Domestic Conflict and Credit Constraint

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Abstract

This study explores the potential link between domestic conflict (such as civil war) and credit constraint. We build a theoretical model which shows that domestic conflict increases with the easing of credit constraint. The theoretical channels also establish evidence of multiple equilibria, i.e., low level of conflict is associated with low credit constraint and high level of conflict is associated with high credit constraint in presence of feedback from domestic conflict to credit constraint. Our empirical findings generally validate the theoretical conjectures. Using battle deaths as a proxy for the level of conflict and private credit by deposit money banks and other financial institutions as a proportion of GDP as the measure of credit availability for a large panel of countries within the time period 1960-2010, the empirical estimation results show the following. First, the level of conflict declines with a relaxation in credit constraint, i.e., ceteris paribus, there is a negative relationship between the level of conflict and credit availability, though the theory conjectures a positive relationship. Second, there is a feedback from the level of conflict to credit constraint, i.e., there is evidence of reverse causality from level of conflict to credit availability. We use the variation in elevation across regions of countries as the novel instrument of domestic conflict and countries legal origins as instruments for credit constraint in order to address potential endogeneity arising out of reverse causality in the empirical setup. Employing the systems estimation with two explicit structural equations based on the theoretical discussions, we also find that when there is feedback from the level of conflict to credit constraint, the relaxation in the credit constraint or credit availability decreases the level of conflict. In addition, the systems approach helps us to pin down the evidence of multiple equilibria, i.e., low level of conflict is associated with low credit availability and high level of conflict is associated with high credit availability. The findings may have important policy implications in mitigating domestic conflict.

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1 Introduction

In this paper we investigate the potential link between domestic conflict (such as civil war) and credit constraint using a large panel dataset of countries over a long period of time, 1960-2010. Domestic conflict, defined as the conflict between government forces and insurgent groups within a country without any external influence and measured by a number of different methods, including number of deaths or causalities per year, is one of the very persistent problems plaguing a number of world countries, and especially the developing countries (see, among others, Esteban, Mayoral, and Ray, 2012b). In addition to its direct consequence of number of lives lost, domestic conflicts have enormous detrimental impact on countries broad human, economic and social fabric in terms of numbers of people affected, injured, displaced, destruction of their immediate livelihood provisions to name a few (see, Global Burden of Armed Violence, Geneva Declaration, 2008). Therefore, investigating their potential causes and consequences remains a very pressing issue of first order importance in the 21st century.

A corpus of large literature (see, the recent survey in Blattman and Miguel, 2010) reviews various aspects of domestic conflict, including factors responsible for triggering and sustaining this global menace. Influential papers by Fearon and Laitin (2003), Montalvo and Reynal-Querol (2005), Esteban and Ray (2011), and Esteban, Mayoral, and Ray (2012a, 2012b) identify differences in ethnicity, measured by fractionalization and polarization as important drivers of domestic conflict across nations. Besley and Persson (2011) analyses this issue within the realm of political violence and find that violence (can be one-sided violence or repression as well as two-sided violence like civil war) is associated with external natural shocks which would affect wages, foreign aid and resource rents in countries besieged by weak political institutions. Looking at the domestic conflict markers from more economic perspective, a number of studies link the natural resource prices and rents extracted from those resources to investigate if changes in natural resource prices and associated changes in rents can drive domestic conflict (see, inter alia, Ross, 2004; Humphreys, 2005). Another set of studies focus on primary commodities prices and show a causal link between primary commodities prices and civil war across countries (see, among others, Fearon, 2005; Brueckner and Ciccone, 2010). Angrist and Kugler (2008) and Dube and Vergas (2013) look at the exogenous shocks in specific commodities prices like coca, coffee and oil and conclude that variation in prices of these particular commodities can explain within-country civil conflict in Colombia.

