after non-intervention and a victory of the predator, can still earn a fraction of the profits from the resource, $\alpha\Pi_T$, with $\alpha \in (0, 1]$. Moreover, after intervention, the third party earns an additional $\beta_T\Pi_T$, with $\beta_T \ge 0$, representing (eventual) improved bargaining terms. The strong interest condition in such a case becomes the condition that $((1-\alpha)p_w + \beta_T)\Pi_T$ is increasing and its limit is larger than M. Such condition is very similar to the condition in the main text, but for the factor $1-\alpha$ in front of p_w. For $\alpha = 1$, the condition is easier to satisfie than the condition in the main text; for $\alpha < 1$, none of the condition imply the other, in general. However, the discussion in the main text of the cases in which it is likely to hold still applies.

Hence, in this proof we refer to the Strong Interest condition as:

(Generalized) Strong Interest of the third party for v large enough $((1-\alpha)p_w+\beta_T)\Pi_T$ is increasing, and $\lim_{v\to\infty}((1-\alpha)p_w+\beta_T)\Pi_T \geq M$.

Expected payoffs and probability of conflict The expected payoff from non-intervention in this case becomes $p_w\alpha\Pi_T+(1-p_w)\Pi_T=(1-(1-\alpha)p_w)\Pi_T$. The equilibrium in the subgame following the alliance with R is:

1. if $\varepsilon_P<0$, P always attacks;
2. if $p_w\Pi_P(v)<\varepsilon_P$, P never wants to attack and there is no war;
3. if $((1-\alpha)p_w+\beta_T)\Pi_T(v)-\mu_R>\varepsilon_T$ then T would intervene in case of conflict, hence P does not attack unless $\varepsilon_P<0$;
4. if $p_w\Pi_P(v)>\varepsilon_P$ and $((1-\alpha)p_w+\beta_T)\Pi_T(v)-\mu_R<\varepsilon_T$ then there is no intervention and P attacks.

In this case, the probability of conflict is:

$$\begin{aligned}P^R(war)=&P(\{\varepsilon_P\leq 0\}\cup\{0<\varepsilon_P\leq p_w\Pi_P,\,\varepsilon_T<(p_w+\beta_T)\Pi_T-\mu_R\})=\\&F_P(0)+(F_P(p_w\Pi_P)-F_P(0))(1-F_T^R)\end{aligned}$$

where $F_T^R\coloneqq F_T(((1-\alpha)p_w+\beta_T)\Pi_T-\mu_R)$.

The equilibrium in the subgame following the alliance with P is in the main text, and the probability of conflict is:

$$\begin{aligned}P(war)^P&=P(\{\varepsilon_P<0\}\cup\{0\leq\varepsilon_P<p_w\Pi_P,\,\varepsilon_T>(1+\beta_T-p_w)\Pi_T-\mu_P\}\\&\quad\cup\{0\leq\varepsilon_P<\Pi_P,\,\varepsilon_T\leq(1+\beta_T-p_w)\Pi_T-\mu_P\})\\&=F_P(0)+(F_P(p_w\Pi_P)-F_P(0))(1-F_T^P)+F_T^P(F_P((1-\beta_P)\Pi_P)-F_P(p_w(1-\beta_P)\Pi_P))\end{aligned}$$

where $F_T^P\coloneqq F_T((1+\beta_T-p_w)\Pi_T-\mu_P)$.

The expected payoff of T from choosing to be allied with R is:

$$P^R(war)(1-(1-\alpha)p_w)\Pi_T+(1-P^R(war))\Pi_T=(1-(1-\alpha)p_w(F_P(0)+(F_P^P-F_P(0))(1-F_T^R)))\Pi_T$$

the expected payoff from choosing to be allied with P is:

$$(1-F_T^P)F_P^P p_w \Pi_T + (F_P(\Pi_P) - F_P^P)\left(F_T^P((1+\beta_T)\Pi_T - \mu_P) - \int^{(1+\beta_T - p_w)\Pi_T - \mu_P} \varepsilon_T \mathrm{d}F(\varepsilon_T)\right)$$

where $F_P^P \coloneqq F_P(p_w(1-\beta_P)\Pi_P)$, F_T^P and F_T^R have been defined in the text.

