Natural Resources, Conflict, and Conflict Resolution

UNCOVERING THE MECHANISMS

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The interpretation of the resource-conflict link that has become most publicized—the rebel greed hypothesis—depends on just one of many plausible mechanisms that could underlie a relationship between resource dependence and violence. The author catalogues a large range of rival possible mechanisms, highlights a set of techniques that may be used to identify these mechanisms, and begins to employ these techniques to distinguish between rival accounts of the resource-conflict linkages. The author uses finer natural resource data than has been used in the past, gathering and presenting new data on oil and diamonds production and on oil stocks. The author finds evidence that (1) conflict onset is more responsive to the impacts of past natural resource production than to the potential for future production, supporting a weak states mechanism rather than a rebel greed mechanism; (2) the impact of natural resources on conflict cannot easily be attributed entirely to the weak states mechanism, and in particular, the impact of natural resources is independent of state strength; (3) the link between primary commodities and conflict is driven in part by agricultural dependence rather than by natural resources more narrowly defined, a finding consistent with a "sparse networks" mechanism; (4) natural resources are associated with shorter wars, and natural resource wars are more likely to end with military victory for one side than other wars. This is consistent with evidence that external actors have incentives to work to bring wars to a close when natural resource supplies are threatened. The author finds no evidence that resources are associated with particular difficulties in negotiating ends to conflicts, contrary to arguments that loot-seeking rebels aim to prolong wars.

Keywords: *civil war; resource-conflict link; resource dependence*

1. INTRODUCTION

In early April 1975, President Tombalbaye of Chad appealed on national radio for popular vigilance, warning that members of the army were plotting a coup against him. He explained that if anyone wanted to know *why* a coup was being plotted, the answer lay with the oil in the Doba fields in the south. This appeal turned out to be Tombalbaye's last public address. On April 13, he was killed during Chad's first suc-

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cessful coup d'etat.[1] Unfortunately for Tombalbaye, he had had increasingly strained relations with France, his chief military backer, ever since he allowed U.S. corporations to prospect for oil in the ex-colony. The U.S. corporation was successful where French prospectors had failed. And France took umbrage.[2] Ever since, oil has had a striking prominence in the intrigues of Chadian politics. The government of Hissène Habré is reported to have received U.S. support in exchange for his support of U.S. oil corporations while politicians and NGOs argue that the present president, Idriss Déby, previously Habré's right hand man, was offered military support from France's Elf if he would overthrow the Habré régime and give France a stake in the southern oil fields.[3] The oil in the south has also been seen to be fuelling southern ambitions for a federalist state, if not for outright separation. The leader of the present southern opposition, Ngarlejey Yorongar, has been incarcerated for accusing the previous southern leader, Wadal Kamougué, of allowing himself to be co-opted by the government in exchange for money from Elf.[4] In short, in the eyes of Chad's political leaders, control of oil revenues has been central to Chadian politics for almost thirty years; it has made and broken political leaders, has incited violence, and has shaped political agendas.

But what is perhaps most striking about Chadian oil is that, up to 2003, not a single drop had been pumped.

The role of oil in Chad's politics illustrates some of the complexity of the linkages between natural resources and conflict. Contrary to popularized images of resource conflicts in Africa, oil did not lead to rival warlords establishing resource-funded local monopolies in Chad—the stories that link resources to conflict here center on gaining tight control of the state rather than on the creation of chaotic environments. And while natural resources may produce conflict by leading to shadowy states, the weakness of Chad's state structure cannot be attributed to its dependence on oil revenues to buoy it; until recently none has been earned. Chad's experience comes closer to what Michael Ross (2002) terms a "booty futures" story—in which resources matter because revenues can be raised in advance to gain control of them. In such a context, policy prescriptions emanating from conflict research—that rebel financing needs to be cut off through the infiltration of quasi-criminal trade routes and robust opposition to rogue states—fall wide of the mark.

The problem is that unless we understand the mechanisms linking resources to conflict, the advice of conflict scholars will be of limited use to the policy community. And unless we test these mechanisms, we will be unsure of the generality of processes we observe in individual cases, such as those seen in Chad. In this article, I explore the diversity of mechanisms that may link natural resources to conflict and develop and employ strategies to identify which mechanisms are likely to be in operation when.

1. This explanation is provided by Mohammet Sally, a leader of FROLINAT, the dominant Chadian rebel group at the time (interviews, N'djamena, April 2003). The leader of the coup, Wadal Abdelkadar Kamougué, denies any connection between the coup and Doba oil (interviews, N'djamena, April 2003).

2. On French frustration see Nolutshungu (1996). Jacques Foccart (1999) describes how by 1969 the involvement of U.S. corporations in Chad was seen as an insult to the prestige of the French army.

3. This claim, emanating apparently from the leader of the opposition, Yorongar, has been argued by *Agir ici -Survie* (1999) and Verschave (2000). And according to Verschave, Déby also had at least tacit military support from the French troops stationed in N'djamena.

4. *Agir ici -Survie* (1999) and interviews with Yorongar (N'djamena, April 2003).

The article is organized as follows. Drawing largely on the experiences of Sahelian and West Africa states as well as work by scholars who have studied a wider set of cases and identified relevant mechanisms (notably, Le Billon 2001; Snyder 2002; Ross 2002, 2003, 2004a), I catalogue a series of mechanisms that may link natural resources to conflict onset and conflict duration. With the aim of engaging with the econometric literature, the task then is to find ways econometrically of differentiating between the effects of these rival mechanisms. I discuss four strategies for doing so, indicating how the different strategies may be used for the problems at hand. In the final section I turn to the data, building on the model developed by Fearon and Laitin (2003); I begin the task of identifying the work of rival mechanisms on conflict onset and duration and testing a core set of the relations discussed in previous sections.

2. NATURAL RESOURCES AND CIVIL WARS: AN EMBARRASSMENT OF MECHANISMS

Highly influential research by Paul Collier and Anke Hoeffler at the World Bank[5] suggests that countries whose wealth is largely dependent on the exportation of primary commodities—a category that includes both agricultural produce and natural resources—are highly prone to civil violence. In explaining the correlation between primary commodities and conflict, Collier and Hoeffler argue that conflict may be explained either by greed or by grievances, such as feelings of ethnic or political marginalization. They conclude (in large part based on the correlation between primary commodities and conflict) that to understand the causes of contemporary civil wars we should forget about political and cultural arguments and focus instead on the greed of rebels and especially on their trade in natural resources.[6]

The problem is that the correlation between commodities and conflict does not imply either that rebels are greedy or that they finance their campaigns through the trade in natural resources. The correlation could arise, for example, if conflict, or even expectations of a conflict, causes other economic activities, such as tourism and manufacturing, to cease, leaving only extractive industries to function.[7] But even if the relationship is not so spurious, there are at least six rival families of mechanisms that could explain the relationship between natural resources and war onset and duration; rebel greed is just one of them.[8] Here are the six.

5. See especially Collier and Hoeffler (2000b).

6. Different versions of this research vary in the extent to which evidence for "greed" simply means evidence for the economic "opportunity' to fight. Collier and Hoeffler argue, "We test a 'greed' theory focusing on the ability to finance rebellion, against a 'grievance' theory focusing on ethnic and religious divisions, political repression and inequality. We find that greed considerably outperforms grievance." Collier and Hoeffler (2000b) suggest furthermore that the relevant "opportunity" is in fact the opportunity *for predation*, arguing, "Our model suggests that what is actually happening is that opportunities for primary commodity predation cause conflict." For a recent statement of this research position, see Collier (2003).

7. See Bannon and Collier (2003) and Collier's (1999) study of the impact of conflict on Uganda's economic structure.

8. For an excellent discussion of a number of these mechanisms, as well as case study evidence supporting them, see Ross (2004a).

The greedy rebels mechanism, with three variants. The first, emphasized by Collier and Hoeffler, is that domestic groups may engage in quasi-criminal activity to benefit from resources independent from the state. The second, argued by Fearon and Laitin (2003), is that natural resources increase the "prize" value of capturing the state. The first variant should lead to the local expulsion of the state, as in Colombia; the second, to bids to gain state control, as in Chad or, as argued by Engelbert and Ron (2004), the Republic of Congo. Plausibly the first variant may lead to the second, or vice versa, as in Sierra Leone, where control of the diamond areas sufficiently weakened the state as to make state capture appear easy. In a third variant, if natural resources are concentrated in a particular region of a country, this may ground beliefs among dissatisfied groups that a seceding state could be viable or even prosperous.[9] As with the feasibility mechanism discussed below, the greedy rebels mechanism does not require that rebels control resources directly; it may be sufficient to extract rents from those who do, as has been done with oil extractors in Colombia, Cabinda, and Nigeria.