Keeping the above issues in mind, in this paper, we focus on credit constraint and its possible link with domestic conflict. There is a broad consensus in the literature that credit constraint affects long run economic growth (see, inter alia, Banerjee and Newman, 1993; Galor and Zeira, 1993). One could see credit constraint or lack of credit availability

as a big hindrance in engaging in productive and legal economic activities. In this setup, if the opportunity cost of joining any illegal activity like insurgency is very low, then a participant may join the rebel forces to earn a living. Of course, this may not be the main or only reason to join the rebel army as there may be other motives (see, Collier and Hoeffler, 2004). However, it can be a plausible driver of domestic conflict where the participant is desperate to veer off the acute credit shortage. Note that, rents from primary commodities or natural resources as highlighted in the above studies, then can be seen as an exclusive prize worth fighting for. On the other hand, looking at the other extreme, if there is no credit constraint and access to easy credit is abundant, then the rents associated from legal and productive economic activities may become much less and returns from investing in illegal activities like insurgency may yield a better return. Therefore, high level of credit availability may also lead to high domestic conflict as then the credit available may be channelized to fund and finance the conflict. Note that the above arguments hinges on the underlying fact that there is absence of or no monitoring mechanisms to steer clear of the possible two dimensional problem. The lack of regulatory support can be attributed to a weak institutional setup which appears to be a reality in a lot of conflict prone countries.

In this study, at first, we build a theoretical model based on the above intuition. Recently, Janus (2012) presents a theoretical model to explain the link between natural resource extraction and civil conflict. Janus (2012) finds that the credit constraint arising out of the mismatch between resource rents to buy capital inputs into the conflict plays an important role in the sense that if the constraint is binding, then exogenous negative shocks to resource prices will mitigate conflict. Our modelling assumes more generic structure as it involves credit available to participants not because of natural resource rents only, but uses credit availability from banks and other legal financial institutions. The theoretical model also views this problem within an endogenous setup where there is a feedback from conflict to credit constraint, and vice versa. Specifically, the theory shows that domestic conflict increases with the easing of credit constraint. The theoretical channels also establish evidence of multiple equilibria, i.e., low level of conflict is associated with low credit constraint and high level of conflict is associated with high credit constraint in presence of feedback from domestic conflict to credit constraint.

Afterwards, we test the theoretical predictions of the paper using a cross-country panel dataset of a large number of countries for a long period of time, 1960-2010. Following Miguel, Satyanath and Sergenti (2004), we carefully chose the empirical strategy to identify robust correlations and plausible causal relationship between domestic conflict and credit constraint. Unlike a large number of empirical studies focusing on the reduced form analysis (see, Blattman and Migeul, 2010), we concentrate on estimating the structural

equations informed by the theoretical conjectures. Using battle deaths as a proxy for the level of conflict and private credit by deposit money banks and other financial institutions as a proportion of GDP as the measure of credit availability, the empirical estimation results show the following. First, the level of conflict increases with a relaxation in credit constraint, i.e., ceteris paribus, there is a negative relationship between the level of conflict and credit availability, though the theory conjectured otherwise. Second, there is a feedback from the level of conflict to credit constraint, i.e., there is evidence of reverse causality from level of conflict to credit availability. We use the dispersion of elevation across regions of countries as the novel instrument of domestic conflict and the legal origin as the instrument for credit constraint in order to address potential endogeneity arising out of reverse causality in the empirical setup. Employing the systems estimation with two explicit structural equations based on the theoretical discussions, we also find that when there is feedback from the level of conflict to credit constraint, the relaxation in the credit constraint or credit availability decreases the level of conflict. In addition, the systems approach help us to pin down the evidence of multiple equilibria, i.e., low level of conflict is associated with low credit availability and high level of conflict is associated with high credit availability.

