The Incidence of Civil War: Theory and Evidence*

Timothy Besley
London School of Economics and CIFAR

Torsten Persson
IIES, Stockholm University and CIFAR

September 25, 2008

Abstract

This paper studies the incidence of civil war over time. We put forward a canonical model of civil war, which relates the incidence of conflict to circumstances, institutions and features of the underlying economy and polity. We use this model to derive testable predictions and to interpret the cross-sectional and times series facts about the incidence of conflict. Our most novel emprical finding is that variation in the world market prices of exported and imported commodities are strong and significant predictors of the within-country incidence of civil conflict.

*We are grateful to participants in the CIFAR meeting in Calgary, especially Jim Fearon, for comments, to David Seim for research assistance, and to CIFAR, the ESRC, and the Swedish Research Council for financial support.

1 Introduction

Violent internal conflict plagues many states in the world. Counting all countries and years since 1950, the average yearly prevalence of civil conflict is about 7%, with a peak of more than 12% in 1991 and 1992, according to the Correlates of War data set. Figure 1a shows the variable time trend in the worldwide prevalence of civil war. The cumulated death toll of these conflicts is now approaching 20 million people.[1] Obviously, it is of first order importance to understand the forces behind this source of human suffering.

The aims of this paper is to develop a theoretical model of the economic and institutional determinants of conflict, and to use this model to interpret the incidence of civil conflict in the data. This twofold purpose is rooted in our belief that is very hard to empirically investigate the causes of civil war without beginning from an explicit theory. We view this paper as a first step along a path with joint and iterative development of theory and empirical work in this area. In both the theoretical and empirical sphere, we are fortunate in being able to build on a number of prior contributions.

Classic theoretical models of conflict, such as those suggested by Grossman (1991) and Skaperdas (1992), have thus been applied to civil war.[2] In common with the model developed here, these authors see conflict as the outcome of an equilibrium process in which the incentives of the various parties are explicitly modeled. Those incentives arise from the technology of conflict, the preferences of the protagonists, and the underlying economic constraints. Much progress has been made on this basis. However, most of the theoretical work has been pursued quite separately from the empirical literature and the models have therefore not generally been formulated to generate predictions about observable variables.[3]

The model in this paper begins with a government and opposition that can mount an insurgency aimed at overthrowing the government. While not every incidence of civil war is captured this way, a large set of cases is (see Fearon (2007) for discussion). Three mechanisms are key to understanding when an insurgency breaks out. The first is the opportunity cost of fighting: when incomes are higher, the cost of insurgency is higher, as is the cost

[1] See Lacina and Gledtisch (2005).

[2] See Caselli (2006) and Chassang and Padro i Miquel (2006) for more recent theoretical contributions.

[3] Fearon (2007) is an exception. However, he follows a rather different modeling aapproach to that adopted here.

of defending against it, simply because the recruiting of fighters is more expensive. This mechanism is key to earlier models such as Grossman's (1991). The second mechanism concerns the nature of the prize that is won by holding office and how this will be distributed given institutional constraints. Better institutional constraints can limit conflict by reducing the incentive to capture the government, whereas larger natural resource rents appropriable by government increase the gain from fighting. The third mechanism concerns the technology for fighting and the likely allocation of political power in the absence of an insurgency.

In recent years, a growing empirical literature has emerged which looks at these general issues (see, for example, Sambanis, 2002 for a broad review). A very robust finding in this literature is that poor countries are disproportionately involved in civil war, even though the direction of causation may be difficult to establish. The concentration to poor countries is shown in Figure 1b, which plots the country-wise incidence of civil war since 1950 (or independence, if later) against GDP per capita in the year 2000. But the interpretation of this correlation is open to debate. Fearon and Laitin (2003) see it as reflecting limited state capacity to put down rebellions, while Collier and Hoeffler (2004) see it as reflecting the lower opportunity cost of fighting in low-income economies.

There is also considerable debate about other prospective drivers of civil war, such as ethnic divisions and political institutions. When it comes to natural resources, results diverge as well. While some authors have found natural resources to significantly raise the probability of onset and/or duration of civil war, other researchers have failed to find such an effect (see Ross, 2004 for a review of the literature on this topic). Most of these studies measures the influence of natural resources by the *between-country* variation in measures such as primary exports over GDP, however, which makes it hard to rule out alternative interpretations of the findings in terms of reverse causation or omitted variables.[4]

There is small emerging literature on modeling conflicting within countries. For example, Deininger (2003) uses community level data from Uganda finding that scarcity of economic opportunities (proxied by infrastructure)

[4]Miguel, Satyanath and Sergenti (2004) use weather shocks to instrument for income in African countries from the 1980s and onwards, and find that lower income raises the probability of civil conflict. Related to the approach in this paper, Bruckner and Ciccone (2007) show that an export price index also predicts growth and that the relationship between growth and civil war is heterogeneous across democracies and non-democracies.

and the presence of cash crops are correlated with the civil strife. Most related to this paper is Dube and Vargas (2008) which exploits variation in coffee and oil prices to model the incidence of conflict within Colombian municipalities.

The main empirical contribution of the paper is to look at the incidence of conflict, controlling for unobserved causes behind the uneven incidence of civil war across countries and time by fixed country effects and fixed year effects. Specifically, we show that country-specific price indexes constructed for agricultural products, minerals and oils (using 1980 as a base year) have considerable explanatory power in predicting the *within-country* variation of conflict. The fact that we exploit time variation in world market prices for commodities makes it implausible to argue that long-run aspects of political, economic, cultural or social structure are driving the results. We also show that the effect is heterogeneous across political institutions, in a way entirely consistent with the theory. In particular, the international price effects are only present where political institutions are weak, but absent (or opposite in sign) where political institutions are strong.

The remainder of the paper is organized as follows. The next section develops our model. Section 3 discusses some preliminaries needed to go from model to empirical implementation, while Section 4 describes the data used in our empirical work. Section 5 discusses the empirical results in two parts: we first look entirely at cross-sectional differences, and then move along to longitudinal results exploiting within-country variation. Section 6 concludes.

2 Basic Model

Our aim is to build a model that is simple and tractable and, at the same time, serves as a useful guide for how observable economic and political factors determine the probability of violent domestic conflict.

Any model that generates conflict as an equilibrium outcome relies on either imperfect information or inability of the parties to commit to (post-conflict) strategies. The key friction in our model is of the second type: the inability of any prospective government to credibly offer post-conflict transfers, and the inability of potential insurgents to commit not to use their capacity to engage in conflict.

There are two groups: A and B. Each group makes up one half of the

population. Time is infinite and denoted by $s = 1, ...$ One generation is alive at each date and is labelled according to the date at which it lives. At the beginning of each period, members of the group that held power at the end of the previous period inherit a hold on the incumbent government, denoted by $I_{s-1} \in \{A, B\}$. The other group makes up the opposition, denoted by $O_{s-1} \in \{A, B\}$. The incumbent group can mount an army, denoted by $L^{I_{s-1}}$, and financed out of the public purse. Power can be transferred by peaceful means, but the opposition can also mount an insurgency with armed forces $L^{O_{s-1}}$ and try to take over the government. The winner of armed conflict becomes the new incumbent and the loser the new opposition, denoted by $I_s \in \{A, B\}$ and $O_s \in \{A, B\}$.

The new incumbent gets access to existing government revenue, from taxes and natural resources, which is denoted by R_s. The revenue is divided between spending on general public goods G_s and transfers to the incumbent T^{I_s} and the opposition T^{O_s}. Revenues are stochastic and drawn afresh each period from a known distribution function $D(R)$ on finite support $R \in [R_L, R_H]$. The precise timing of these different events/decisions are spelled out below.

Individual incomes and utility Individuals supply labor in a common labor market to earn an exogenous wage w_s. We assume that individuals have utility functions

$$\alpha_s H(G_s) + c^{J_s} , \tag{1}$$

where c^{J_s} is private consumption by group $J_s \in \{I_s, O_s\}$ and G_s is the level of public goods provided, with the parameter α_s reflecting the value of public goods. The function H is increasing and concave and α_s is distributed identically and independently over time on support $[\alpha_L, \alpha_H]$ with c.d.f. $K(\alpha)$.

The government budget constraint in period s can be written

$$\sum_{J_s \in \{I_s, O_s\}} \frac{T^J}{2} - G_s + R_s - w_s L^{I_{s-1}} \geq 0 , \tag{2}$$

where $L^{I_{s-1}}$ are resources committed to the army by the previous incumbent.[5]

[5] This formulation assumes that the new incumbent pays for the army ex post, honoring any outstanding "war debts".

Institutions As mentioned above, power can be transferred between groups according to democratic principles, or by a violent conflict in which each group raises armed forces $L^{J_{s-1}}$ to fight. The probability that group O_{s-1} wins power and becomes the new incumbent I_s is

$$\gamma\left(L^{O_{s-1}}, L^{I_{s-1}}\right) \ , \tag{3}$$

which depends on the resources devoted to fighting – function γ is increasing in its first argument and decreasing in the second. In this formulation, $\gamma(0,0)$ is the probability of a peaceful transition of power between the groups.[6] Below we make a specific assumption on the functional form of (3).