The greedy outsiders mechanism. Rather than resulting from the greed of rebels, as emphasized by recent literatures, the existence of natural resources may be an incentive for third parties—states and corporations—to engage in or indeed foster civil conflicts. Hence, for example, the escalation of the civil war in the Democratic Republic of Congo has resulted in part from the involvement of neighboring states seeking raw materials (Dashwood 2000; Meldrum 2000; Willum 2001). The secessionist bid in Katanga in Congo was supported if not instigated by the Belgian firm Union Minière du Haut Katanga. And evidence suggests that the French oil corporation Elf took actions that led to an escalation of the conflict in the Republic of Congo (Verschave 2000).

The grievance mechanism. Natural resource dependence could in fact be associated with grievances rather than greed.[10] There are at least four variants of this mechanism. First, countries with middling levels of dependence on natural resources may be experiencing transitory inequality as part of the development process.[11] Second, economies that are dependent on natural resources may be more vulnerable to terms of trade shocks. These could cause instability and dissatisfaction within groups that suffer from the shocks (in this case, the problem is not with dependence on natural resources per se but that natural-resource-dependent economies are likely to be dependent on a small number of commodities for their export earnings).[12] Third, the process of extraction may produce grievances, for example, through forced migration. Ross, for

9. Such arguments have been made for the cases of Biafra in Nigeria, Katanga in Congo, Cabinda in Angola, Casamance in Senegal, Bougainville in Papua New Guinea, and southern Sudan. See also Ross (2003).

10. The introduction of the terms greed and grievance is unfortunate, not least because the distinction between them appears to be a moral rather than a positive one.

11. This may follow for example from the Kuznets curve hypothesis that predicts transitory inequality resulting simply from the fact that different parts of an economy may develop at different rates.

12. Vulnerability will also be more likely if the risks associated with the commodities are highly correlated—either in terms of price fluctuations or in terms of production conditions, such as the weather. There is no reason to expect that an economy exporting a diversified portfolio of natural resources will be particularly susceptible to income shocks.

example, describes externalities of the extraction process itself in Aceh and Papua New Guinea such as environmental damage and loss of land rights. Or finally, natural resource wealth may be seen as more unjustly distributed than other wealth—as has been claimed in Sierra Leone and Nigeria. In Niger, the insurgent groups stressed not just that the north received little investment from the political center in the south but also that the south relied economically on revenues gained from the uranium wealth of the north, with no visible returns to the north. Such are the fears presently in Chad: with no expectation that any of the oil revenues will accrue to their region, local leaders in the Doba area have petitioned to the oil corporations for direct compensation, in the form of scooters for each village leader.[13]

The feasibility mechanism. Natural resources could provide a way to finance rebellions that have been started for other reasons, thereby increasing the prospects of success.[14] This can occur either through control of production during conflict, or, in principle, through the sales of booty futures. Insofar as natural resource dependence matters through feasibility effects, it is a "permissive cause" rather than a "root cause" of conflict. Some scholars argue that because motivations for conflict are ubiquitous only permissive causes of this form matter, nevertheless insofar as there is *variation* in motivation, the feasibility explanation implies that there is a need to take account of root causes when responding to conflicts. In principle, there should also be observable differences in the conduct of wars, and of negotiations, between those that are conducted to access resources and those that are financed by resources but conducted to achieve other goals (although of course motivations may change over time).

The weak states mechanism. State structures may be weaker in natural-resource-dependent economies. There are two prominent variants of the argument, both of which focus on the strength of state-society linkages. One variant focuses on the society side of weak society-state relations and holds that when citizens are untaxed by governments, they have less power over them: they may have less information about government activity, weaker incentives to monitor government behavior, and fewer instruments at their disposal to withdraw support from governments; accordingly, resource-dependent states may have little compulsion to respond to the demands of their citizens or create structures that engage their citizens. The implications of these arguments are ambiguous insofar as they may result in greater insulation but less resilience of the state. The second channel focuses on the state side of state-society relations, arguing that governments that rely on natural resources rather than taxation have weakened incentives to create strong bureaucratic institutions.[15] The argument is a

13. Formally the Chad deal provides for 5 percent of revenues to be spent in the region of oil extraction in the south. Few in the south believe that the government, dominated by northerners, will implement this deal (interviews with village chiefs, Doba, April 2003).

14. As noted above, this interpretation of resources providing "opportunity" (as opposed to motivation) is indeed a "softer" interpretation of the result that is sometimes suggested by Collier and Hoeffler.

15. Although, as argued by Snyder and Bhavnani (2005 [this issue]), the degree to which resources lead to a weakened capacity for tax raising is partly endogenous to policy choices.

long-standing one for oil-dependent states and has been recently stressed by Fearon and Laitin (2003), who argue that oil states are more likely to have weak structures because they have less need for intrusive bureaucracies to raise revenue.[16] The result may be a state such as Mobutu's Zaire that is divorced from the domestic economy.

The sparse networks mechanism. Plausibly, the importance of natural resources may lie in their impacts on the daily economic activities of the citizens of an economy and how these in turn affect attitudes of citizens or relations between citizens. One way in which this more indirect route could function is as follows. Natural-resource-dependent economies may have weak manufacturing sectors—an effect exacerbated by "Dutch Disease" dynamics[17]—and correspondingly low levels of internal trade. Insofar as internal trade is associated with greater levels of social cohesion and interregional interdependence, the weakness of the manufacturing sector and the fragmentation of an economy into independent enclaves of production may raise conflict risks. The argument that dense trade networks reduce conflict risks is already well established in the study of international conflicts. Liberal theorists argue that where trade is mutually beneficial, to fight with a trading partner would be to commit "commercial suicide."[18] Related arguments claim that, through exchange, trading partners develop greater understanding for each others' cultures. Political philosophers, meanwhile, suggest that trade reduces the risk of conflict because trade alters cultures: that there is something about trade that makes people less violent.[19] Empirical research demonstrates that once proximity is taken into account, states that trade with each other are less likely to fight each other.[20] However, good cross-national measures of the density of internal trade or the sparseness of internal networks do not exist, and so this hypothesis, tested at the international level, is untested at the within-country level.

There are then many possible mechanisms underlying the relationship between natural resources and conflict that need not imply that civil war is typically a result of greed. Different mechanisms require different sorts of policy responses. But knowing what response is most appropriate requires thinking more carefully about ways to distinguish the workings of these different mechanisms.

16. See also Moore (2001) on the role of "unearned state income" on political development and Sørli (2002) on the relationship between oil and "rentier" states.

17. "Dutch Disease" describes the effect of a rise in the price of nontradables relative to tradables that adversely impacts on nonboom exporting sectors. The effect may also lower growth if manufactured exports are more growth-enhancing than nontradables. Since growth is negatively associated with conflict, it could be that natural resources effect conflict via their impact on growth.

18. Angell (1933).

19. The classic statement is that "wherever there is commerce, manners are gentle" (Montesquieu 1749, quoted in Hirschman 1982). Recent experimental evidence also suggests that market relations are associated with greater "fair-mindedness." See Ensminger (2001).

20. See Oneal and Russett (1999), Russett (2002), and Doyle (1997) for explanations of the source of the dispute between liberals and realists and evidence that, when variables such as geographic proximity are controlled for, trade reduces conflict.

3. NATURAL RESOURCES AND DURATION

There are also multiple avenues through which resources may affect duration. I point to seven families of such mechanisms.

The feasibility mechanism. Plausibly natural resource financing creates longer wars by enabling rebel groups to keep fighting. The more general statement is Napoleon's: an army marches on its belly. In terms of military feasibility, it might not matter much whether what is in the belly comes from trade in natural resources, local abundance of food supplies, extortion, subscriptions, overseas aid, or production by the troops. In any case, the marginal effect of local natural resource endowments may be to increase duration.

The duration of the Angola conflict is in part explained by the fact that both sides had access to natural resource financing to support their combatants. Across Sahelian states, too, there is evidence for the idea. The wars in Senegal and Sudan have been long in duration, and rebel groups have been able to benefit directly from the resources—both commodities and nontraded foodstuffs—around them. Conflicts in Niger and Mali have been more difficult to sustain. The regions occupied by insurgents in these countries have not been wealthy enough to support a protracted struggle.[21]

The military balances mechanism. The financing available to protagonists is of use not just for keeping combatants alive and fighting but for protecting assets and inflicting damages on the opposing side: these are effects that influence the ease of victory and may also influence the ease of negotiated settlements. Insofar as the link between natural resources and conflict operates through this mechanism, we do not expect a monotonic relationship between the assets available to any one side and duration. The expectation from the quantitative study of international wars is that wars with financial asymmetries are likely to last less long: balance makes for longer wars. In this case, the marginal impact of quantities of natural resources on duration depends on whether they tend to produce more symmetric or less symmetric forces. One implication of this logic is that changes in international policy and actions on conflict financing (such as the regulation of the diamond trade) can *increase* conflict duration if they lead to greater symmetry between combatant sides.