The empirical strategy deals with private credit available through legal channels. However, one would most probably agree with the assertion that this is not the exclusive source of financing conflict as parties in conflict, especially the insurgents tend to finance conflict through various illegal activities, like money laundering, obtaining ransom payments, earnings from illegal sales of drugs, diamond, oil and other natural resources as well as earnings from the sale of primary commodities (see, inter alia, Keen, 1998; Le Billon, 2000; Ross, 2004;). The conflict may also be financed through loans obtained from legal channels as insurgents may use this route to raise monetary resources and then obtain arms and other logistical supplies to sustain the domestic conflicts they are involved in. Therefore, the estimates in the econometric analysis may be biased downward or may capture one part of the conflict financing channel. We believe that other illegal factors can be controlled with the time fixed effects. It is interesting to note that even in this setup, we find a positive and robust relationship between the level of credit availability and the level of domestic conflict. As a result, the actual impact of credit availability on mitigating domestic credit would be much more.

2 Theoretical Framework

There are two groups, 1 and 2, fighting for a prize worth X. Apart from conflict, the groups can also obtain income from agriculture. Both conflict and agriculture require capital.

Let k_i^A and k_i^C denote the capital input into agriculture and conflict respectively by the i-th group. Normalizing the price of agricultural output to 1, the value of agricultural output is $f(k_i^A)$.

Assumption 1. $f : [0, \infty) \to [0, \infty)$ is strictly increasing, concave and thrice differentiable. Moreover, $f(.)$ satisfies the Inada conditions.

Next turning to conflict, given that group i spends k_i^C on conflict, group i wins the prize with probability $\frac{F(k_i^C)}{F(k_i^C)+F(k_j^C)}$, where $F(.)$ satisfies

Assumption 2. $F : [0, \infty) \to [0, \infty)$ is strictly increasing, weakly concave and thrice differentiable. Further, $\lim_{k\to 0} \frac{F'(.)}{F(.)} = \infty$, and $\lim_{k\to\infty} \frac{F'(.)}{F(.)} = 0$.

Assumption 2 is satisfied, for example, if $F(.)$ is linear.

The financial market is assumed to be imperfect, leading to credit rationing. While this imperfection can be modeled in different ways, we adopt a formalization that is very similar to that in Gal-or and Zeira (1993). Individuals can lend any amount at the world rate of interest, which is exogenously given and normalized to 1. Borrowing involves an *ex post* moral hazard problem, in that the borrowers can evade the associated payments. Lenders can however avoid such defaults through costly precautionary measures. Thus a lender can spend an amount z at keeping track of a borrower, when this borrower can still evade the lenders but only at a cost of βz, where $\beta > 1$. Note that the maximal penalty that can be imposed on a borrower is capped at βz, which captures the idea that penalizing defaulters may not be very easy, especially in conflict prone areas.

Denoting the borrowing rate of interest by r, it is clear that $r > 1$, as the lenders must spend on preventing default. Further, competition among lenders drive down profits to zero, so that assuming that the amount borrowed is d, we have that

$$d.r = d + z. \tag{1}$$

d is chosen so that default is not worthwhile, i.e.

$$d(1 + r) = \beta z. \tag{2}$$

Solving (1) and (2), we obtain,

$$r = \frac{\beta + 1}{\beta - 1}. \tag{3}$$

Further this leads to a credit-constraint of $\overline{k}$, where

$$\overline{k} = \frac{\beta z}{1 + r} = \frac{z(\beta - 1)}{2}. \tag{4}$$

In what follows, we shall work with the reduced form expressions, r and $\overline{k}$, given by (3) and (4) respectively.