Each group (when in opposition) has the power to tax/conscript its own citizens to finance a private militia in order to mount an insurgency. We denote this capacity by ν so $L^{O_{s-1}} \leq \nu$ which is common to the two groups so that neither has a greater intrinsic capability to fight. This formulation sweeps aside the interesting issue of how it is that an opposition can solve the collective action problem in organizing violence.

Political institutions are assumed to constrain the possibilities for incumbents to make transfers to their own group. To capture this as simply as possible, assume that a politician must give $\sigma \in [0,1]$ to the the opposition group, when it makes a transfer of 1 to its own group implying that $T^O = \sigma T^I$. Given this assumption, we use the government budget constraint (assuming that it holds with equality) to obtain:

$$T^{I_s} = 2(1-\theta)\left[R_s - G_s - w_s L^{I_{s-1}}\right] \ , \tag{4}$$

where $\theta = \frac{\sigma}{1+\sigma} \in [0, 1/2]$. Throughout, we interpret a higher value of θ as more representative, or consensual, political institutions. The real-world counterparts of a high θ may be a more proportional electoral system, or more minority protection through a system of constitutional checks and balances. If $\theta = 1/2$, then transfers are shared equally across the two groups.

Timing The following timing applies to each generation s:

1. The value of public goods α_s and natural resource rents R_s are realized.

[6] This follows the symmetry of the model in giving neither of the groups an intrinsic advantage of gaining power peacfully. However, the model could be extended to allow for this. If $\gamma(0,0) < 1/2$, there is a pro-incumbent bias, perhaps due to party recognition or media control.

2. Group O_{s-1} chooses the level of any insurgency $L^{O_{s-1}}$.

3. The incumbent government chooses the size of its army $L^{I_{s-1}}$.

4. Group I_{s-1} remains in office with probability $1-\gamma\left(L^{I_{s-1}}, L^{O_{s-1}}\right)$.

5. The winning group becomes the new incumbent I_s and determines policies, i.e., a vector of transfers and spending on public goods: $\left\{\left\{T^{J_s}\right\}_{J_s\in\{I_s,O_s\}}, G_s\right\}$.

6. Payoffs for period s are realized, consumption takes place, and the currently alive generation dies.

We solve the model by working backwards to derive a sub-game perfect equilibrium.

2.1 Equilibrium policies

Suppose now that we have a new incumbent determined at stage 4 above. Then, using (4), the optimal level of public goods is determined as:

$$G_s = \arg\max_{G\geq 0}\left\{\alpha_s H\left(G_s\right) + 2\left(1-\theta\right)\left[R_s - G_s - w_s L^{I_{s-1}}\right] + w_s\right\} \ . \qquad (5)$$

Define $\hat{G}\left(z\right)$ by

$$H_G\left(\hat{G}\left(z\right)\right) = \frac{1}{z} \ .$$

We record the policy solution as:

Lemma 1 *For given R_s and α_s, public goods are provided as:*

$$G_s = \min\left\{\hat{G}\left(\frac{\alpha_s}{2\left(1-\theta\right)}\right), R_s - w_s L^{I_{s-1}}\right\} \ .$$

There are two cases. If α_s is large enough and/or R_s small enough, all public spending goes to public goods and any incremental revenues are spent on public goods. Otherwise, the optimal level of public good is interior and increasing in α_s and θ. Intuitively, transfers to the incumbent's own group become more expensive as θ increases. In the special case when $\theta = 1/2$, we get the same amount of spending on public goods as the amount that would be chosen by a Utilitarian planner. With an internal solution for G_s, any residual revenue is spent on transfers which are distributed according to the θ-sharing rule.

2.2 The strategy of conflict

We now study the process of conflict looking for an equilibrium, in which first the opposition decides whether to mount an insurgency and then the incumbent government chooses how to respond. As we show below, the equilibrium has three possible regimes. In the first, no resources are committed to conflict by either side, i.e. peace prevails. In the second, there is no insurgency, but the government uses armed forces to repress the opposition and increase its chances to remain in power. In the third case, there is outright conflict where both sides are committing military resources to a civil war.

Using the results in the last subsection, it is easy to check that the expected payoff of the incumbent is:

$$\hat{V}^I\left(\alpha_s, R_s; L^{O_{s-1}}, L^{I_{s-1}}\right) = \alpha_s H\left(G_s\right) + w_s \tag{6}$$

$$+\left((1-\theta) - \gamma\left(L^{O_{s-1}}, L^{I_{s-1}}\right)(1-2\theta)\right) \ .$$

The key term is $\left((1-\theta) - \gamma\left(L^{O_{s-1}}, L^{I_{s-1}}\right)(1-2\theta)\right) > 1/2$, which is the weight the incumbent attaches to end-of period transfers. This weight depends on the institutional restriction on transfers as well as on the probability of a transition in power.

For the opposition group, we have

$$\hat{V}^O\left(\alpha_s, R_s; L^{O_{s-1}}, L^{I_{s-1}}\right) = \alpha_s H\left(G_s\right) + w_s\left(1 - L^{O_{s-1}}\right) \tag{7}$$

$$+\left(\theta + \gamma\left(L^{O_{s-1}}, L^{I_{s-1}}\right)(1-2\theta)\right) 2\left[R_s - G_s - w_s L^{I_{s-1}}\right] \ ,$$

where $\left(\theta + \gamma\left(L^{O_{s-1}}, L^{I_{s-1}}\right)(1-2\theta)\right) \leq 1/2$ is the opposition's weight on expected transfers.

These payoffs functions expose a key asymmetry in the model between the incumbent and opposition in terms of financing the army. The incumbent's army is publicly financed and reduces future transfers. For the opposition, any insurgency must be financed out of the group's own private labor endowment given the power to tax its own citizens.

The two payoff functions also express the basic trade-off facing the two parties. On the one hand, higher armed forces have an opportunity cost. On the other hand, for given armed forces of the other party, they raise the probability of capturing or maintaining power and take advantage of the monopoly on government revenue. To study the resolution of these countervailing incentives, we make the following assumptions:

Assumption 1

(*a*) *The technology for conflict is:* $\gamma\left(L^O, L^I\right) = \mu\left[L^O - \xi L^I\right] + \gamma^O$
(b) $\xi \geq 1$
(c) $\mu\xi \leq \gamma^O \leq 1 - \mu\nu$.

Part (a) assumes that a "linear probability model" governs the outcome of conflict. Part (b) says that the government has an advantage in fighting. Restriction (c) on parameters guarantees that the probability of turnover stays strictly between 0 and 1, and will hold if μ is small enough. Under these assumptions, we get a straightforward characterization of conflict regimes in terms of the size of the public revenues. This particular conflict function is chosen mainly for analytic tractability – specifically, it gives a simple closed-form solution to the conflict stage of the model.[7] This will enable us to generate specific predictions to take to the data.

To solve for the equilibrium level of conflict, define $Z_s = R_s - G_s$ as the level of "uncommitted" government revenues, i.e., the amount that can maximally be spent on transfers (given equilibrium public-goods provision). The conflict equilibrium can then be described in terms of two threshold values for Z_s, namely:

$$\underline{Z}_s = \frac{w_s}{\mu\left(1-2\theta\right)}\left[\frac{1-\theta-\gamma^O\left(1-2\theta\right)}{\xi}\right] \tag{8}$$

and

$$\overline{Z}_s = \frac{w_s}{\mu\left(1-2\theta\right)}\left[1+\frac{\theta+\gamma^O\left(1-2\theta\right)}{\xi}\right] \ . \tag{9}$$

It is straightforward to check that Assumption 1(b) implies $\overline{Z}_s > \underline{Z}_s$. Note that both threshold values are increasing in the level of wage income.

Under Assumption 1, we have the following result (which is proved in the Appendix):

Lemma 2 *There are three possible regimes:*

1. *If* $Z_s < \underline{Z}_s$*, the outcome is peaceful with* $\widehat{L}^{O_{s-1}} = \widehat{L}^{I_{s-1}} = 0$*.*
2. *If* $Z_s \in \left[\underline{Z}_s, \overline{Z}_s\right]$*, there is no insurgency* $\widehat{L}^{O_{s-1}} = 0$*, but the incumbent government chooses armed forces to repress the opposition such that:*

$$\widehat{L}^{I_{s-1}} = \frac{1}{2}\frac{\left(Z_s - \underline{Z}_s\right)}{w_s} \ .$$

[7] The linear conflict model is also exploited in Azam (2005).