The theory and evidence from negotiated settlements to end civil wars is less clear, although researchers (e.g., Zartman 2000) suggest that balance facilitates negotiated settlement. The opposite argument can however also be made: that asymmetries reduce the uncertainty around the outcome of conflict, leading to a lower likelihood of bargaining failures.

Michael Ross (2002) suggests that "booty futures" financing—financing to secure assets that can be gained after a war ends—can be associated with longer wars. It is not

21. A Sahelian counterexample to the logic is provided by Chad. The FROLINAT rebellion, lasting from 1966 to around 1980, was protracted but took place almost exclusively in a resource poor part of the country, in the B.E.T. region of the north. The reason that FROLINAT could keep going when comparable rebellions in Mali and Niger could not is that FROLINAT had access to prolonged foreign support, in this case from Libya.

clear why this should be so, however: insofar as the mechanism requires the ability to make credible commitments, we may expect it to work to the advantage of one side only—the government side (that is, the side that already has rights that it can sell and that can, in principle, be enforced with the help of the international system) and thereby lead to asymmetries and possibly shorter wars. In any case, whichever side is financed by booty futures, if benefits accrue only after a conflict ends, we would expect financiers to act only when they expect wars to be short, or to act to ensure that wars are short.

The fragmented organizational structures mechanism. A new and fruitful line of research argues that that the extent to which the benefits from conflict require *joint* production may affect rebel organizational structures. Le Billon (2001) focuses on the centralization of the production process—with concentrated resources, such as oil, requiring more organizational cohesion and allowing for more hierarchical organizational structures than diffuse resources such as cattle. As argued by Ross (2003), goods also vary in how they can be marketed, and this, too, can affect group cohesion.[22] Weinstein (2005 [this issue]) focuses on benefits that can be targeted to individuals in the short run and those that accrue only in the long term and are conditional on the success of the rebellion.

These organizational effects may matter for war duration. Researchers have suggested, for example, that we should expect a positive relationship between the cohesiveness of a rebel organization[23] or its degree of hierarchy[24] and the duration of a conflict. The experiences of Senegal and Mali, however, both suggest that if anything the *lack* of cohesiveness leads to longer conflicts. While cohesiveness may improve the fighting capacity of a group and thereby delay any military victory over the group by the government, in a context where military victory is unlikely, cohesiveness may instead lead to an improved ability to reach a negotiated settlement. Conversely, the lack of cohesion can prevent effective negotiation by preventing the formulation of a coherent ideology or set of demands as well as by resulting in an inability on the part of rebel groups to convince the state that they can deliver what they offer.[25]

22. Some goods, particularly bulky goods destined for export to a well-structured international market, will have more centralized marketing channels than less bulky goods sold in less structured markets. These qualities can be described as variations in a resource's "obstructability."

23. Collier, Hoeffler, and Söderbom (2001), for example, argue that "[many] rebel organizations face severe problems of maintaining cohesion: hence the much shorter duration of such wars." As suggested by Nicholas Sambanis in comments, a useful distinction may be drawn between the ability of leaders of a given group to enforce orders and the existence of multiple factions, each with its own leadership structures. Lack of the former type of cohesion may make military victory for the government more likely, while lack of the latter may prevent negotiated resolution.

24. More hierarchical structures may lead to longer wars because the leadership is less likely to suffer personally from the costs of the conflict and is more likely to gain a large share of benefits. However, if a settlement can be negotiated that benefits the leadership, more hierarchical organizations may be better able to guarantee the adherence of the organization to the terms of the settlement.

25. While the literature on bargaining (e.g., Schelling 1960) suggests that fragmentation, by producing limited mandates, may strengthen a negotiator, this logic only holds when the limits are within the bargaining set. If placed outside the bargaining set, the bargainer may be seen as being unable to deliver *any* deal.

The possibility of pork mechanism. A related argument focuses on peace negotiations. The argument suggests that having rents to divide among faction leaders greases the wheels of a negotiation process; if rents can be provided to multiple sides, the argument goes, their adherence will be more reliable. Englebert and Ron (2004) argue, for example, that the availability of oil monies facilitated adherence to peace agreements in the Republic of Congo. Related arguments have been made to encourage the timely allocation of aid monies following peace negotiations; similar arguments have been made to explain coalition formation in pork politics in the United States (consider, for example, Lohmann and O'Halloran's [1994] model of the "universal log-roll"). The argument should be most applicable in situations where allocations of pork are conditional upon a return to peace—for example, if an oil industry is incapable of functioning during times of conflict but can restart afterwards.

This logic of these arguments suggests that if resource exploitation depends on peace, then the presence of natural resource endowments should make negotiation more likely to succeed. However, cooperative game theorists might expect pork politics incentives to work in just the opposite direction. In the context of distributive politics, these theorists predict that if any coalition reaches an agreement, new coalitions will typically be able to form that will have an incentive to overturn that agreement.[26] This suggests that credible commitments should be especially difficult to achieve in negotiations: the presence of natural resources that yield transferable rents should make negotiation more difficult by providing subgroups with incentives to renegotiate ex-post.

The domestic conflict premium mechanism. Groups that benefit during conflict may prefer to fight than to win and therefore act as spoilers to peace processes. If, as argued by Keen (1998) and Collier (2000c), natural resource endowments are associated more with greed-inspired rebellions, then the fighters in these conflicts may not have an interest in the success of negotiations. Weinstein (2005), though not directed to the question of conflict duration, nonetheless adds a new element to such domestic conflict premium arguments. The nature of the resources available to a group, he argues, can structure the *characteristics* of a group's membership. Groups with natural resource wealth may be more likely to attract "consumers" that benefit from the rewards that take place during conflict and less capable of attracting "investors" who may be driven by benefits that are realized only after successful collective action.

A caveat to these arguments is necessary. To provide the link between the benefits of war and a conflict's duration, we need to know not just that individuals benefit in wartime but that they believe that they benefit *more than they would in times of peace* (see, for example, Collier 2000a). The real puzzle is, What prevents parties from agreeing on a peaceful arrangement that leaves everyone better off? Typical answers to this question focus on the ability of agents to make credible commitments to each other to honor agreements made in war time. Another possibility is a feasibility constraint on negotiators: individuals may do well out of war because they are engaged in illegal

26. More formally, in noncollegial distributive games, the set of equilibrium points—the core—is generically empty.

activities that they would not be able to undertake during peacetime; if so, compensating protagonists after a conflict may not be financially feasible for a state that rejects future trade in these commodities.

This, it seems, is what leads to the special relationship between illegal economic activities, the illegal drug trade in particular, and protracted conflicts. Over the course of the Casamance conflict, for example, rebels have increasingly become reliant on natural resources—notably cannabis, cashew nuts, and timber. Control of these industries would likely shift in the absence of the conflict and appears to have rendered productive negotiations difficult. More generally, groups that get financing from contraband fight in longer wars (Fearon 2004). In these instances, unless states are willing to turn a blind eye to trade in illegal goods by protagonists of conflict, settlements will be difficult to achieve. In the absence of alternative forms of compensation, peace in such conflicts then may require victory rather than negotiation.

The international conflict premium mechanism. Insofar as third parties can bring pressure to bear on the resolution of conflicts, their incentives can help determine the duration of conflicts. Neighboring states can provide sanctuary for rebel bases within their borders, and they can provide logistical support to one side or another. They can also facilitate mediation. Which of these they decide to do may depend again on the optimal benefits they can expect to achieve during wartime relative to those they could gain in a negotiated settlement, a feature that can often depend on the resource endowments of their neighbors.

The experience of Sahelian states is again rich in this regard. The greatest international influence on the duration of the Mali conflict was probably that exerted by Algeria. The Mali conflict took place in a region bordering southern Algeria—one home to Berber populations living in similar conditions to those of Tuareg groups in Mali. Algeria had security reasons not to want to see the conflict drag on; but it also failed to gain economically from the conflict. It used its control over supply routes and over Tuareg exiles and refugees in Algeria to place pressure on the rebels. And as a major supplier of oil as well as military and economic aid, it placed pressure on Bamako. Countries neighboring Senegal did not have the same fears of a spread of the conflict, and neither Guinea-Bissau nor Gambia had strong motivations to bring the conflict to an end. Indeed, both countries have benefited from the war economy associated with the conflict—Guinea-Bissau, through the routing of cashew exports through the zone and by acting as a market to areas more isolated from Senegalese markets; and Gambia, through its involvement with the routing of cannabis and timber exports through the country (Evans 2002). As a result, not only have the rebels not come under pressure from these sources, but they have benefited financially and militarily from their relations with them.

The sparse networks mechanism. An analogy of the sparse networks mechanism for conflict onset may help explain conflict duration. Just as dense linkages within economies may prevent a conflict from breaking out, so may they help resolve them. Such an argument has been made for the Sierra Leone war by Paul Richards (1996), who suggests that aid enclaves may have hindered conflict resolution by limiting the

extent of economic exchanges.[27] An illustration of the logic is also provided by the conflict in Mali: of two rebel groups, ARLA and FPLA, for only one of them, the FPLA, did the members have dense economic exchanges with the Songhoi community in the north. The suspension of these exchanges during the conflict was expensive for both the Tuareg fighters in the FPLA and the members of the Songhoi civil defense militias; the desire to reestablish them led to a successful series of negotiations between these groups while the ARLA continued fighting until ultimately they were defeated.