Hence, the third party chooses to be allied with R if and only if:

$$\begin{aligned}&(1-p_w F_P(1-F_T^R))\Pi_T > (1-F_T^P)F_P p_w \Pi_T + \\ &(F_P(\Pi_P) - F_P)\left(F_T^P((1+\beta_T)\Pi_T - \mu_P) - \int^{(1-p_w)\Pi_T - \mu_P} \varepsilon_T \mathrm{d}F(\varepsilon_T)\right)\end{aligned}$$

Case 1: v large Define $E^P = \int^{(1+\beta_T - p_w)\Pi_T - \mu_P} \varepsilon_T \mathrm{d}F(\varepsilon_T)$. If $v \to \infty$ the condition above is satisfied if and only if:

$$((1-pF_P(1-F_T^R)) - (1-F_T^P)F_P p - (F_P(\Pi_P) - F_P)F_T^P)\Pi_T + \Delta F_P(\mu_P + E^P) > 0$$

As $v \to \infty$, $p_w \to 0$. Moreover, by the strong interest assumption, $E^P \to \mathbb{E}\varepsilon_P > 0$. We have two cases. If $\Delta F_P \to 0$, then the expression above is asymptotically equivalent to $\Pi_T + \Delta F_P(\mu_P + E^P)$, and is positive. If instead $\Delta F_P \to \ell > 0$, then the expression above is asymptotically equivalent to $(1-\ell)\Pi_T + \ell(\mu_P + E^P)$, still positive. Hence, for v large, the third party supports the resource holder.

Hence, the probability of conflict for v large is:

$$P^R(war) = F_P(0) + (F_P - F_P(0))(1-F_T^R)$$

and the derivative is:

$$f_P(p_w'\Pi_P + p_w\Pi_P)(1-F_T^R) - f_T((1-\alpha)p_w'\Pi_T + ((1-\alpha)p_w + \beta_T)\Pi_T' - \mu_R' p_w')(F_P - F_P(0))$$

where as in the previous sections we omitted the argument of the densities f_P and f_T. Using the Lemma B.1, this is smaller than:

$$(f_P(1-F_T^R) - f_T(1-\alpha)(F_P - F_P(0)))(p_w'\Pi_T + p_w\Pi_T') + f_T(-\beta_T\Pi_T' + \mu_R' p_w')(F_P - F_P(0))$$

Now $\mu'_R p'_w < 0$. Moreover, if $(p_w + \beta_T)\Pi_T$ goes to M, then $F_T^R \to 1$. So if $f_T(M) > 0$, the remaining term is minus the derivative of $(p_w + \beta_T)\Pi_T$: if SI_T holds, this is negative. If instead $f_T(M) \to 0$, then the function $G(x) := 1 - F_T^R(1/x)$ has a Taylor approximation:

$$G(x) - G(0) \sim G'(x)x =$$

that is:

$$1 - F_T^R(1/x) \sim f_T(1/x)(1/x^2)x$$

so

$$1 - F_T^R \sim f_T((p_w + \beta_T)\Pi_T - \mu_R)$$

So the derivative above is smaller than:

$$f_T((f_P((p_w+\beta_T)\Pi_T-\mu_R)-(1-\alpha)(F_P-F_P(0)))(p'_w\Pi_T+p_w\Pi'_T)+f_T(-\beta_T\Pi'_T+\mu'_R p'_w)(F_P-F_P(0))$$

$$= f_T((f_P(p_w+\beta_T)-(1-\alpha)(F_P-F_P(0))p'_w-\beta_T(F_P-F_P(0)))\Pi_T-(1-\alpha)p_w\Pi'_T-\mu_R+\mu'_R p'_w(F_P-F_P(0)))$$

the coefficient of Π_T converges to $-\beta_T$, and so also in this case the derivative is negative.

Case 2: v **small** If $v \to 0$ instead, if the choice is R, if $f_P(0) > 0$, the only part surviving in the derivative is $f_P p_w \Pi'_P$, and is positive. If instead $f_P(0) \to 0$, use the fact that asymptotically $F_P - F_P(0) \sim f_P p_w \Pi_P$ and obtain that the derivative is asymtptically equivalent to:

$$f_P\left[(p'_w\Pi_P + p_w\Pi_P)(1 - F_T^R) - f_T((1-\alpha)p'_w\Pi_T + ((1-\alpha)p_w + \beta_T)\Pi'_T - \mu'_R p'_w)p_w(1-\beta_P)\Pi_P\right]$$

and again the only term surviving is $p_w\Pi'_P(1 - F_T^R) > 0$. So the probability is increasing.