3. If $Z_s > \overline{Z}_s$, there is civil war where the opposition mounts armed forces

$$\widehat{L}^{O_{s-1}} = \frac{\xi\left(Z_s - \overline{Z}_s\right)}{w_s} \ ,$$

and the government chooses an army:

$$\widehat{L}^{I_{s-1}} = \frac{1}{w_s}\left[Z_s - \frac{\overline{Z}_s + \underline{Z}_s}{2}\right] \ .$$

The Lemma describes three cases. When Z_s is below $\underline{Z}_s$, no conflict erupts as both the incumbent and the opposition accept the (probabilistic) peaceful allocation of power, where the opposition takes over with probability γ^O. For $Z_s \in \left[\underline{Z}_s, \overline{Z}_s\right]$, the government invests in armed forces to increase its survival probability, but the opposition does not invest in conflict. Finally, when $Z_s > \overline{Z}_s$, the opposition mounts an insurgency, which is met with force by the government.

Two sources of government advantage lie behind these results. On the one hand, the government can fund its army out of public revenues. On the other hand, we have assumed that $\xi \geq 1$, which reflects a comparative advantage of government forces.

It is straightforward to compute the equilibrium probability that the opposition win office as:

$$\hat{\Gamma}^O\left(Z_s\right) = \begin{cases} \gamma^O & Z_s \leq \underline{Z}_s \\ \gamma^O - \frac{\mu\xi}{2w_s}\left[Z_s - \underline{Z}_s\right] & Z_s \in \left[\underline{Z}_s, \overline{Z}_s\right] \\ \gamma^O - \frac{\mu\xi}{2w_s}\left[\overline{Z}_s - \underline{Z}_s\right] & Z_s \geq \overline{Z}_s \ . \end{cases}$$

As Z_s increases, the probability of the incumbent losing office diminishes when the government represses the opposition. However, once a civil war breaks out, additional increases in Z_s do not change the expected outcome of the conflict even though both groups commit more resources to fighting.

The result in Lemma 2 also allows us to derive the size of the transfers received by the winning group as a function of the level of tax revenues. To this end, define

$$\hat{T}\left(Z_s\right) = \begin{cases} Z_s & Z_s \leq \underline{Z}_s \\ \frac{\left[Z_s + \underline{Z}_s\right]}{2} & Z_s \in \left[\underline{Z}_s, \overline{Z}_s\right] \\ \frac{\left[\bar{Z}_s + \underline{Z}_s\right]}{2} & Z_s \geq \overline{Z}_s \end{cases}$$

as the net revenue function. Equilibrium transfers are thus:

$$T^{I_s} = (1-\theta)\, 2\hat{T}\left(Z_s\right) \text{ and } T^{O_s} = \theta 2\hat{T}\left(Z_s\right) \ .$$

While the transfers are weakly monotonic in Z_s, it is easy to see that under civil war (where $Z_s \geq \overline{Z}_s$), there is super crowding out of additional public revenue. The incumbent government has a unitary marginal propensity to spend on the army out of additional resources, while the opposition continues to spend more resources on its insurgency in an effort to capture those resources. This implies that additional resources above $\overline{Z}_s$ yields a Pareto inferior outcome![8]

To unpack the implications of the model for the incidence of conflict, it is necessary to understand what determines the distribution of Z_s and the threshold values given by (8) and (9), in particular the way in which they depend upon the parameters of the model. Such knowledge will allow us to match the predictions of the model to the cross-sectional and longitudinal patterns in the data.

3 From Theory to Evidence

In this section, we discuss how our proposed theory can inform empirical studies of the incidence of civil war. Although the model is extremely simple, it gives a clear and transparent set of predictions how parameters of the economy and the polity affect the incidence and severity of conflict. A clear advantage of beginning from the theory is that it allows us to discuss which parameters are country specific and time specific, which are observable, and which are unobservable.

We begin by defining the level of "equilibrium" non-committed government revenue for country c at date s as:

$$Z_{c,s}\left(\alpha_{c,s}, R_{c,s}; \theta_c\right) = R_{c,s} - \hat{G}\left(\frac{\alpha_{c,s}}{2\left(1-\theta_c\right)}\right) \ . \tag{10}$$

[8] Observe also that our model does not deliver the paradox of power result from Hirschleifer (1991). Because of the symmetry in the model, none of the parties has a systematically weaker incentive to invest in an army. This would not be true in a model like the one in Besley and Persson (2008b), where the incumbent internalizes the preference of the opposition more or less depending on political institutions.

The *incidence* of conflict in country c at date s is then characterized by the *probability* that:

$$Z_{c,s}\left(\alpha_{c,s}, R_{c,s}; \theta_c\right) > \overline{Z}_{c,s} = \psi\left(\theta_c, \mu_c, \xi_c, \gamma_c^O\right) w_{c,s} = \psi_c w_{c,s} \ , \qquad (11)$$

where the country-specific multiplier of the wage is a function $\psi(\cdot)$ defined by

$$\psi\left(\theta, \mu, \xi, \gamma^O\right) = \frac{\xi + \theta}{\xi\mu\left(1 - 2\theta\right)} + \frac{\gamma^O}{\mu\xi} \ .$$

Condition (11) illustrates the basic trade-off mentioned above between the opportunity cost of fighting and rasing the probability of winning the redistributive cake.

To operationalize an empirical model based on (11), three issues must be dealt with. First, one has to make decisions on measurement of the key parameters. Second, it is necessary to take a stance on what is fixed (at the country level) and what is time varying. Third, an empirical specification must be found that makes plausible distinctions between what is endogenous and what is exogenous to the process generating civil conflict.

Beginning with measurement, decent empirical proxies can be found for $w_{c,s}$, $R_{c,s}$, and θ_c. There are readily observable sources of data on whether a country is in civil war, but we have no clear-cut indicator for whether it is in a repression regime. However, below we discuss some possible measures of repression like political rights and military spending. The other determinants of civil war are unobservable (or very hard to measure). Among these unobservables, we treat the conflict technology parameters μ_c, ξ_c and γ_c^O as fixed, but allow the demand for general interest public goods α_s to vary over time, as it does in the model. In all cases, these unobservables become part of the error process assumed to help generate our data.

To move to the data, consider country c at date s. Let $\varepsilon_{c,s} = \hat{G}^c(\frac{\alpha_{c,s}}{2(1-\theta_c)})$ denote the randomness induced by fluctuations in the demand for public goods. Now, $\varepsilon_{c,s}$ will have a c.d.f. $X^c(\varepsilon - A_c)$ on the support $[0, \hat{G}^c(\frac{\alpha_{H\ c,s}}{2(1-\theta_c)})]$ where A_c is the country specific mean of $\varepsilon_{c,s}$. Using condition (11) in the theoretical model, we can define the conditional probability that a researcher observes conflict in country c at date s as

$$X^c(R_{c,s} - \psi\left(\theta_c; \mu_c, \xi_c, \gamma_c^O\right) w_{c,s} - A_c) \ . \qquad (12)$$

It follows that an increase in $R_{c,s}$ or a decrease in $w_{c,s}$ in a given period s raises the probability of observing civil war, unless θ is not to close to its maximum

value. The reason for the qualification is that when $\theta \to \frac{1}{2}$, $\psi \to \infty$. Because $R_{c,s}$ has finite support, $R_{c,s} - \psi\left(\theta_c; \mu_c, \xi_c, \gamma_c^O\right) w_{c,s} < 0$, which is below the support of $\varepsilon_{c,s}$. By continuity, X^c is thus increasing in $R_{c,s}$ and decreasing in $w_{c,s}$ only as long as θ_c is below some upper bound $\overline{\theta}_c < \frac{1}{2}$.

In similar vein, we can also consider the *intensity of conflict*, which we take to be a monotonic function of the total amount of resources devoted to fighting, conditional on being in conflict, and is given by:

$$w_{c,s}\left(L_c^{O_s} + L_c^{I_s}\right) = \left[\left(Z_{c,s} - \overline{Z}_{c,s}\right)\xi_c + Z_{c,s} - \frac{\overline{Z}_{c,s} + \underline{Z}_{c,s}}{2}\right] . \tag{13}$$

This too depends on the underlying institutional determinants and economic conditions.

We study the empirical determinants of conflict in two steps. We begin by considering what can be learned solely from between-country variation, looking at cross-section evidence on the prevalence of conflict across countries. Then, we look at within country-variation which only exploits the variation of conflict over time. In this second step, we will also flesh out the economic model to make explicit which role commodity-price fluctuations might play in affecting conflict.

3.1 Between-Country Variation

Consider the cross-sectional implications implied by the average value of (12) over a country's history. The average incidence of civil war can be derived from the unconditional probability of observing conflict in country c, viz.

$$E\{X^c(R_{c,s} - \psi\left(\theta_c; \mu_c, \xi_c, \gamma_c^O\right) w_{c,s} - A^c); \overline{R}^c, \overline{w}^c\} , \tag{14}$$

where $\overline{R}^c$ is the country-specific mean of resource rents $R_{c,s}$ and $\overline{w}^c$ is the country-specific mean of wages.$w_{c,s}$. The model gives a series of predictions about how changes in parameters affects the cross-country pattern of conflict.