4. MECHANISMS AND ESTIMATION

With so many possible mechanisms, is it possible to differentiate between them? And is it possible to do so in a way that can engage with the econometric literature? The challenge seems particularly daunting when multiple mechanisms may well be in operation at the same time. One view is that econometric work can only produce correlations and that qualitative work is required to identify the mechanisms that underlie these correlations. In this section, I argue that this view is based on a somewhat false distinction between qualitative and quantitative work; I argue that it is indeed possible to use econometric methods to help differentiate between multiple mechanisms, and I suggest four relatively standard techniques that can be employed to do so.

To describe the techniques and their domains of application, I will assume that the outcome of interest, y, is binary: hence, in any particular case i, the event did or did not occur. Since law-like generalizations are typically not attainable in social science, we can treat y as a random variable distributed according to some density function, such as the Bernoulli function, conditional upon some set of explanatory variables. The aim then is to estimate the properties of the function in a way that can distinguish between rival mechanisms whose effects may easily be conflated.

I proceed by discussing two different ways—referred to as systems with "Type B" and "Type A" mechanisms by Elster (1998)—in which rival mechanisms may relate to each other. For each of these, I identify two simple "fixes"—in all cases techniques that already exist—that can be used to help distinguish between mechanisms when multiple mechanisms exist.

SYSTEMS WITH TYPE B MECHANISMS

Following Elster (1998), a system with Type B mechanisms is one in which multiple mechanisms may work simultaneously, possibly with opposite effects.[28] In such situations, we may incorrectly infer from a simple correlation that an independent variable has no effect on a process, even though it has multiple effects, possibly work-

27. Richards (1996) argues that this mechanism was plausibly at work in the Sierra Leone case.

28. Elster (1998) focuses on cases in which effects work in opposite directions. When effects work in the same direction, there will not be ambiguity about the direction of the net impact of the independent variable, but distinguishing between mechanisms may nonetheless be important if responses to different mechanisms differ.

ing in different directions. The challenge here is to identify the opposing effects. Should multiple mechanisms work in the same direction, the challenge is to assess the different contribution of the different mechanisms.

The simplest econometric fixes for such indeterminacy problems arising from Type B mechanisms use more fine-grained data. Two approaches stand out.

Disaggregating the Explanatory Variable

The first, and most obvious, approach is to identify finer data that can distinguish between rival stories. When the relationship being studied is as general as that between natural resources and conflict, econometricians dispose of a degree of discretion in selecting what measures to use. In practice, the choice of measure may be driven by mundane concerns of data availability. Sometimes it is also driven by the more worrying concern of which measure produces the "best" results, where the metric for best is too often the size of the *t*-statistic. With a focus on mechanisms, however, the selection can be determined by the ability of different measures to identify divergent observable implications of rival mechanisms. If multiple mechanisms are simultaneously in operation, and each has an independent effect on the outcome, then multiple measures may be able to capture the effects of these rival mechanisms. Let me illustrate the point by focusing on rival mechanisms used to explain the relation between national oil sales and conflict.

The weak states mechanism described above is based on the idea that states that depend on natural resources for their revenues rather than on taxation have weak state structures and hence are less capable of mustering support against a threat. A rival mechanism—the greedy rebels mechanism—focuses instead on the idea that control of the state becomes more valuable to men with guns when there are oil revenues in the bargain. Similarly, the feasibility and the greedy outsiders mechanisms suggest that an important determinant of conflict is the financing that can be raised on the strength of *future* production ("booty futures" financing). Fearon and Laitin (2003) recognize both the weak states mechanism and the rebel greed mechanism, but they cannot distinguish between these two on the basis of a single correlation.[29] Nonetheless, insofar as they affect different aspects of governance, these different mechanisms have very different implications for policy.

Qualitative differences in the mechanisms, however, can form the basis for quantitative tests to distinguish between them. The first mechanism works through the supply side of tax revenues—where the revenues come from—the second set of mechanisms work through the demand side—who benefits from the revenues. The first mechanism is also more backwards looking, the latter set more forward looking. In principle, the two sets of mechanisms can be distinguished: the first suggests a correlation between conflict and the past size of revenues from oil relative to tax revenue (or better, some direct measure of bureaucratic depth); the latter suggests a correlation

29. The measure used by Fearon and Laitin (2003)—an indicator of whether oil exports constitute at least a third or all exports—is not tailored to individuate the effect of the two mechanisms described by the authors.

between conflict and future discretionary government income. If measures of these characteristics of economies are not too highly correlated with each other, multivariate analysis should be able to distinguish between their different effects. In particular, should a measure of petroleum reserves have an effect on conflict risks, or conflict duration, *after controlling for actual production*, then this would provide strong evidence for the greedy rebel and booty futures ideas: in particular, the booty futures argument would be able to explain a correlation that neither the "weak state" mechanism nor the grievance mechanism is incapable of explaining.

Disaggregating the Dependent Variable

Consider a situation in which it can be observed, after the fact, which paths have dominated. In this case, the possibly inconsistent linkages between the explanatory variables and the dependent variable of interest can be identified by generating a more fine-grained dependent variable that records the paths that have dominated and then employing standard techniques for studying multicategory dependent variables. Depending on how the processes relate to each other, methods such as multinomial logit, conditional logit, or multivariate[30] probit techniques may be appropriate.[31] A related approach can be used even if it cannot, in *all* cases, be observed after the fact which paths have dominated. In particular, Gordon and Smith (2004) present an elegant model in which there are multiple mechanisms that cannot be observed but for which, in *some* cases at least, it is clear whether one or other path led to an outcome.

Consider now an illustration of a case in which only one pathway is pivotal and, ex post, that pathway is observable. I noted above that there is ambiguity in the expected impact of natural resources (x) on conflict termination (y) via its influences on the cohesiveness of rebel groups. Cohesion may have military implications for rebels, allowing them to fight for longer and reducing the probability of a military defeat, leading, plausibly, to longer wars. But it may also allow rebels to negotiate more effectively, increasing the probability of attaining a negotiated settlement. Disaggregating these effects may be achieved by using a more fine-grained variable y^* that records whether a conflict persists, whether it ends through a military victory, or whether it ends through negotiation. If we use data with sufficient variation in these outcomes, we can then use the techniques noted above to work out what the impact of resources are on the likelihood of military victory and, separately, on the likelihood of negotiated settlements. In effect, by estimating its impact on a more finely dependent variable, we identify rival channels linking an independent variable to a more coarsely defined dependent variable.

30. A multivariate probit approach may be appropriate if it the operation of *multiple* mechanisms can ex post be recognized and, hence, the dependent variable can be disaggregated into a series of distinct success measures along different paths.

31. An assumption implied by using the standard multinomial logit in this context is that the *relative* probability of a negotiated settlement or a continuation of the war is independent of the probability of a military victory. This is consistent with a view that there are separate diplomatic and military channels working more or less independently, but it is more problematic if increases in the chances of a military victory for one side are likely to reduce (or increase) the efficacy of negotiation. The plausibility of the model can be tested using either Hausman or Small-Hsiao tests.

SYSTEMS WITH TYPE A MECHANISMS

Again following Elster (1998), assume that there are two possible processes that link some independent variable x to the outcome variable y, but that for any observation, only one of these two mechanisms applies In this context, Elster refers to a "Type A" mechanism problem as one where "the indeterminacy concerns which (if any) of several causal chains will be triggered." We can consider two cases, one in which the process that determines which mechanism will operate is known, and the second in which it is stochastic or unknown.

Type A Mechanisms Where the Sorting Procedure Is Known

If the process for determining which path is selected is known, then the problem posed by Type A mechanisms is not difficult. For example, assume that the impact of x on y depends on some third variable w, then it is sufficient to specify this relationship in the likelihood function and proceed as usual. For linear specifications this is most simply done by introducing an interactive term, $w \times x$, in the list of regressors. More generally, appropriate functional forms can be specified directly depending on the way w is believed to matter.

As an example, consider the following simplified version of the argument that the impact of natural resources depends on institutions (Snyder 2002; Smith 2004). Let x denote natural resource endowments and let w denote an indicator variable for strong states. In a linear framework, one formalization of the argument that natural resources induce chaos if and only if state structures are weak is given by the hypothesis that the coefficient on x is positive and is equal in magnitude but opposite in sign to the coefficient on $w \times x$, and hence, that if $w = 1$, the marginal effect of x is uniformly zero, but if $w = 0$, then the marginal effect is positive. Should natural resources *reduce* the risk of conflict if state structures are strong but increase it if they are weak, then we expect the coefficient on x to be positive and smaller in magnitude but opposite in sign to the coefficient on $w \times x$.