If instead the alliance is with P:

$$P(war) = F_P + (F_P(\Pi_P) - F_P)(1 - F_T^P)$$

the derivative is:

$$f_P(1-\beta_P)(p'_w\Pi_P + p_w\Pi'_P)F_T^P - f_T(p'_w\Pi_T + (p_w + \beta_T)\Pi'_T - \mu'_R p'_w)(F_P(\Pi_P) - F_P)+$$

$$+f_P(1-\beta_P)(\Pi_P)\Pi'_P(1 - F_T^P)$$

and if $v \to 0$ $F_P(\Pi_P) - F_P(0) \to 0$. So if $f_P(0) > 0$ the negative term goes to zero and the expression is asymptotically equivalent to $f_P(p_w \Pi'_P) F_T^P + f_P(\Pi_P)\Pi'_P(1 - F_T^P)$, so it is positive. If instead $f_P \to 0$, we can use the fact that $F_P(\Pi_P) \sim f_P \Pi_P$ and $F_P \sim f_P p_w \Pi_P$, and that $f_P(\Pi_P) \sim f_P(p_w \Pi_P)$ to rewrite it as:

$$f_P(1-\beta_P)\left[-(p'_w \Pi_T + p_w \Pi'_T - \mu'_R p'_w)(1-p_w)\Pi_P + \Pi'_P(1-F_T^P) + (p'_w \Pi_P + p\Pi'_P)F_T^P\right]$$

and now the only surviving terms are $\Pi'_P(1-\beta_P)(1-F_T^P) + p_w(1-\beta_P)\Pi'_P F_T^P > 0$, so the probability of conflict is increasing.

Proposition B.1. *If $\beta_T > 0$, $\lim_{v\to\infty} \Pi'_T > 0$ and p_w is asymptotically equivalent to v^{-a}, for some $a > 0$, then the SI_T condition is satisfied.*

Proof. Call $\lim_{v\to\infty} \Pi'_T = \ell$, this implies that Π_T is asymptotically equivalent to ℓv. Hence, SI_T is equivalent to:

$$((p_w + \beta_T)\Pi_T)' > 0 \iff p'_w \Pi_T + (p_w + \beta_T)\Pi'_T > 0$$

and for $v \to \infty$ the expression is asymptotically equivalent to $\ell(p'_w v + \beta_T) = \ell(v^{-a} + \beta_T) \to \ell\beta_T > 0$. This means that for v large enough $(p_w + \beta_T)\Pi_T$ is increasing. Moreover, it also implies that $(p_w + \beta_T)\Pi_T$ is asymptotically equivalent to $\ell\beta_T v$, and so in particular diverges. The two last observations mean that the condition SI_T is satisfied.

□

□

B.2 Proofs of Section 3

We calculate the equilibrium price, assuming all problems have an interior solution.

If there is no war, the FOC is:

$$\Omega_T \alpha (g_T)^{\alpha-1} = p \tag{5}$$

that is

$$p = \frac{\alpha\Omega}{g_T^{1-\alpha}} = \frac{\alpha\Omega}{(R_M + R_R)^{1-\alpha}} \tag{6}$$

where we already used the market clearing condition $g_T = R_R + R_M$. The equilibrium profits of the third party are as follows:

$$\pi_T = \Omega(R_M + R_R)^\alpha - \frac{\alpha\Omega}{(R_M + R_R)^{1-\alpha}}(R_M + R_R) = (1-\alpha)\Omega(R_M + R_R)^\alpha$$

If there is war instead, the FOC yields:

$$p(war) = \frac{\alpha\Omega}{g_T^{1-\alpha}} = \frac{\alpha\Omega}{(R_M + \eta R_R)^{1-\alpha}} \tag{7}$$

because now market clearing yields $R_M + \eta R_R = g_T$. The profit of the third party in this case is:

$$\pi_T(war) = (1-\alpha)\Omega(R_M + \eta R_R)^\alpha$$

Call Π_P the profit of the predator when it seizes the resource. Since in this case war occurs for sure:

$$\Pi_P = \frac{\alpha\Omega}{(R_M + \eta R_R)^{1-\alpha}}\eta R_R$$

Instead, the payoff of having access to the resource for T is:

$$\Pi_T = (1-\alpha)\Omega(R_M + R_R)^\alpha - (1-\alpha)\Omega(R_M + \eta R_R)^\alpha$$

Proof of Corollary 1

RC is satisfied by the assumptions.