Our first result considers the effect of public good preferences α_s on conflict:

Proposition 3 *An increase the average value of general public goods expenditures A^c reduces the cross-sectional incidence of conflict.*

To understand this in terms of the theory, observe that an increase in α_s, reduces $Z_s(\alpha_s, R_s; \theta)$ because $\hat{G}$ is an increasing function. In fact, for large enough α_s, we have $Z_s(\alpha_s, R_s; \theta) = 0$, which guarantees a peaceful outcome. By reducing the conflict over redistributive transfers, demand for public goods also reduces conflict over the state. This finding is quite difficult to test in the data. However, one crude fact in support of this finding is that there is a strong negative correlation in the data between the incidence of external wars and civil conflict.[9]

Our second result concerns the impact of economic development on conflict:

Proposition 4 *An increase in average wages $\overline{w}^c$ reduces the incidence of conflict.*

By (11), an increase in w_s raises the critical bound $\overline{Z}_s$ for civil war. Intuitively, higher real incomes increases the opportunity cost of raising an army and hence reduces the likelihood that the opposition (and the incumbent) will wish to fight. It also reduces the intensity of conflict since both groups find it more costly to fight when the opportunity cost cost is higher.

The next result concerns political institutions:

Proposition 5 *More consensual political institutions, an increase in the value of θ^c, reduce the cross-sectional incidence of conflict.*

This works through several channels. More consensual institutions increase spending on public goods via the function $\hat{G}$ and thereby decreases the *size* of the redistributive cake. They also raise the lower bound for conflict as $\psi\left(\theta, \mu, \xi, \gamma^O\right)$ is increasing in θ. This captures the fact that consensual institutions reduce the value of holding power, since the incumbent now captures a smaller *share* of the redistributive cake. The total resources expended on conflict are also lower when institutions improve.

Finally, we consider the impact of government revenue triggered by higher natural resource rents:

Proposition 6 *An increase in the average level of natural resource rents $\overline{R}^c$ increases the cross-sectional incidence of conflict.*

[9] Of the total country-years in our panel data set, only a share 0.0018 have simultaneous extranal and internal conflict.

This works by increasing Z_s and hence the likelihood that R_s lies above the conflict threshold. For a given opportunity cost of armed forces, the redistributive prize of winning becomes higher. It also clear from (13) that, as Z_s goes up, so do the resources devoted to conflict.

In a panel of countries of length T, the unconditional probability of civil war converges to the sample average in country c of a binary civil war indicator (which takes a value of 1 when the country is in civil war and a value of 0 otherwise), as $T \to \infty$. The data points in Figure 1b display precisely such sample averages.

Let $civ_{c,s}$ be a dummy variable denoting whether country c is in civil conflict at date s. Then in a cross sectional setting, we average this variable over time for the period 1960 to 1997 and then run regressions of the form:

$$\overline{civ}_c = a + by_c + \kappa_c \ ,$$

where y_c is a suitably chosen vector of measures of institutions and economic characteristics. We discuss in greater detail below how to define this vector to reflect the predictions of the model.

3.2 Within-Country Variation

The theoretical predictions at the within-country level are related to those that we derived in the previous sub-section. It is of particular interest to use time variation in $\theta^{c,s}$, $w_{s,c}$ and $R_{c,s}$ to explain the time-varying incidence of civil conflict. To isolate plausibly exogenous variation in the latter two variables, we wish to exploit time variation in import and export prices determined in world markets. To this end, we begin by developing a simple micro-founded model to illustrate how prices of importable and exportable raw materials impact on wages and natural resources rents, and hence on the incidence of civil war over time (according to our original model).[10]

Suppose that a small open economy produces an exported good, the price of which in period s, p_s is given from world markets. The export good is produced using a fixed factor k_c which varies by country and can be thought of as land, mines, or oil wells (measured in efficiency units). Since we are interested in the short-run effect of raw materials prices, we assume that the

[10] See Dube and Vargas (2008) for an alternative model of how commodity prices can affect the incidence of conflict.

production function has fixed coefficients, i.e.:

$$Y_{s,c}^{x} = \min\left\{l_{s,c}^{x}, k_c\right\} \ ,$$

where $l_{s,c}^{x}$ is the quantity of labor used in producing the export good in country c. As long as $p_s > w_{s,c}$, then $l_{s,c}^{x} = k_c$, and

$$R_{s,c} = k_c \left(p_s - w_{s,c}\right)$$

are the rents earned on the fixed factor which we assume accrue to government.

Another sector produces a (tradeable or non-tradeable) consumption good from labor and an imported raw material, which is denoted by $m_{s,c}$ with (given) price q_s. The price of this good is set equal to one (i.e., we let it be the numeraire good). Production in this sector also uses fixed coefficients so that:

$$Y_{s,c}^{m} = \min\left\{\zeta_c l_{s,c}^{m}, m_{s,c}\right\} \ .$$

We assume that:

$$\zeta_c < k_c < 1 \ \text{ and } \zeta_c \left(1 - q_s\right) < p_s \ ,$$

which guarantee that both sectors produce.

The equilibrium demand for raw material inputs is:

$$m_{s,c} = \zeta_c l_{s,c}^{m} = \zeta_c (1 - l_{s,c}^{x}) = \zeta_c \left[1 - k_c\right] \ .$$

We assume that production in the importables sector is competitive and, because of constant returns, leads to zero profits. The equilibrium wage is then determined from

$$\left[1 - k_c\right]\left[\zeta_c \left(1 - q_s\right) - w_{s,c}\right] = 0 \ ,$$

or

$$w_{s,c} = \zeta_c \left(1 - q_s\right) \ .$$

In this case:

$$\frac{\partial w_{s,c}}{\partial q_s} = -\zeta_c \ ,$$

i.e. the wage is decreasing in the price of importable raw materials.

Using this simple model, we get the following prediction on the impact of prices of raw materials on the incidence of civil war.

Proposition 7 *The incidence of civil war is increasing in raw material import prices, q_s and export prices p_s, provided that the inclusiveness of political institutions θ_c fall below some upper bound $\overline{\theta}_c$.*

By (12) we want to investigate the impact of commodity prices on $Z_{c,s} - \overline{Z}_{c,s}$. Now observe that:

$$\frac{d(Z_{c,s} - \overline{Z}_{c,s})}{dp_s} = \frac{dR_{c,s}}{dp_s} = k_c > 0.$$

A higher price of exported commodities thus raises the probability of observing conflict, since the latter is increasing in $Z_{c,s} - \overline{Z}_s$. For the price of imported raw materials, we have:

$$\frac{d(Z_{c,s} - \overline{Z}_{c,s})}{dq_s} = \left(\frac{dR_{c,s}}{dw_{c,s}} - \frac{d\overline{Z}_{c,s}}{dw_{c,s}} \right) \frac{dw_{c,s}}{dq_s} = \zeta_c(k_c + \psi_c) > 0 \ .$$

Intuitively, a higher price of imported raw material lowers the wage, which raises rents in the export sector and, hence, the prize for winning ($Z_{c,s}$). The lower wage also has a direct positive effect on the probability of observing conflict, by lowering the opportunity cost of fighting and hence the conflict threshold ($\overline{Z}_{s,c}$). The qualification in the later part of the proposition follows from the argument right below (12).

While this simple two-sector model is special in having fixed coefficients, the mechanism it describes would hold with the possibility of factor substitution, as long as this is not too great. The basic economics is clear. Higher prices for exported commodities has a direct effect on civil war by increasing rents. The effect of higher imported commodity prices comes from the fact that they reduce the demand for labor in the importables sector and hence puts downward pressure on the wage.

This analysis justifies our focus on the following empirical model of the incidence of civil conflict over time. We estimate panel regressions with a binary civil-war indicator as the dependent variable and with fixed country effects. This is equivalent to estimating:

$$X^c(R_{c,s} - \psi\left(\theta_c; \mu_c, \xi_c, \gamma_c^O\right) w_{c,s}) - E\{X^c(R_{c,s} - \psi\left(\theta_c; \mu_c, \xi_c, \gamma_c^O\right) w_{c,s})\} \ . \quad (15)$$

Proceeding in this way identifies the effect of resource rents and real incomes on the incidence of civil war exclusively from the within-country variation of these variables. The impact of their average values and of the time-invariant

parameters in each country will be absorbed by the country fixed effect. This stands in marked contrast to the existing empirical literature that typically bases the estimates on the cross-country variation in the data.