Type A Mechanisms Where the Sorting Procedure Is Not Known

If, however, the selection mechanism is unknown, then it may still be possible to write the outcome as a result of two or more rival functional forms where the actual selection of the functional form is governed by a stochastic process.[32] For this type of problem, the method of "switching regressions" may be used to determine the individual characteristics of each of the rival processes plus the properties of the "switching equation." The switching equation—which determines which process is relevant for

32. For example, we could have

$$\begin{cases} y_i \sim f(X) \text{with probability } q(X) \\ y_i \sim g(X) \text{with probability } 1 - q(X) \end{cases}$$

In this case, the expected value of y may be written in a single equation as

$$\bar{y} = q(X)f(X) + [1 - q(X)]g(X).$$

any given case—can itself be a function of a series of explanatory variables. This allows us to determine, first, the conditions under which going down one path is more likely than going down the other, and second, the properties of each of the two paths.

We have then multiple and fairly standard ways in which we can test the more "thick" explanations that arise from qualitative work without losing the generality that quantitative methods can help deliver. In the next section, I explore whether these techniques can be effective in helping to understand the relation between resources and conflict.

5. RESULTS: MECHANISM IDENTIFICATION

In this section, I begin to use the techniques described above to identify or exclude individual mechanisms that may underlie the basic relation between resource endowments and conflict.

DATA

The family of possible measures that could be used to capture the abstract notion of natural resource abundance is large. The most common measure that has been used is the value of primary commodity exports as a share of GDP or of total exports. Alternatives include stocks of natural resources, or measures of sales or stocks of different types of commodities; and many different normalizations of each type of measure can also be used.

For some of the mechanisms discussed in the literature, there is a concern that measures used to identify these mechanisms do not measure what we think they measure. For example, in motivating their research and interpreting their result, Collier and Hoeffler focus on resources such as diamonds and drugs. Yet these commodities are unlikely to be captured by the measure they employ—the share of primary commodity exports in GDP. Illegal commodities are certainly excluded and diamond flows are also likely not to figure in official data, at least when states are weak. The Collier and Hoeffler measure and Fearon and Laitin's (2003) oil measure also *include* reexports—primary commodities that are shipped through the country but not necessarily produced within the country. Hence, in Collier and Hoeffler's data, Singapore appears as one of the most natural-resource-dependent economies, while Sudan and Burma feature as countries with among the lowest levels of dependence on natural resources. Such reexports bear no relation to the stories provided by Collier-Hoeffler and Fearon and Laitin.

Even ignoring these issues, there is a problem that data that has been used is not sufficiently fine to distinguish between those mechanisms for which effects operate through the impacts of resources on the desires and calculations of a small number of political actors, as suggested by the greedy rebels mechanism or the feasibility mechanism, and mechanisms that function through deeper economic and social structures such as suggested by the sparse networks mechanism.

As a first cut at responding to these shortcomings, I collected new data on the archetypical lootable resource: diamonds. The diamonds data is taken from the *Mining Annual Review* (various years), the *Metals and Minerals Annual Review* (various years), and the *Diamond Registry* (based on U.S. Geological Survey data). The advantage of this measure is, first, that it is more fine grain than export data presently employed, but second, that the sources do not rely only on export data but also on information gathered from actors in the industry and information provided by mining corporations, in particular the sources attempt to provide estimates of total diamond production, including diamonds that are exported clandestinely. The measures of diamonds differ from those used by Lujala, Gleditsch, and Gilmore (2005 [this issue]) insofar as they do not contain either information regarding where in the country the diamonds are mined or whether they derive from alluvial or kimberlite sources; they have an advantage, however, in that they record quantities mined and not simply the existence or number of mining sites.

I then collected a measure of the level of production and proven reserves of oil—a less lootable resource but one whose benefits are still subject to capture by small number of actors. The measure of oil production records the average amount of oil extracted per day in a given year, measured in millions of barrels per day. The oil data is derived from measures reported in the *BP Statistical Review of World Energy*/*BP Statistical Review of the World Oil Industry* (various years), PennWell Corporation's *Oil & Gas Journal*, the U.S. Department of Energy, the *OPEC Bulletin*, and *Petroleum Economist*. In cases where there are differences in a single source between contemporaneously published figures and later figures, I use the latest figures under the assumption that these correct for past reporting errors and may better reflect private information at the time. In cases where there are differences between sources, I use a simple average of the estimates of the multiple sources.[33]

One important difference between this measure and other measures used in the literature, such as those used by Fearon and Laitin (2003) and Ross (2003), is that it does not include oil reexports and so allows us to distinguish between extraction, which involves large rents, and the more industrial oil processing sector. Unlike the Fearon and Laitin variable, the measure used here is continuous.

The measure of estimated reserves is recorded in billions of barrels and is somewhat vaguely defined as "the volume of oil remaining in the ground that geological and engineering information indicate with reasonable certainty to be recoverable from known reservoirs under existing economic and operating conditions." The oil reserves data is derived from the same sources as listed above. The correlation between the production and reserves measures is .65 while these two have a correlation with measure

33. After interpolation, if no source reports known reserves, then it assumed that that known reserves are 0. Problematic cases with known production but no reported reserves include Indonesia (1973-1980), Nigeria (1971-1980), Russia (1993-1997). Dropping these cases results in a loss of about 5 percent of the observations in Table 1 but leaves the core results on the difference between the effects of production and the effects of reserves unaltered; dropping these cases in Table 2 results in loss in observations of more than 20 percent and does alter the results, leaving only reserves significant in model III and both reserves and production significant in model VI. The results in Table 4 become stronger when these cases are dropped.

Fearon and Laitin (2003) oil-exporting states dummy variable of .36 and .46, respectively.

A primary advantage of these oil measures is that they allow us to distinguish between oil produced in the past and oil still in the ground and, hence, of potential value in the future. Measured in quantities, conversion factors and published prices allow for conversion of these measures into values.[34] Below, however, I simply use measures of total production, plus production per capita.

Finally, as a rough measure of economic structures, I use the recorded share of agricultural value added in national income, drawn from the World Bank's (2003) *World Development Indicators*.

WEAK STATES, SPARSE NETWORKS, AND BOOTY FUTURES

These measures allow us to test a number of the mechanisms relating to conflict onset identified in section 2.

Consider first the sparse networks mechanism. I argued that the effects of natural resource dependence may derive primarily from its impacts on the *structure* of economies rather than through the particular rent-seeking incentives that natural resources provide for government or rebel elites. If indeed what matters is the weakness of economic integration within a country, then we should expect to see conflict risks arising in nonindustrial economies (after conditioning on national income) whether or not these countries possess natural resource wealth, narrowly defined. If so, the problem of primary commodity dependency may be more general than the problem of natural resource dependency. For the purpose of this study, I use the share of agriculture in national income as a measure of economic structure.

Tables 1 and 2 report on tests of these ideas. The models reported use Fearon and Laitin's (2003) data and model of civil war onset as a baseline but employ a rare events logit specification (King and Zeng 1999) and add alternative measures of economic activity (brief descriptions of all other variables are provided in Table 5). I begin in Table 1 by looking at the African sample—that is, at those cases that motivated much of the discussion above. I then turn to the global sample in Table 2.

The results in equation V of Table 1 indicate that there are indeed effects associated with structural features of economies, as measured by the degree of agricultural dependence of economies—an effect likely to be picked up by studies that use primary commodities as a proxy for natural resources. The magnitude of the coefficients are such that a rise in agricultural dependence from an African mean of 33 percent (about the level of Cote d'Ivoire in 1990) to one standard deviation above the mean to 50 percent (about the level of Sierra Leone in 1990) increases the chances of conflict onset by about 1.5 percentage points, all else being equal (all other variables set at their means, 95 percent confidence intervals: 0.3 to 3.3 percentage points).

The results in equation V indicate furthermore that these effects are independent of effects related to oil and diamonds. This lends prima facie support to the notion that the

34. The data set attached to this article includes an annual index of oil prices along with code to replicate the results of this article using the value of oil production rather than quantities.

TABLE 1
Differential Effects? Africa Sample
(Dependent Variable: FL Measure of Civil War Onset)

Independent Variable	*I*	*II*	*III*	*IV*	*V*	*VI*
Oil production (per capita)	13.137		14.635			14.229
	(1.49)		(1.88)*			(2.00)**
Oil reserves (per capita)		2.074	1.38			1.502
		(0.54)	(0.63)			(0.79)
Diamond production (per capita)				0.592		0.539
				(3.53)***		(3.97)***
Agricultural value added as share of GDP					0.038	0.04
					(2.28)**	(2.37)**
Observations	1,482	1,503	1,482	1,482	1,283	1,283

NOTE: All the variables reported above were entered with a one-period lag. All equations were estimated using rare events logit and post-1960 data. Controls in all equations include Fearon and Laitin's (FL; 2003) measures of Lag of War, Lag of GDP, Log of Population, Log of Mountainousness, Non-Contiguity, Instability, Democracy, Ethnic Fractionalization, Religious Fractionalization. Absolute value of robust z-statistics shown in parentheses.
*Significant at 10%. **Significant at 5%. ***Significant at 1%.

problem of primary commodity dependence is not simply one of the availability of lootable or obstructable resources but may also relate to structural feature of economies and how these structure social relations. These findings, identified in the African sample, are in evidence in the global sample in Table 2; more weakly in equation V and more strongly in equation VI.