Thus the objective of the i-th group is to maximize

$$U_i(k_i^A, k_i^C) = f(k_i^A) + \frac{F(k_i^C)}{F(k_1^C) + F(k_2^C)} X - r(k_i^A + k_i^C), \tag{5}$$

subject to the credit constraint that

$$k_i^A + k_i^C \leq \overline{k}. \tag{6}$$

Note that the benchmark outcome where the credit constraint does not bind, is given by the pair (k_{uc}^A, k_{uc}^C) (uc standing for unconstrained), that solves

$$f'(k^A) = r = XF'(k^C)/4F(k^C).$$

Given Assumptions 1 and 2, it is easy to see that this benchmark outcome is well defined. We let $k_{uc}^A + k_{uc}^C > \overline{k}$, so that the credit constraint binds, i.e. (6) holds with equality. Next turning to the constrained maximization problem, and substituting equation (6) into (5), the first order condition for the i-th group is given by:

$$\frac{\partial U_i}{\partial k_i^C} = -f'(\overline{k} - k_i^C) + X\frac{F'(k_i^C)F(k_j^C)}{[F(k_1^C) + F(k_2^C)]^2} \leq 0, i \neq j. \tag{7}$$

We let $R_i(k_j^C)$, $i \neq j$, denote the reaction function of group i.

We begin by establishing some properties of Nash equilibria, namely existence, uniqueness and symmetry. First note that k_i^C is bounded above by $\overline{k}$, and morever $U_i(\overline{k} - k_i^C, k_i^C)$ is concave in k_i^C.[1] Thus from the Debreu fixed point theorem an equilibrium in pure strategy exists (Fudenberg and Tirole (2005), theorem 1.2).

We next argue that any equilibrium must be symmetric. Suppose to the contrary there is an asymmetric equilibrium where $k_1^C = x$, $k_2^C = y$, and $x > y \geq 0$. Then from the first order condition of group 1,

$$-f'(\overline{k} - x) + X\frac{F'(x)F(y)}{[F(x) + F(y)]^2} = 0,$$

which, from A1 and A2, implies that

$$-f'(\overline{k} - y) + X\frac{F'(y)F(x)}{[F(x) + F(y)]^2} > 0.$$

[1] Note that

$$\frac{\partial^2 U_i}{\partial k_i^{C2}} = f''(\overline{k} - k_i^C) + \frac{XF(k_j^C)[\{F(k_1^C) + F(k_2^C)\}F''(k_i^C) - 2F'(k_i^C)^2]}{[F(k_1^C) + F(k_2^C)]^3} < 0.$$

This however implies that group j's decision is not optimal, which is a contradiction. Thus any equilibrium must be symmetric.

Denoting the equilibrium level of conflict of both groups by k^C, we therefore have that

$$f'(\overline{k} - k^C) = X\frac{F'(k^C)}{4F(k^C)}. \tag{8}$$

Next observe that the LHS of (8) is increasing, whereas the RHS is decreasing in k^C. Thus a unique equilibrium exists. Moreover, given that $f'(\overline{k}) < \infty = XF'(0)/F(0)$, the equilibrium must be an interior one, i.e. $k^C > 0$.

Proposition 1(i) below summarizes the above discussion. Even more interestingly, Proposition 1(ii) demonstrates that the level of conflict is decreasing in the amount of credit available, i.e. k^C is decreasing in $\overline{k}$.

Proposition 1 *Let $k^A_{uc} + k^C_{uc} > \overline{k}$, so that the credit constraint binds.*

(i) An equilibrium exists. It is unique, symmetric, interior and stable.

(ii) The level of conflict k^C increases with a relaxation in the credit constraint, i.e. an increase in $\overline{k}$, the level of conflict k^C increases, as well as with an increase in X.

Proof. (i) Stability follows because one can show that $R_1(k^C_2)$ intersects $R_2(k^C_1)$ from above in the $k^C_1 - k^C_2$ plane (Figure 1). The formal argument which is routine, follows by showing that $R_i^{-1}(0) > R_j(0)$, for $i \neq j$. (Figure 1).