The heterogeneity in the incidence of conflict at different dates is thus mainly attributed to time variation in factors that affect wages, $w_{c,s}$ and rents $R_{c,s}$. We can also allow for macro shocks in the global economy that hit all countries in a common way through year fixed effects (time indicator variables), which pick up (in a non-parametric fashion) any general trends in the prevalence of civil war such as the ones shown in Figure 1a. Thus, the simplest baseline model emerging from (15) a linear probability model with:

$$civ_{c,s} = a_c + a_s + by_{c,s} + \kappa_{c,s} \tag{16}$$

where a_c are country fixed effects, a_s are year fixed effects. and where $y_{c,s}$ is a suitably defined vector of time-varying regressors to include export and import price indexes for primary commodities. To test the auxiliary prediction that $y_{c,s}$ only has an effect for non-inclusive political institutions (where $\theta_c < \overline{\theta}_c$), we estimate (16) in different samples defined by the political institutions in place.

To take account of country-specific variance in the error term, we always estimate with robust standard errors. While (16) allows for heterogeneity in a flexible way, one econometric concern is that the fraction of countries in civil war is low, which may bias linear probability estimates. To diagnose such bias, we also estimate a conditional (fixed effects) logit model.

4 Data

We explore the incidence of civil war in a panel data set, where each observation is a country year for the period 1960-2000, subject to data availability.

Two main data sources have been used in the empirical literature to identify the incidence of civil conflict. One of our main dependent variables is whether a given country has a civil war in a given year. This indicator variable is obtained from the Correlates of War (COW) data set, which provides annual data on conflicts (from 1816) up to 1997. This indicator takes a value of 1 if the number of deaths in violent conflict in a given country and year exceeds 1000 people. We also use a similar indicator from the Uppsala/PRIO data set on civil war which goes all the way to 2005, and also includes data on the onset of civil war as well as detailed data on the number of battle deaths

in each conflict, which can be used as a proxy for the intensity of conflict. There are some differences in the classifications of wars between the two data sets – the correlation is 0.73. Of the 5279 possible country-year pairs in our period where both data sets are available, there is disagreement in only 292 cases – in 43 of these the COW data classifies a country as being in conflict when Uppsala/PRIO does not; the opposite is true in 259 country-year observations. For example, Turkey is classified as being in conflict between 1984 and 1990 by the Uppsala/PRIO data, but not by the COW data. On the other hand, Thailand is viewed as being in conflict between 1970 an 1973 by COW, but not by Uppsala/PRIO. Since we have no strong prior about which set of judgments is more compelling, we will check the robustness of our results to using both classifications of conflict. However, our main results are based on the COW data.

The means of the main cross-sectional variables are given in Table 1. The table displays summary statistics for three classifications. In the first column, we look at the means (standard deviations in brackets) for all 124 countries for which the main variables are available between 1960 and 2000. We then disaggregate into the 39 countries that have had a civil conflict over this period and those that have not. This gives us a feel for how these two groups vary. Table 1 shows that the overall incidence of conflict during this period is 8%. However, among the countries with any conflict, 27% of the country-year observations are in conflict. A more continuous measure of civil conflict uses battle deaths.[11] However, this is available only for a more limited sample of countries. Unsurprisingly, given the 1000-death threshold, average battle deaths in the non-conflict sample is a tenth of the level among the conflict countries. Looking at the level of military spending and military personnel across the samples, we find little evidence of any difference.

Considering background characteristics of countries, the level of income per capita (from the Maddison data set) is higher among non-conflict states (around three times higher). States having experienced civil wars are also more likely to be oil dependent, with more than 10% of their GDP being generated by oil exports according to the NBER-UN trade data set. The same broad pattern is found when we consider primary products more generally, including minerals and agricultural products.

Table 1 also shows that around 37% of conflict states are democracies, as measured by having a *polity2* variable in the Polity IV data set exceeding

[11] See http://www.prio.no/CSCW/Datasets/Armed-Conflict/Battle-Deaths/

zero, compared to 49% of non-conflict states. We also measure parliamentary democracy by a dummy variable. This is set equal to 1 if the country is democratic according to the *polity2* definition and, at the same time, has a parliamentary form of government (defined as a confidence requirement of the executive vs. the legislature, as in Persson and Tabellini, 2003). Only 15% of country-year observations in conflict states pertain to parliamentary democracies, as against 28% of those in the non-conflict state sample. We also construct a measure of high constraints on the executive, exploiting the *xconst* variable in Polity IV data. This latter variable takes on integer values from 1 to 7 and captures various checks and balances on the executive. We set our indicator equal to 1, when *xconst* takes on its maximum value of 7, and 0 otherwise. Table 1 shows that 31% of country-year observations have high executive constraints among states that have not had a civil war, compared to only 12% among those that have. Finally, we look at a measure of respect for political rights, as reported by Freedom House. The average score among conflict states is 1.93 compared to 3.07 among non-conflict states.

Our study of the within-country pattern of civil conflict will use exogenous time variation in resource rents and real incomes due to changes in commodity prices.[12] Using trade volume data from the NBER-UN Trade data set, and international price data for about 45 commodities from UNCTAD, we construct country-specific export price and import price indexes. Although these go back as far as 1960, they are the data constraining length of the panel that we study. The price indexes for a given country have fixed weights, computed as the share of exports and imports of each commodity in the country's GDP in a given base year (1980). Using the insights from the two-sector model in Section 3.2, we interpret a higher export price index as a positive shock to natural resource rents $R_{c,s}$, and a higher import price index as a negative shock to (real) income $w_{c,s}$. To get another source of exogenous time variation in income, we use data on natural disasters from the EM-DAT data set. Specifically, we construct an indicator variable that adds together the number of floods and heat-waves in a given country and year, assuming that both act as a negative shock to real income.

[12] The method that we follow is similar to Deaton and Miller (1996).

5 Results

5.1 Between-country variation

To investigate the validity of the model predictions discussed in Section 3, we first consider some basic cross-sectional patterns in the incidence of civil war. These parallel the findings that have been discussed in the previous literature. However, it is useful to anchor these cross-sectional facts and to assess their robustness in the context of our model.

To this end, Table 2 presents results from a few cross-sectional regressions. Our basic specification uses the prevalence of conflict (the average number of years in which a specific country has been in conflict between 1960 and 1997) as our dependent variable. All specifications include the log of GDP per capita as a right hand side variable. This serves as a proxy for the average value of the wage for country c, $\overline{w}^c$. In column (1), we find that richer countries are less likely to be involved in conflict than poorer ones – a basic finding of the literature. We also include a dummy variable for whether a country is democratic. Somewhat surprisingly, this turns out to be *positively* correlated with the prevalence of civil war. This suggests either that democracy is correlated with unobervables in the cross-section, that democracy is a poor proxy for consensual institutions as measured by θ^c, or that the correlation between democracy and civil war is more subtle and not well captured by a linear model.[13] Turning to economic structure, we find no evidence, in the cross section, that large oil exporters are more often in civil conflict. However, large (non-oil) primary goods exporters are, *ceteris paribus*, less likely to be involved in a civil conflict. While these results are all interesting, it is quite difficult to interpret them in terms of the theory outlined above.

In column (2), we repeat the specification from column (1) including a dummy variable capturing whether the country is a parliamentary democracy. Arguably, this is a better proxy for θ^c. While this variable is negatively correlated with civil-war prevalence, the correlation is not statistically significant. In column (3), we include an interaction term between parliamentary democracy and whether a country is a large oil or primary products producer. Here, there is some evidence that civil war is more prevalent among large oil producers that are not parliamentary democracies.[14]

[13] For the latter possibility, see Collier and Rohner (2008).

[14] Although a closer look at the data suggests that this is basically a Trinidad and Tobago

Our model suggests that we should look at the possibility of repression as well as conflict. One symptom of repression is poor political rights. We therefore use the Freedom House measure of political rights as a left-hand-side variable in column (4). Better political rights are positively correlated with income per capita and – almost by definition – better in democracies. More striking, however, is the finding that large oil exporting states tend to have poorer political rights, even though they are not more conflictual, suggesting the possibility that the repression regime is more prevalent in that group of states. In column (5), we look at the level of military spending. Here, we find that this is increasing in income per capita and lower in democracies (although less so in parliamentary democracies). However, there is no correlation with whether a country is a large oil or primary products exporter.

While these results are interesting and serve to breath some life into the predictions of the model, the results in Table 2 cannot be given a causal interpretation. The main problem is the likelihood of biases due to unobserved heterogeneity across countries (or time). Many of our right-hand side variables are likely to be correlated with unobservable features of countries such as culture, institutions and history. Moreover, as has been widely recognized in previous work, using purely cross-sectional way at the data, throws away important information about the factors that shape the timing of the onset of civil war and its duration once it begins. It is to this time variation we now turn.

5.2 Within-country variation

Table 3 gives the results from estimating the linear probability specification in (16) on our data. In column (1), we run our basic specification on the whole panel with 124 countries. The estimates show that income per capita is negatively correlated with civil war incidence, in conformity with the cross-sectional results of Table 2. In contrast to the cross-sectional result, being democratic is now negatively to incidence of civil war. This confirms the difficulty of drawing inference from cross-sectional variation in the presence of considerable cross-country heterogeneity. Both GDP per capita and democracy may be simultaneous with the incidence of civil war, however. This is much less likely for the export and import price indexes for agricultural and

effect.

mineral products. Both these indexes are both positively and significantly correlated with the incidence of civil war. On the contrary, the country-specific oil export price does not explain civil war, while the oil import price is negatively correlated with civil war.