Nonetheless, the estimated coefficients on the oil and diamond measures in equation V of Tables 1 and 2 also suggest that while economic structures matter, the problem is not simply one of "modernization" or the lack of it, but an outcome of the political incentives resulting from particular types of natural resource commodities: oil and diamonds. We now try to distinguish between these incentives.

I noted above that the "weak states" and the "grievance" mechanisms linking resources to conflict could be distinguished from some "greedy rebels" mechanisms insofar as the former would indicate a relationship between past production and conflict and the latter suggests a relationship between future production potential and conflict. One way to study this relationship econometrically is to look for different impacts of historical oil production and the potential for future oil production, as measured by reserves. Turn then to the estimated coefficients on the measures of oil production and of proven reserves in Table 1. We see here evidence of a positive relationship between conflict onset and past oil production, at least once we control for oil reserves. The size of the coefficient is such that an increase in production from 0 to 0.1 barrels per person per day (roughly the level produced in the Republic of Congo in 1997) is associated with a rise in the chances of a conflict onset by about 5 percentage points (all other variables held at their means; 95 percent confidence intervals are 0.15

TABLE 2
Differential Effects? Global Sample
(Dependent Variable: FL Measure of Civil War Onset)

Independent Variable	*I*	*II*	*III*	*IV*	*V*	*VI*
Oil production (per capita)	2.38		4.61			2.954
	(3.93)***		(4.43)***			(6.24)***
Oil reserves (per capita)		0.353	–0.254			0.182
		(5.31)***	(1.05)			(2.59)**
Diamond production (per capita)				0.549		0.516
				(3.67)***		(5.09)***
Agricultural value added as share of GDP					0.021	0.025
					(1.87)*	(2.17)**
Observations	5,208	5,240	5,208	5,208	3,721	3,721

NOTE: All the variables reported above were entered with a one-period lag. All equations were estimated using rare events logit and post-1960 data. Controls in all equations include Fearon and Laitin's (FL; 2003) measures of: Lag of War, Lag of GDP, Log of Population, Log of Mountainousness, Non-Contiguity, Instability, Democracy, Ethnic Fractionalization, Religious Fractionalization. Absolute value of robust z-statistics shown in parentheses.
*Significant at 10%. **Significant at 5%. ***Significant at 1%.

and 17.5 percentage points).[35] Importantly, however, we find no similar evidence of a correlation between reserves and conflict, once we control for production. These patterns are also found at the global level. Both production and reserves enter significantly in equations I and II of Table 2. The marginal effect of oil is, however, much weaker in the global sample compared to the African sample, a similar rise from 0 to 0.1 barrels per person in the global sample is only associated with a 0.4 percentage point rise in the probability of conflict onset. As with the African sample, the coefficient on reserves loses significance once we account for production in equation III of Table 2. In equation V, estimated using a more restricted sample, the coefficient on reserves enters significantly, but its effect, controlling for production, is substantively much weaker than the effect estimated in equation II. This evidence is then supportive of the weak state structures and the resource grievances hypotheses (although it cannot distinguish between them) but fails, particularly for the African subsample, to provide support for the greedy rebels mechanism, greedy outsiders mechanism, or booty futures variant of the feasibility mechanism.

35. These effects, though strong in this model, are, as in previous work on natural resources, highly sensitive to the sample and the model used. In some of the equations, significance on the coefficients of interest is lost when a standard logit specification is used rather than a rare events logit specification, and in some cases, relationships are no longer significant when total resources rather than per capita resources are used. The data files that accompany this paper also provide results for nonrare events logit and logit fixed effects specifications. In the nonrare events version, which is subject to bias, much weaker results are found for the per capita measures, although many of the results for aggregate quantities are not affected. No effects are identified for either oil or diamonds in fixed-effects specification, indicating that most of the effects are due to cross-national rather than intertemporal variation. The results are robust to the taking the log of the oil measures.

THE POLITICAL ECONOMY OF EXTRACTION HYPOTHESIS

We have some evidence then that natural resources relate to conflict through their impacts on state capacity. In section 4, however, I discussed a somewhat more complex relationship between resources and state strength, indicating that the degree to which natural resources have adverse effects depends on *prior* levels of state strength. In that discussion, I suggested the use of a simple interaction specification to test the idea that whether lootable resources lead to conflict will depend on the degree of state strength.

To test this hypothesis, I again use the new measures of oil. And for a more lootable commodity, I focus again on diamond production. Measuring state strength—or specifically the strength of institutions that can distribute wealth efficiently—poses numerous problems. I use three proxies, all of which are imperfect. The first is Fearon and Laitin's (2003) measure of political instability—whether a state has undergone a large change in its political institutions over the past three years. Such changes may, but need not, indicate weakness of state structures. The second measure is a combination of Fearon and Laitin's instability measure and their "anocracy" measure: it takes the value of 1 if a state is a robust democracy or a robust dictatorship and a 0 otherwise. The third measure I employ is Evans and Rauch's (1999) measure, designed to record the "Weberianness" of state structures. A major drawback of this measure, however, is that it has no time series component and covers relatively few countries.[36] All three measures are likely to be endogenous to conflict; if conflicts or expected conflicts weaken state capacity, especially in resource-dependent states, then this will bias us towards finding a result different from zero.

In Table 3, I report the results of the tests of interactive effects between the three natural resource measures and the three state strength measures. In general, I find that while (with the exception of the Weberianness measure), the state strength measures and the natural resources measures typically enter significantly and with the expected sign, the interaction term typically fails to enter significantly. The exception is for the case of oil production; here I find weak evidence that oil production has especially adverse effects in weak states. The coefficients in equations I and II indicate that past oil production has an adverse effect on all polities but that this effect is augmented for weak states. The coefficients in equation III indicate that for this measure of state strength, past oil production is associated with higher risks of conflicts in weak states but may in fact be associated with lower risks in strong states. This effect captures the Snyder-Smith thesis quite well. It is only however observed for the case of oil production—and, notably, is not found for the case of diamonds production—and in all cases the estimated coefficients in the interaction terms attain significance only at the 90 percent level.[37]

36. As this measure is time-invariant, I employed it in both a cross-section and as a fixed effect in a panel.

37. These results are in general weaker when total measures rather than per capita measures are used. The exception is that in this case, one of the interactive terms on diamonds enters significantly, but this again appears to be a fragile result.

TABLE 3
The Political Economy of Extraction:
Global Sample (Dependent Variable: FL Measure of War Onset)

	I	*II*	*III*	*IV*	*V*	*VI*	*VII*	*VIII*	*IX*[a]
Measure of Natural Resources	*Oil Production (Per Capita)*			*Oil Reserves (Per Capita)*			*Diamonds Production (Per Capita)*		
Measure of Strength/Weakness	*Instability*	*Strong*[b]	*Weberian*	*Instability*	*Strong*[b]	*Weberian*	*Instability*	*Strong*[b]	*Weberian*
Natural resources	2.415	8.537	–89.911	0.336	0.956	1.603	1.11	0.937	3,204.00
	(3.94)***	(3.36)***	(1.70)*	(5.67)***	(1.25)	(0.16)	(4.27)***	(3.19)***	(.)
Strength/weakness	0.595	–0.466	–0.056	0.646	–0.51	–0.051	0.618	–0.517	–0.047
	(2.39)**	(1.67)*	(0.72)	(2.57)**	(1.80)*	(0.66)	(2.49)**	(1.85)*	(0.55)
Interaction term	10.978	–5.313	18.572	0.974	–0.588	1.368	–0.004	0.543	–800.649
	(1.82)*	(1.93)*	(1.93)*	(0.43)	(0.76)	(1.24)	(0.01)	(1.27)	(.)
Observations	5,170	5,167	1,339	5,170	5,167	1,339	5,170	5,167	1,339

NOTE: All the variables reported above were entered with a one-period lag. All equations were estimated using rare events logit and post-1960 data. Controls in all equations include Fearon and Laitin's (2003) measures of Lag of War, Lag of GDP, Log of Population, Log of Mountainousness, Non-Contiguity, Instability, Democracy, Ethnic Fractionalization, Religious Fractionalization. Absolute value of z-statistics reported in parentheses. Note that approximately 25 percent of observations are lost due to missing data when reserves are added.

a. Computational problems encountered in estimating equation IX.

b. "Strong" is given by (1 – Instability) × (1 – Anocracy).