The derivatives are:

$$\Pi'_P = p\alpha\Omega\eta\frac{R_M + \alpha\eta R_R}{(R_M + \eta R_R)^{2-\alpha}}$$

$$\Pi'_T = (1-\alpha)\Omega\alpha\left((R_M + R_R)^{\alpha-1} - \eta(R_M + \eta R_R)^{\alpha-1}\right)$$

The first is obviously positive. To check the second, notice that is positive if and only if:

$$(R_M + R_R)^{\alpha-1} > \eta(R_M + \eta R_R)^{\alpha-1}$$

that is:

$$(R_M + \eta R_R)^{1-\alpha} > \eta(R_M + R_R)^{1-\alpha}$$

$$R_M + \eta R_R > \eta^{\frac{1}{1-\alpha}}(R_M + R_R)$$

$$R_M(1-\eta^{\frac{1}{1-\alpha}})+R_R\eta(1-\eta^{\frac{1}{1-\alpha}-1})>0$$

and $\frac{1}{1-\alpha}-1>0$ so $\eta^{\frac{1}{1-\alpha}-1}<1$ and this inequality is true. This proves AI.

A sufficient condition for EE is that $\frac{\Pi'_P}{\Pi'_T}$ is decreasing. To prove this, the ratio of marginal payoffs is:

$$\frac{\Pi'_P}{\Pi'_T}=\frac{R_M+(\eta-1+\alpha)R_R}{(R_M+\eta R_R)^{2-\alpha}\left((R_M+R_R)^{\alpha-1}-\eta(R_M+\eta R_R)^{\alpha-1}\right)}$$

Taking the derivative, we find that it is decreasing if and only if:

$$\begin{aligned}&(\alpha-1)R_M\left(R_M+\eta R_R\right)^{\alpha-3}\times\\&\left(\left(R_M+R_R\right)^{\alpha-2}\left((2\eta-1)R_M+\eta R_R(\alpha(\eta-1)+1)\right)-\eta^2\left(R_M+\eta R_R\right)^{\alpha-1}\right)<0\end{aligned}$$

Manipulating this expression, we find that this is true if and only if

$$R_M>(1-\alpha)\frac{\eta}{1-\eta}R_R$$

Concerning the hypothesis of Theorem 2.1, we have to check the limit:

$$\lim_{R_R\to\infty}\frac{w_P^\gamma}{w_P^\gamma+(R_R+w_P)^\gamma}(1-\alpha)\Omega\left((R_M+R_R)^\alpha-(R_M+\eta R_R)^\alpha\right)$$

$$=\lim_{R_R\to\infty}\frac{w_P^\gamma}{w_P^\gamma+(R_R+w_P)^\gamma}(R_M+R_R)^\alpha(1-\alpha)\Omega\left(1-\left(\frac{R_M+\eta R_R}{R_M+R_R}\right)^\alpha\right)$$

and this goes to infinity if $\alpha>\gamma$.

B.3 Proofs of extensions in the appendix

Proof of Proposition A.1

T prefers to intervene in favor of R if:

$$\mu_R<\mu_P$$

$$\Pi_T-\mu_R-\varepsilon_T>\alpha\Pi_T$$

It prefers to intervene in favor of R if:

$$\mu_R>\mu_P$$

$$\Pi_T-\mu_P-\varepsilon_T>\alpha\Pi_T$$

It prefers to stay out otherwise. In the first stage P chooses to attack depending on the intervention choice and the values of ε_P, similarly as in the proof of Theorem 2.1.

So the intervention choice depends uniquely on the μs, and by CW it follows that intervention is in favor of R if sufficiently high.

Hence, if v is sufficiently small, and intervention is in favor of P the probability of conflict is:

$$F_P(p_w\Pi_P(v)) + F_T((1-\alpha)\Pi_T - \mu_P)(F_P(\Pi_P(v)) - F_P(p_w\Pi_P(v)) + F_P(0)$$

The derivative is:

$$f_P(p'_w\Pi_P + p_w\Pi'_P) + f_T(-\eta' p'\Pi_T + (1-\eta)\Pi'_T - \mu'_P p'_w)\Delta F_P + F_T(f_P\Pi'_P - f_P(p'_w\Pi_P + p_w\Pi'_P))$$

now proceeding as in the proof of 2.1 we see that if $v \to 0$ the only surviving term is $p_w\Pi'_P > 0$, so the derivative is positive.