As well as being statistically significant, the basic results are also quantitatively important. The results in column (1) of Table 2 imply that a one standard deviation (of the within-country variation) increase in the non-oil export price index raises the probability of civil war by 1 percentage point. This is a sizeable effect, about 11% of the mean probability of civil war in the sample (0.087). The non-oil import price effect is larger, with a one standard deviation hike mapping into a 15% increase in the probability of conflict. These are all average effects. However, the fact that we have constructed a country-specific price index implies that the effect of any given price change will be heterogeneous across countries according to the weights used for constructing the price index. Thus, a change in the world price of a specific commodity will affect the probability of civil war differently across countries given common coefficients of the kind that we have estimated.

Our theory also implies a second kind of heterogeneity. A given change in resource rents or real incomes will only affect the probability of civil war when political institutions are non-inclusive(do not protect minorities) – i.e., when $\theta^c < \overline{\theta}^c$. In columns (2) and (3) of Table 3, we therefore split the sample between parliamentary democracies and non-parliamentary democracies. The pattern for export and import prices differ starkly across these subsamples. Non-oil primary export and import prices are positively correlated with civil war in the non-parliamentary democracies sample, but negatively correlated in the sample of parliamentary democracies. (Also, GDP per capita and oil import prices are no longer significantly related to civil war in the latter group.) This conforms to the prediction in Proposition 7, which gives a key role to θ^c by determining in which equilibrium we expect a particular country to be.

Column (4) of Table 3 further disaggregates the export and import prices into agricultural products and minerals. The data suggest that it is agricultural import and export prices and mineral import prices drive the positive correlation with civil war. In column (5), we add in the weathershock variable, which is available only for a more restricted sample of countries and time periods. As expected, a weathershock is positively correlated with the incidence of civil war. In this sample, oil export prices continue to be statistically insignificant, while oil import prices now have the expected (positive)

sign. For the sake of comparison with the above results, a one standard deviation increase in non-oil export prices, non-oil import prices and oil import prices raises the probability of civil war by, respectively, 14%, 15% and 7%.

Table 4 considers the robustness of this last set of the results to the econometric specification and the estimation sample. In column (1) we report estimates from a conditional (fixed effects) logit model. Since this method effectively drops all countries and years in which there is no civil war, the sample is more restricted (to the 38 countries that have time-series variation in the left-hand side variable). These results confirm the findings of the model in column (5) of Table 3. That is, primary (non-oil) import and export prices are positively correlated with the incidence of civil war, as is the oil-import price index. Within this restricted sample, being democratic has no explanatory power, whereas a higher GDP per capita remains negatively correlated with civil war incidence. In column (2) of Table 4, we estimate a linear probability model on the same sample as the one used in the conditional logit. This is a useful cross-check that the econometric specification is not driving the results, as the results in columns (1) and (2) are essentially similar in economic terms.[15] In columns (3) and (4), we repeat the same exercise on the sample of non-parliamentary democracies that have had a civil war during our time period. The results are again consistent with those presented in Table 3.

The results in column (2) of Table 4 can be used to reassess the economic significance of the findings in column (5) of Table 3, given that the sample of countries is arguably rather different. Now, a one standard deviation increase in non-oil export prices, non-oil import prices, and oil import prices raise the probability of civil war (relative to the mean of the sub-sample) by, respectively, 20%, 11% and 14%. Note, however, that the subsample mean of conflict is as high as 0.28, i.e., more than one country year out of four is a conflict year. Evidently, this sub-group of countries is not only generally susceptible to conflicts, but also particularly so when commodity prices are on the rise.

Table 5 instead assesses the robustness of the results to alternative measurement. Column (1) uses the measure of civil war incidence from PRIO.

[15] As a further check, note that the size of the coefficients in columns (1) and (2) are quite similar when adjusted appropriately, i.e. by multiplying the logit estimates by $\hat{p}\,(1-\hat{p})$ where $\hat{p}$ is the average predicted probability. Since $\hat{p}$ is on the order of 0.3, this means that the cofficients in column (1) should be multiplied by about 0.2 to make them comparable to those in column (2).

Again, the results are quite similar even though the commodity import price index is no longer significant. Column (2) looks at the onset of civil war, which has been extensively studied in the earlier literature. Here, our empirical model offers little explanatory power. This suggests that our time varying regressors are doing a better job at picking out periods with conditions for a civil war to be sustained over time, rather than conditions which are relevant only in periods when a civil war begins.

In column (3), we consider a more continuous measure of conflict – battle deaths. Again, the basic results from Table 3 remain robust: export and import prices are positively correlated with battle deaths. In columns (4) and (5), we assess the robustness of the results to splitting the sample according to whether the country has weak or strong executive constraints. In line with our findings in Table 3, it is only countries with weak executive constraints where civil war incidence is higher in the wake of higher non-oil primary export and import prices.

Finally, in Table 6, we attempt to return to the issue whether some countries, in particular big oil exporters, appear to be repressing rather than fighting a civil war. These results paint a more mixed picture. Column (1) shows military spending and non-oil primary export prices to be positively correlated. In column (2), we look at military personnel and find that military recruitment does indeed appear to respond positively to higher oil export prices. This is suggestive evidence that the repression mechanism may be at work in oil exporting countries. When we consider political rights in column (3). however, we find hard-to-explain evidence that political rights improve in the wake of hiking oil import prices.

6 Concluding Comments

We have put forward a canonical model for thinking about the incidence of civil war. This model enables us to interpret the data and to identify factors that affect the time-series and cross-sectional patterns of conflict. Our main empirical innovation has been to examine the role of primary commodity price variation in affecting the incidence of civil conflict, while controlling for fixed country and year effects. This gets around one of the key worries in the literature, namely that it is unobserved characteristics of institutions, culture and economic structure that are primarily responsible for civil war. Motivated by the theory, we have also shown that the effects of world-market

prices are heterogeneous, depending on whether or not a country is a parliamentary democracy, or has a system of strong checks and balances, which we interpret as proxies for a key model parameter.

The paper brings a complementary perspective to the emerging body of literature on civil conflict. Much work remains to extend our approach of interpreting empirical results through the lens of simple theoretical models. One helpful but limiting feature of the current model is the symmetry between incumbent and opposition. The model can be extended with income inequality so that wage rates are heterogenous. It can also be extended so that groups vary their weighting of national interests (national public goods) and private interests (transfers). The impact of such heterogeneity on conflict is less clear cut than what is often claimed in intuitive reasoning.

Our empirical analysis has not more than superficially picked up a main theme in the existing empirical literature: the distinction between onset and duration of civil war. To keep in line with our general approach, this would require an explicit theory that included the determinants of state dependence. One way to do that would be precisely to introduce group heterogeneity – this would generate state-dependence in the incidence of civil war, as the equilibrium played in the model would depend on the identity of the group in power. Such a theory would thus have to formulate a joint model of civil war incidence and political turnover.

Another major issue that this paper has sidestepped is how conflict affects the process of economic development. A full treatment of this, requires an understanding of the way development shapes the incentives to invest in both private and public capital. Besley and Persson (2008b) use a model related to the one in this paper to analyze how state capacities evolve in response to the prospect of conflict. This includes the incentive to invest in raising tax revenues as well as the incentive to invest in market supporting institutions which increase private productivity. However, as important as it is, a long way remains to go before we can integrate the empirical research programs on civil war and on economic growth.

References

[1] Azam, Jean-Paul, (2005), "The Paradox of Power Reconsidered: A Theory of Political Regimes in Africa," *Journal of African Economies*, 15, 26-58.

[2] Besley, Timothy and Torsten Persson (2008a), "The Origins of State Capacity: Property Rights, Taxation and Politics", forthcoming in the *American Economic Review*.

[3] Besley, Timothy and Torsten Persson (2008b), "State Capacity, Conflict and Development", paper underlying Persson's 2008 Presidential address to the Econometric Society.

[4] Bruckner, Markus and Antonio Ciccone, (2007), "Growth, Democracy, and Civil War", CEPR Discussion Paper No. 6568.

[5] Caselli, Francesco, (2006), "Power Struggles and the Natural-Resource Curse," unpublished typescript, LSE.

[6] Chassang, Sylvain and Gerard Padro i Miquel, (2006), "Strategic Risk, Civil War and Intervention", unpublished typescript, Princeton and LSE.

[7] Collier, Paul and Anke Hoeffler (2004). "Greed and Grievance in Civil War," *Oxford Economic Papers* 56, 563-595.

[8] Collier, Paul and Dominic Rohner, (2008), "Democracy, Development and Conflict," *Journal of the European Economic Association* 6, 531-540.