*Significant at 10%. **Significant at 5%. ***Significant at 1%.

EVIDENCE ON CONFLICT DURATION MECHANISMS

To help distinguish between some of the rival mechanisms that may link natural resources and conflict duration, I construct a simple duration model like that described in section 4.

The duration model uses data from the Fearon and Laitin data set to construct a binary variable indicating whether, conditional upon the existence of a conflict, the conflict ends in a given year. Data based on Barbara Walter's conflict termination data set and qualitative sources was then used to split this dichotomous measure into a three-way variable that takes the value 0 if a conflict is ongoing in a given year, 1 if a conflict is resolved through military means, and 2 if a conflict is resolved through a negotiated settlement. Further information on these variables can be found in Walter (1997, 2002) and Fearon and Laitin (2003).[38] The method employed to relate different measures of natural resources to this outcome variable is multinomial logit.[39]

As explanatory variables, I introduce a series of controls alongside the measures of diamond production and oil production and reserves. The effects of each of the resource measures on duration are a priori ambiguous. Introducing the diamond measure is intended to help distinguish between the fragmented organizational structures mechanism and the domestic conflict premium mechanism, which can have opposite implications for duration depending on whether a victory or a negotiations channel is pursued. Introducing the oil measure, meanwhile, is intended to help distinguish between the military capability mechanism and the possibility of pork mechanism, in particular to help determine whether desires to capture oil revenues are more likely to encourage compromise at the negotiation table or one-sided support on the battlefield.

Hence, the model allows us to parse some of the duration mechanisms discussed above. Insofar as it focuses only on "internal" factors, the model is incomplete and a caveat is in order: since external factors are likely to be correlated with the natural resource measures employed in this model, their exclusion may induce omitted variable bias. There are also potential endogeneity problems—the data suggest, for example, that oil production typically rises over the course of a conflict—and reserves fall—whereas diamonds production falls during the course of a conflict.

With these caveats in mind, we turn to the results of the model in Table 4. The model suggests that natural resources are associated with *shorter* conflicts—this is supported both for the oil measures and for diamond production. This finding is counterintuitive because there are a number of well-known long conflicts in countries rich in natural resource—notably Sudan, Columbia, and Angola. It also runs contrary to many

38. In cases where these sources disagreed, Fearon and Laitin (2003) codings were generally employed after consultation with other sources. In some instances, the differences in dates implied different types of terminations from those recorded by Walter (1997). For example, where Walter records a successful settlement in Lebanon in 1976, I record the war as ending with a military victory in 1990; whereas Walter records the war in Tajikistan as ending in 1994 without a settlement, I record it as ending in 1997 with a settlement. In cases where conflict in the Fearon and Laitin data set were not in Walter, secondary sources were used to determine the form of termination, using Walter's coding rules.

39. See Beck, Katz, and Tucker (1998) on the relation between logit models and duration models.

TABLE 4
Conflict Duration Model with Victory and Negotiation Channels

Dependent Variable	*I*	*II*	*III*	*IV*	*V*	*VI*	*VII*	*VIII*	*IX*
Independent Variable	*"Pooled" Termination*	*Channel 1 Victory*	*Channel 2 Negotiation*	*"Pooled" Termination*	*Channel 1 Victory*	*Channel 2 Negotiation*	*"Pooled" Termination*	*Channel 1 Victory*	*Channel 2 Negotiation*
Diamond production	0.1	0.086	0.141						
	(2.31)**	(1.84)*	(1.38)						
Oil reserves				0.022	0.02	–0.099			
				(1.66)*	(1.63)	(0.49)			
Oil production							0.378	0.38	0.093
							(2.16)**	(2.28)**	(0.19)
Year	0.013	–0.005	0.076	0.014	–0.004	0.075	0.01	–0.009	0.076
	(0.87)	(0.29)	(2.01)**	(0.88)	(0.28)	(1.98)**	(0.64)	(0.55)	(2.00)**
Polity score	–0.009	–0.061	0.137	0.001	–0.048	0.139	–0.004	–0.053	0.137
	(0.36)	(1.84)*	(2.27)**	(0.04)	(1.47)	(2.30)**	(0.14)	(1.62)	(2.30)**
Population (logged)	–0.479	–0.327	–1.106	–0.454	–0.313	–0.967	–0.525	–0.398	–1.029
	(3.00)***	(2.12)**	(3.47)***	(2.79)***	(2.07)**	(3.11)***	(3.07)***	(2.46)**	(3.23)***
Ethnic fractionalization	–1.677	–1.53	–2.567	–1.566	–1.439	–2.294	–1.544	–1.457	–2.36
	(2.50)**	(1.94)*	(2.19)**	(2.38)**	(1.84)*	(2.01)**	(2.32)**	(1.86)*	(2.06)**
Africa dummy	0.065	–0.042	0.74	0.225	0.134	0.824	0.267	0.218	0.843
	(0.17)	(0.10)	(0.99)	(0.59)	(0.31)	(1.12)	(0.70)	(0.50)	(1.15)
Constant	–23.611	10.663	–145.14	–24.857	10.129	–143.072	–17.13	19.906	–144.931
	(0.78)	(0.34)	(1.93)*	(0.80)	(0.32)	(1.92)*	(0.55)	(0.62)	(1.93)*
Observations	794	794	794	797	797	797	794	794	794

NOTE: Regression also includes three cubic splines (produced using Beck, Katz, and Tucker's [1998] methodology). For all multinomial logit models, application of the Hausman test suggests that we cannot reject the null that the independence of irrelevant alternatives (IIA) hypothesis is indeed satisfied. The Small-Hsiao test (but not the Hausman test) suggests that the IIA assumption is violated for the diamonds model (and that the probability of negotiation success, relative to no termination, depends on the probability of military victory). The Small-Hsiao, like the Hausman test, does not reject the null of IIA for either of the oil models.
*Significant at 10%. **Significant at 5%. ***Significant at 1%.

hypotheses and claims in the literature.[40] Despite the well-known cases of long wars, a larger range of other cases make the general relationship, controlling for other factors. In particular, there are many cases of long wars in countries that have little or no oil or diamonds: in the data set, these include the conflicts in Afghanistan, Sri Lanka, Ethiopia, Mozambique, and Somalia, which all lasted for more than fifteen years. And there are also many cases of short wars in countries that do have these resources; these include the Biafran war in Nigeria, the Shaba insurgencies in Zaire (1978), the Kurdish/Shiite revolts in Iraq (1991), and conflicts in Azerbaijan (1992-1994), Georgia (1992-1994), Croatia (1995), Central African Republic (1996-1997), and Yemen (1994).

Let us turn now to the mechanisms. In equations 2 and 3 (and similarly, equations 5 and 6, and 8 and 9) of Table 4, conflict termination is disaggregated into settlements and victories. Strikingly, we see that for both oil and diamond production, disaggregating the paths to peace suggests that natural resource abundance is associated with easier military victories. But in neither case is there evidence that natural resources facilitate or obstruct negotiated settlements. This provides clues as to *why* natural resource conflicts may be shorter.

Consider first the organizational structures mechanism and the results on diamonds. If revenues from diamond sales are more likely to benefit rebels than governments, and should they lead to more fragmented rebel organizational structures, then, as suggested above, there are two opposite implications that this may have for conflict duration: it may make military victory over rebels easier but negotiated settlements more difficult. The evidence in Table 4 suggests that the first channel may be salient but provides no support to the second channel. Instances of military victories in diamond-rich countries include the relatively short Zairian conflicts ending in 1965 and 1978. Although there were multiple attempts at negotiation in Sierra Leone in Angola, those conflicts also ended with the military defeat of the rebel groups and the disintegration of their organizational structures. The result provides evidence against the conflict premium mechanism: If combatants in diamond-rich areas are primarily concerned with accumulating wealth during wartime, then we should expect little success of negotiations. The fact that diamond production is not associated with lower chances of success for negotiations is then inconsistent with this argument.[41]

The results on oil in equations IV through IX of Table 4 suggest that although oil conflicts end quickly, this is not due to their benign influence on negotiations: we find no evidence in support of the possibility of pork mechanism.[42] In the case of oil production, we find some evidence that oil conflicts are associated with faster military victories; this is consistent with the discussion of the military balances mechanism

40. Ross (2004b), for example, suggests that commodities that are lootable (such as diamonds) and commodities that are obstructable (such as oil) should both lead to longer wars. Bannon and Collier (2003) note that conflicts are likely to make countries even more dependent on natural resources and thereby make conflicts more difficult to resolve.

41. A stronger test of the conflict premium mechanism would, however, require the use of information on contraband.

42. The effects are qualitatively similar when per capita data is used for both production and reserves—the oil measures are positively related to victory and negatively related to negotiation, while the diamond measures are positively related with both—however, the estimated relations are generally weaker.