If for v small intervention is in favor of R, the the calculations are analogous to Proposition 2 and we again obtain that the probability is increasing.

If v is sufficiently large the intervention is in favor of R. The probability of conflict is:

$$F_P(p_w\Pi_P)(1 - F_T((1-\alpha)\Pi_T - \mu_R)$$

The derivative is:

$$f_P(p'_w\Pi_P + p_w\Pi'_P)(1 - F_T) - f_T(-\alpha' p'_w\Pi_T + (1-\alpha)\Pi'_T - \mu'_R p'_w)F_P$$

Proceeding as in the previous proof, we have to study the sign of:

$$(1-\alpha)\Pi'_T - \alpha' p'_w\Pi_T - \mu'_R p'_w$$

a sufficient condition for this to be positive is:

$$\frac{\Pi'_T}{\Pi_T} > \frac{\alpha' p'_w}{1-\alpha}$$

If $\alpha' \leq 0$ for v large this is true. If $\alpha' > 0$ then for v large we have that $\frac{\alpha' p'}{1-\alpha} \sim \frac{p'_w}{p_w}\alpha' \frac{p_w}{1-\alpha}$. Now $\frac{p_w}{1-\alpha}$ converges to 0 if $1-\alpha(0) > 0$. Otherwise, it converges to an indeterminate form $\frac{0}{0}$, so that by De l'Hôpital Theorem it is asymptotically equivalent to: $\frac{p'_w}{-\alpha' p'_w} = -\frac{1}{\alpha'}$. Hence the whole expression is asymptotically equivalent to:

$$\frac{\alpha' p'_w}{1-\alpha} \sim -\frac{p'_w}{p_w}\alpha' \frac{1}{\alpha'} = -\frac{p'_w}{p_w}$$

so that the condition is equivalent to:

$$\frac{\Pi'_T}{\Pi_T} > -\frac{p'_w}{p_w}$$

Proof of Proposition A.2

The expected gain from a war for P is $p_w \Pi_P (1 - F_T(p_w \Pi_T)) - \varepsilon_P$. Then there are also here three types of equilibria:

- If $p_w \Pi_P (1 - F_T((p_w)\Pi_T)) < \varepsilon_P$, P never wants to attack and there is no war;
- If $p_w \Pi_P (1 - F_T((p_w)\Pi_T)) > \varepsilon_P$ then P attacks and there is war. If in addition $(p_w)\Pi_T(v) > \varepsilon_T$ then there is intervention, otherwise there is no intervention.

The analysis of the alliances proceeds in a very similar way: for v small enough T is allied to P, for v large enough is allied to R. If v is small the analysis is identical to the theorem in the text.

If v is large the probability of conflict is:

$$F_P((p_w \Pi_P - \mu_P)(1 - F_T(p_w \Pi_T - \mu_R)))$$

derivative of probability of conflict when T allied with R (high v) is:

$$P' = f_P^R \left(-f_T^R ((\beta_T + p_w)\Pi'_T + p'_w \Pi_T - \mu'_R p'_w)\Pi_P p_w + (1 - F_T^R)(\Pi'_P p_w + \Pi_P p'_w) \right)$$

Now $\mu'_R \to 0$, so this is the same as:

$$f_P^R \left(-f_T^R ((\beta_T + p_w)\Pi'_T + p'_w \Pi_T)\Pi_P p_w + (1 - F_T^R)(\Pi'_P p_w + \Pi_P p'_w) \right) < 0$$

Now if $M < \infty$ everything remains finite apart from $1 - F_T^R$ and possibly f_T^R. IF $f_T^R(M) > 0$ we are done. If not, using the approximation $1 - F_T^R \sim f_T^R(M - (\beta + p_w)\Pi_T + \mu_R)$ (for

$M > (\beta + p_w)\Pi_T - \mu_R$, zero otherwise), we find that the above is positive if and only if

$$-f_T^R((\beta_T + p_w)\Pi_T' + p_w'\Pi_T)\Pi_P p_w + f_T^R(M - (\beta + p_w)\Pi_T + \mu_R)(\Pi_P' p_w + \Pi_P p_w') < 0$$

$$-((\beta_T + p_w)\Pi_T' + p_w'\Pi_T)\Pi_P p_w + (M - (\beta + p_w)\Pi_T + \mu_R)(\Pi_P' p_w + \Pi_P p_w') < 0$$

and the second term goes to zero. Moreover, the first term is negative if either $\beta_T > 0$, or SI_T holds.