[9] Deaton, Angus and Ron Miller (1996) "International Commodity Prices, Macroeconomic Performance and Politics in Sub-Saharan Africa," Princeton Studies in International Finance, No. 79, Princeton, NJ, Princeton University, International Finance Section.

[10] Deininger, Klaus, (2003), "Causes and Consequences of Civil Strife: Micro-Level Evidence from Uganda." *Oxford Economic Papers,* 55 (4), 579-606.

[11] Dube, Oeindrila, and Juan Vargas, (2008), "Commodity Price Shocks and Civil Conflict: Evidence from Columbia," unpublished manuscript.

[12] Elbadawi, Ibrahim and Nicholas Sambanis (2002). "How Much Civil War Will We See? Explaining the Prevalence of Civil War", *Journal of Conflict Resolution* 46, 307-334.

[13] Fearon, James (2005), "Primary Commodity Exports and Civil War " *Journal of Conflict Resolution* 49, 483-507.

[14] Fearon, James (2007). "Economic Development, Insurgency and Civil War," in Helpman, Elhanan (ed.), *Institutions and Economic Performance*, Harvard Economic Press, forthcoming.

[15] Fearon, James and David Laitin (2003). "Ethnicity, Insurgency and Civil War", *American Political Science Review* 97, 75-90.

[16] Grossman, Herschel (1991), "A General Equilibrium Model of Insurrection," *American Economic Review* 81, 912-921.

[17] Hirshleifer, Jack (1991), "The Paradox of Power", *Economics and Politics* 3, 177-200.

[18] Humphreys, Macartan (2005), "Natural Resources, Conflict, and Conflict Resolution: Uncovering the Mechanisms," *Journal of Conflict Resolution* 49, 508-537.

[19] Lacina, Bethany Ann and Nils Petter Gleditsch (2005), "Monitoring Trends in Global Combat: A New Dataset of Battle Deaths", *European Journal of Population* 21, 145–165.

[20] Miguel, Edward, Satyanath, Shanker, and Ernest Sergenti (2004), "Economic Shocks and Civil Conflict: An Instrumental Variables Approach", *Journal of Political Economy* 112, 725-753.

[21] Persson, Torsten and Guido Tabellini (2003), *The Economic Effects of Constitutions*, MIT Press.

[22] Ross, Michael (2004), "What Do We Know about Natural Resources and Civil War?", *Journal of Peace Research* 41, 337-356.

[23] Skaperdas, Stergios, (1992), "Cooperation, Conflict, and Power in the Absence of Property Rights," *American Economic Review* 82, 720-39.

7 Proof of Lemma 2

To solve for the Stackelberg equilibrium, we begin by deriving the reaction function of the government to some fixed level of $L^{O_{s-1}}$. Maximizing (6), the first-order condition for the choice of $L^{I_{s-1}}$ is

$$-\left[1-\theta-\gamma\left(L^{O_{s-1}},L^{I_{s-1}}\right)(1-2\theta)\right]w_s+(1-2\theta)\,\mu\xi\left[Z_s-w_sL^{I_{s-1}}\right]\leq 0.$$

Solving for an interior solution, we obtain:

$$w_sL^{I_{s-1}}=\frac{1}{2}\left[L^{O_{s-1}}\frac{w_s}{\xi}+Z_s-\underline{Z}_s\right]. \tag{17}$$

Thus $L^{I_{s-1}}$ is strictly positive for all $Z_s>\underline{Z}_s-L^{O_{s-1}}\frac{w_s}{\xi}$. Thus, a necessary condition for $L^{I_{s-1}}=0$ is $Z_s<\underline{Z}_s$. Below, we will show that this is also sufficient.

Now consider the first order condition to (7) for the insurgent's choice of army, assuming that $L^{I_{s-1}}>0$. This is given by:

$$-w_s+\mu\left(1-\xi\frac{\partial L^{I_{s-1}}}{\partial L^{I_{s-1}}}\right)(1-2\theta)\,2[Z_s-w_sL^{I_{s-1}}]$$
$$-2w_s\left(\left(\theta+\gamma\left(L^{O_{s-1}},L^{I_{s-1}}\right)(1-2\theta)\right)\right)\frac{\partial L^{I_{s-1}}}{\partial L^{O_{s-1}}}\leq 0\ .$$

We can solve this, using Assumption 1(a) and observing that $\frac{\partial L^{I_{s-1}}}{\partial L^{O_{s-1}}}=\frac{1}{2\xi}$, to obtain:

$$-w_s+\mu Z_s-\mu w_s\frac{L^{O_{s-1}}}{\xi}-w_s\frac{\theta+\gamma^O(1-\theta)}{\xi}\leq 0. \tag{18}$$

We now prove the result. A sufficient condition for the insurgent to commit positive resources is that $Z_s\geq\overline{Z}_s$. Observe also that since $\overline{Z}_s>\underline{Z}_s$, $L^{O_{s-1}}=0$ for $Z_s<\underline{Z}_s$ making $Z_s<\underline{Z}_s$ necessary and sufficient for a peaceful equilibrium.

Hence for $Z_s\in\left[\underline{Z}_s,\overline{Z}_s\right]$ we have $L^{I_{s-1}}>0$ with the level in part 2 of the Proposition given from (17). Finally, for $Z_s>\overline{Z}_s$, we find that:

$$\frac{L^{O_{s-1}}w_s}{\xi}=Z_s-\overline{Z}_s \tag{19}$$

where $\overline{Z}_s$ is defined in (9) as long as $L^{O_{s-1}}<\nu$, so the opposition is not constrained buy its revenue raising capacity. Plugging (19) into (17) gives $w_sL^{I_{s-1}}$ as stated in the Lemma. ■