TABLE 5
Descriptions and Summary Statistics for Key Variables Used in the Analysis

Variable	*Units*	*Mean*	*Min*	*Max*	*Source*
War Onset	Binary: Did a civil war begin this year?	0.02	0	1	Fearon and Laitin (FL; 2003)
War Ongoing?	Binary: Is there a war ongoing this year?	0.15	0	1	FL
Log of Population	Quantity (logged)	9.05	5.40	14.03	FL
GDP PPP	Thousand Dollars	3.96	0.13	66.74	FL
Polity Index	Index	–0.58	–10	10	FL
Mountainousness	Log of the percentage of mountainous terrain	2.11	0	4.56	FL
Noncontiguous	Binary	0.16	0	1	FL
Ethnolinguistic Fragmentation	Index	0.40	0.00	0.93	FL (Russian Measure)
Religious Fractionalization	Index	0.38	0	0.78	FL
Instability	Binary: Has the countries score on the Polity democracy scales shifted in the past three years?	0.15	0	1	FL
New State?	Binary: Is the state no more than two years old?	0.03	0	1	FL
Anocracy	Binary: Is the state neither a full democracy nor a full dictatorship?	0.20	0	1	FL
Africa Dummy	Binary: Is state an African state?	0.28	0	1	FL
Oil Production	Millions of barrels per day	0.29	0	12.28	See text
Oil Production/ Per Capita	Barrels per person per day	0.05	0	5.14	Constructed
Oil Reserves	Billion barrels	3.45	0	263.5	See text
Oil Reserves/ Per Capita	Thousand barrels per person	0.88	0	176.97	Constructed
Diamonds production	Million metric carats	0.37	0	43.80	See text
Diamond Production/ Per Capita	Carats per person	0.07	0	13.31	Constructed
Agricultural Production as a Share of GDP	Percentage: Value of Agricultural Production in GDP	22.30	0.14	78.02	World Bank (2003)
State strength	Binary = (1 – Instability) × (1 – Anocracy)	0.73	0	1	Constructed
Weberianess	Scale: How Weberian is the state bureaucracy?	7.10	1	13.5	Evans and Rauch (1999)
Conflict Termination "Disaggregated Measure"	0 = conflict continued, 1 = conflict ended in victory for one side, 2 = conflict ended through negotiations	0.10	0	2	Constructed from FL and Walter (1997, 2002) data

above. There, we noted that the implications of natural resource wealth for the ability of one side to defeat the other are indeterminate without finer information on military balances and control over resources. However, in cases where benefits accrue only after the end of the war, we expect a relationship between conflict duration and the incentives to provide military support to one side or the other: in these cases, outsiders invest if they expect conflicts to be short, and they invest so as to make them short.

A review of the cases suggests that international action was indeed important and likely led to rapid termination of many of these oil conflicts, although this support was not always and everywhere in support of governments. Military victory came relatively quickly, for example, for the government of Nigeria in the Biafran war; in this case, even though France had interests in supporting the breakaway state, massive support by the British for the sovereign state of Nigeria gave the government the resources needed for military victory. However, governments were often on the losing side, and even when they were successful, the role of international actors was often ambiguous. Gulf states, for example, were divided over how to respond to the war in Yemen in 1994, with some providing support for the secessionist south and others supporting the north.[43] Strikingly, the north's ability to benefit from its sovereign status was hampered: UN Security Council Resolution 931 prevented arms from flowing to *either* side. Meanwhile, during the war, one company, CanadianOxy, that continued to pump oil, placed the government's share of the oil funds in an escrow account, only paid out after the end of the conflict.[44]

6. CONCLUSIONS

Prominent research has focused on correlations without constructing tests to identify particular mechanisms that may underlie those correlations. And much of this work has arbitrarily favored one mechanism to the exclusion of others. This article has suggested a series of ways to correct this; it has highlighted tests that can be constructed to check for the workings of rival mechanisms, and it has made progress in using these techniques to begin to parse these different mechanisms.

The empirical regularities presented in this article give grounds for favoring some of the many explanations over others. Nonetheless, econometric tests of the effects of natural resources on conflicts, including those presented here, continue to suffer from severe problems of data, model specification, and in particular a sensitivity of coefficient estimates to variations in model specification (see Fearon 2005 [this issue]). In this article, I have found evidence to support some mechanisms and reported the lack of support for others, but I have not constructed sufficient tests to distinguish between all the mechanisms identified in sections 2 and 3. As mechanisms become unpacked, increasingly more fine grain becomes required to differentiate arguments satisfactorily. Chief among the measures now needed are better indicators of the composition of government revenues, their sources and uses; reliable measures of state strength;

43. "Oil States Accused of Meddling in Yemen," *Le Monde*, June 12-13, 1994.
44. "Oil Firms Return to Yemen," *Agence France Presse*, July 25, 1994.

better indicators of the role of foreign interests in domestic oil production; and measures of the relative strengths of rival forces in a conflict.

In closing, I turn to the policy implications of this work. The importance of focusing on mechanisms for the study of civil wars is not simply that explanations with finer grain are intrinsically more satisfactory to the mind. It derives also from the fact that public policy responses require stories about who is doing what and why. Different stories underlying a single correlation have different implications. Given the caveats above, the following are among the implications of the results from the work presented here.

First, countries dependent on agricultural commodities are at risk, independent of their endowments of oil and diamonds. Sierra Leone was vulnerable not simply because it had gems but because it had not gone through a process of industrialization and held within it clusters of rural communities with relatively weak commercial ties between them. In identifying at-risk countries and in engaging in conflict prevention alongside initiatives to clean up particular commodity trades, there is a need to pursue strategies of diversification more aggressively, directed at bringing countries outside of dependence on primary commodities more broadly defined.

Second, this research finds stronger support for the weak state structures and grievance hypotheses than for the booty futures or state capture hypotheses. This, coupled with the somewhat weaker result that natural resources have especially adverse effects in countries that already have weak states, suggests a redirection of policy priorities. Policy priorities from previous research have focused on protecting assets from capture and cutting off rebel financing. While these initiatives are important, the analysis in this article indicates that greater gains could be achieved by focusing more on better management of the extraction process and better usage of resource revenues that are controlled by states. This result, consistent with a now vast literature on the resource curse (see, for example, Karl 1997), suggests a series of policy responses.

One, to limit grievances induced as part of extraction, is to better regulate the actions of extractive industries. This could be done by requiring corporate compliance with protocols such as the United Nations draft "Norms on the Responsibilities of Transnational Corporations and Other Business Enterprises with Regard to Human Rights" or by corporate participation in voluntary mechanisms such the Global Compact; and it can be supported by resource rich states participating in initiatives such as the Extractive Industries Transparency Initiative.

Another is to focus on tackling the ways in which natural resource revenues weaken state structures or induce grievances. This can be done by better management of intertemporal revenue paths, through the establishment or permanent funds and stabilization funds and rules that place caps on annual government expenditure, as, for example, is provided for under Sao Tome and Principe's oil revenue management law (2004). Another way to achieve this is to prededicate resource revenues to social development, as done in the Chad revenue management law. Governments can also reduce the grievances associated with natural resources by providing better public information about how and where revenues are earned and spent and allowing for oversight of these expenditures by civil society groups. The 2004 Sao Tome oil revenue management law emphasizes these principles and guarantees a role to parliamen-

tary oppositions in overseeing the expenditure of oil monies; the Chadian law, however, has comparatively weak provisions for public access to information. A more radical possibility is to rid the government of natural resource revenues outright—by distributing all revenues directly to citizens—as suggested recently for Nigeria by Sala-i-Martin and Subramanian (2003). This has the advantage that private citizens may spend these revenues better than their governments do and that governments may start trying to satisfy constituencies and building capacity to raise revenues, rather than relying on rents.

Third, this research has found evidence that natural resource conflicts are more likely to end quickly and are more likely to end with military victory for one side rather than with a negotiated settlement. One likely reason is that in the presence of lootable resources, rebel structures are weaker and the groups more vulnerable to defeat. Evidence from survey research suggests, for example, that regular fighters in Sierra Leone's RUF had little loyalty to the movement and would have been ready to drop arms well before Britain finally moved in.[45] Another reason is that once conflicts begin in areas with resources whose benefits accrue only after conflicts end, external actors with interests in those sectors have incentives to support one side or the other with a view to bringing the war to a rapid close. These results suggest reasons to support one-sided military interventions in resource conflicts. But they also provide a reminder that whatever the interests of the citizens of the countries involved, outside actors are *prone* to one-sided engagement in natural resource conflicts, directly or indirectly, and sometimes inducing regime change and producing deadly effects. Both of these factors—the opportunity for engagement in resource wars and the existence of incentives for individual nations to engage in resource wars unilaterally—imply that the policy debate should focus more urgently on establishing workable criteria for determining what regimes should be supported and when external strategies of regime change should be pursued.

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45. Humphreys and Weinstein (2004).

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