Figure 1: Prevalence of Civil War

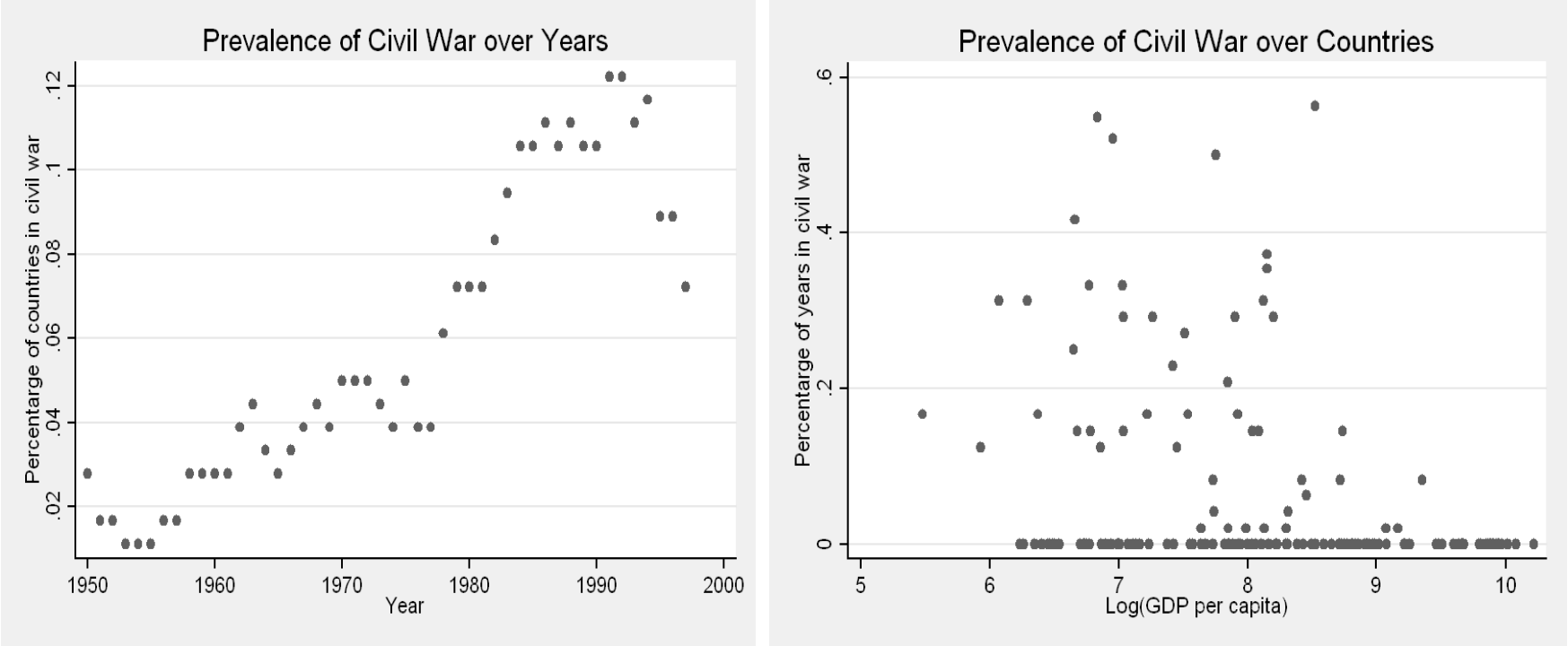

Table 1: Means and Standard Deviation of Important Variables

Variable	Sources	Full Sample	Civil War States	No Civil War States
Civil War	Correlates of War	0.087	0.27	--
		(0.28)	(0.45)	
Battle Deaths (thousands)	PRIO	1.35	2.47	0.26
		(5.59)	(7.55)	(2.00)
Military Personnel Per Capita	World Bank (1985-1997)	0.008	0.008	0.008
		(0.009)	(0.009)	(0.009)
Military Spending Per Capita in 2003 $US	SIPRI (1988-1997)	0.0002	0.0001	0.0003
		(0.0005)	(0.0001)	(0.0006)
GDP per Capita	Maddison	4859	2144	6134
		(5557)	(1698)	(6241)
Large Oil Producer (exports > 10% GDP)	NBER-UN trade data set	0.12	0.15	0.11
		(0.33)	(0.35)	(0.32)
Big Primary Product Producer (exports > 10% GDP)	NBER-UN trade data set	0.29	0.31	0.24
		(0.45)	(0.46)	(0.43)
Democracy	POLITY IV	0.45	0.37	0.49
		(0.50)	(0.48)	(0.50)
Parliamentary Democracy	POLITY IV	0.24	0.15	0.28
	Persson and Tabellini, 2003	(0.43)	(0.36)	(0.45)
High Checks and Balances	POLITY IV	0.25	0.12	0.31
		(0.43)	(0.32)	(0.46)
Political Rights	Freedom House (1972-1997)	2.70	1.93	3.07
		(2.22)	(1.83)	(2.30)

Notes: Standard deviation in parentheses. Data are for 1960-1997 unless otherwise indicated. Political rights is on a 0-6 scale with a higher score denoting better rights protection. There are 39 countries in our core data that have had a civil conflict during the core time period and 85 countries represented in the final column.

Table 2: Between-country correlations

	(1) **Civil War Prevalence**	(2) **Civil War Prevalence**	(3) **Civil War Prevalence**	(4) **Political Rights**	(5) **Military Spending**
Log (GDP per capita)	-0.088***	-0.085***	-0.088***	0.495***	1.644***
	(0.018)	(0.018)	(0.018)	(0.088)	(0.128)
Democracy	0.144***	0.166**	0.172**	3.419***	-0.904**
	(0.048)	(0.069)	(0.071)	(0.524)	(0.451)
Large Oil Exporter	0.067	0.063	0.078	-0.930***	0.148
	(0.041)	(0.042)	(0.047)	(0.291)	(0.483)
Large Primary Exporter	-0.083***	-0.084***	-0.079**	-0.011	-0.058
	(0.030)	(0.030)	(0.037)	(0.188)	(0.255)
Parliamentary Democracy		-0.033	-0.021	0.472	0.543*
		(0.049)	(0.052)	(0.401)	(0.317)
Large Oil Exporter x Parliamentary Democracy			-0.137**		
			(0.058)		
Large Primary Exporter x Parliamentary Democracy			-0.021		
			(0.048)		
Observations	119	119	119	119	107
R-squared	0.209	0.212	0.217	0.819	0.790

Notes: Robust standard errors in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%

Table 3: Within-country determinants of civil war – Basic results

	(1) Civil war in year	(2) Civil war in year	(3) Civil war in year	(4) Civil war in year	(5) Civil war in year
Export price index	0.030**	0.033**	-0.044**		0.094***
	(0.014)	(0.014)	(0.020)		(0.032)
Import price index	0.322***	0.267***	-1.648***		0.525***
	(0.080)	(0.069)	(0.376)		(0.204)
Oil Export Prices	-0.001	-0.001	0.022	-0.001	-0.001
	(0.002)	(0.002)	(0.057)	(0.002)	(0.002)
Oil Import Prices	-0.025***	-0.018***	-0.120	-0.026***	0.071***
	(0.006)	(0.005)	(0.125)	(0.006)	(0.024)
Log(GDP per capita)	-0.091***	-0.106***	-0.008	-0.097***	-0.106***
	(0.014)	(0.015)	(0.037)	(0.014)	(0.019)
Democracy	-0.032**	-0.007)		-0.031**	-0.034**
	(0.013)	(0.015)		(0.013)	(0.015)
Agriculture Export Prices				0.113***	
				(0.033)	
Mineral Export Prices				0.007	
				(0.020)	
Agriculture Import Prices				0.382***	
				(0.122)	
Mineral Import Prices				1.584**	
				(0.620)	
Weathershock					0.014**
					(0.006)
Sample	All	Non-parliamentary democracies	Parliamentary democracies	All	All
Observations	4658	3534	1124	4658	3814
Number of Countries	124	103	49	124	117
R-squared	0.047	0.047	0.067	0.057	0.055

Notes: Robust standard errors in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%.
All specifications include fixed country and year effects

Table 4: Within-country determinants of civil war – Robustness to specification and sample

	(1) Civil war in year	(2) Civil war in year	(3) Civil war in year	(4) Civil war in year
Export price index	2.034***	0.401***	2.575***	0.446***
	(0.629)	(0.099)	(0.682)	(0.109)
Import price index	6.251**	1.111***	5.578	1.038*
	(3.365)	(0.385)	(3.629)	(0.538)
Oil Export Prices	-0.012	-0.001	-0.011	-0.002
	(0.014)	(0.002)	(0.015)	(.0002
Oil Import Prices	5.144**	0.708***	2.749	0.231
	(2.071)	(0.254)	(2.892)	(0.338)
Log(GDP per Capita)	-0.959***	-0.215***	-1.873***	-0.310***
	(0.356)	(0.050)	(0.422)	(0.054)
Democracy	-0.372	-0.059*	-0.285	-0.036
	(0.227)	(0.034)	(0.254)	(0.042)
Weathershock	0.128	0.022	0.124	0.018
	(0.094)	(0.014)	(0.117)	(0.015)
Estimation method	Conditional logit	OLS	Conditional logit	OLS
Sample	Civil war countries	Civil war countries	Civil war non-parl. democracies	Civil war non-parl. democracies
Observations	1282	1488	1067	1067
Number of countries	38	38	34	34
R-squared		0.132		0.120

Notes: Standard errors in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%.
All specifications include fixed country and year effects

Table 5: Within-country determinants of civil war – Alternative measurement

	(1) **Civil War Incidence (PRIO)**	(2) **Civil War Onset (PRIO)**	(3) **Battle Deaths (thousands)**	(4) **Civil War Incidence (COW)**	(5) **Civil War Incidence (COW)**
Export price index	0.107***	-0.019	1.716***	0.104***	-0.031
	(0.032)	(0.015)	(0.366)	(0.034)	(0.027)
Import price index	0.345	0.056	10.512*	0.716***	-1.552***
	(0.243)	(0.076)	(6.178)	(0.222)	(0.330)
Oil Export Prices	-0.001	-0.001	-0.021	-0.001	-0.056
	(0.002)	(0.001)	(0.024)	(0.002)	(0.052)
Oil Import Prices	0.042	-0.002	1.614	0.058**	0.027
	(0.017)	(0.006)	(3.623)	(0.023)	(0.103)
Log(GDP per capita)	-0.087***	-0.007	0.483	-0.145***	0.066*
	(0.019)	(0.008)	(0.769)	(0.021)	(0.040)
Democracy	-0.031**	-0.002	0.023	-0.048***	
	(0.014)	(0.002)	(0.334)	(0.018)	
Weathershock	0.019***	-0.001	0.000	0.006	0.014
	(0.006)	(0.002)	(0.085)	(0.007)	(0.010)
Sample	All	All	All	Low Executive Constraints	High Executive Constraints
Observations	3989	3989	2195	2797	1017
Number of Countries	116	116	80	98	56
R-squared	0.060	0.013	0.041	0.065	0.091

Notes: Robust standard errors in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%.
All specifications include fixed country and year effects

Table 6: Within country determinants of political repression

	(1) **Log of Military Expenditure Per Capita (SIPRI)**	(2) **Log of Military Personnel per Capita (World Bank)**	(3) **Political Rights (Freedom House)**
Export price index	0.408***	0.111	0.043
	(0.112)	(0.103)	(0.179)
Import price index	0.581	0.289	-1.433
	(1.689)	(0.666)	(1.015)
Oil Export Prices	-0.038	0.032***	0.007
	(0.048)	(0.009)	(0.004)
Oil Import Prices	-0.012	-0.099	0.281**
	(0.036)	(0.156)	(0.142)
Log(GDP per capita)	0.594***	0.066	0.009
	(0.137)	(0.099)	(0.097)
Democracy	0.006	-0.105**	
	(0.045)	(0.049)	
Weathershock	-0.010	-0.007	-0.017
	(0.012)	(0.008)	(0.002)
Observations	1192	1449	3135
Number of Countries	106	118	118
R-squared	0.099	0.082	0.098

Notes: Robust standard errors in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%.
All specifications include fixed country and year effects.