(ii) Straightforward differentiation of (8) yields that

$$0 < \frac{dk^C}{d\overline{k}} = \frac{Xf''(\overline{k} - k^C)}{f''(\overline{k} - k^C) + \frac{F(k^C)F''(k^C) - F'(k^C)}{(F(k^C))^2}} < 1,$$

and

$$\frac{dk^C}{dX} = -\frac{\frac{F'(k^C)}{F(k^C)}}{f''(\overline{k} - k^C) + X\frac{F(k^C)F''(k^C) - F'(k^C)}{(F(k^C))^2}} > 0.$$

■

Thus, interestingly, an increase in efficiency in the credit market may generate inefficiencies else where, namely increase conflict. This result is clearly in the spirit of the theory of second best whereby, with multiple market failures, an increase in efficiency in one market need not be welfare improving. From Figure 1, it is clear that an increase in $\overline{k}$ has two effects on k^C_1, one a direct effect arising out of the fact that $R_1(k^C_2)$ shifts out, another an indirect effect arising out of the fact that $R_2(k^C_1)$ shifts outwards. Note that the direct effect leads to an increase in k^C_1, while the indirect effect leads to a decrease in k^C_1. With the direct effect dominating, the result follows.

Remark 1 *Note that the analysis so far only considers a single factor of production, namely labour. We now briefly argue that the earlier analysis goes through qualitatively even if one allows for labour inputs into both agriculture, as well as conflict. Let* k_i^A *and* l_i^A *denote the capital and labour input into agriculture, and* k_i^C *and* l_i^C *denote the capital and labour input into conflict by group* i*. Normalizing the price of agricultural output to* 1*, the value of agricultural output is* $f(k_i^A).g(l_i^A)$*. Next turning to conflict, the probability of winning the prize for group* i *is given by* $\frac{F(k_i^C)G(l_i^C)}{F(k_i^C)G(l_i^C)+F(k_j^C)G(l_j^C)}$*. Let* r *and* w *denote the price of capital and labour respectively. Suppose for simplicity that there is a unique equilibrium. A straightforward extension of the above analysis shows that with a relaxation in the credit constraint,* l^A*,* k^A *and* k^C *all increase.* l^C *however remains unaffected.*

3 Effect of conflict on credit rationing

Recall that we are analyzing a society with two kinds of institutional failures, first the lack of property rights over X, which in fact is the root cause of conflict, and second credit constraint. Till now, the focus had been on the effect of credit constraints on conflict. In this section we extend the analysis to allow for the impact of conflict on the credit constraint. The idea is that because of the uncertainty and chaos unleashed in society through conflict. an increase in conflict makes it harder to penalize the borrowers in case they plan to default, thus tightening the credit constraint. This natural extension creates a feedback loop running from credit constraint to conflict to credit constraint. As we shall argue, the presence of this feedback loop opens up the possibility of multiple equilibria in our framework. We shall identify conditions under which such multipilicity may, or may not appear.

This idea - that conflict may make it harder to penalize defaulters - may of course be formalized in many different ways. We adopt an approach where an increase in the aggregate level of conflict, i.e. $K = k_1^C + k_2^C$, makes it harder to impose a large penalty on the defaulter, i.e. decreases $z(K)$. From (4), we thus have that $\overline{k}(K)$ is a function of K.

Assumption 3. $\overline{k} : [0, \infty) \to [0, \infty)$ is decreasing and thrice differentiable.

Let $k_{uc}^A + k_{uc}^C > \overline{k}(0)$. so that the credit constraint necessarily binds. Thus the utility function of group i, after allowing for the fact that the credit constraint binds, is

$$U_i = f(\overline{k}(k_1^C + k_2^C) - k_i^C) + \frac{F(k_i^C)}{F(k_1^C) + F(k_2^C)} X - r\overline{k}(k_1^C + k_2^C). \tag{9}$$

Thus the first order condition for group i is:

$$f'(\overline{k} - k_i^C)(\overline{k}'(k_1^C + k_2^C) - 1] + \frac{F'(k_i^C)F(k_j^C)}{(F(k_1^C) + F(k_2^C))^2}X - r\overline{k}'(k_1^C + k_2^C) \leq 0. \qquad (10)$$

In order to bring out the essential argument in a more transparent fashion, in the rest of the paper we shall work with a specific functional form for $F(k)$.

Assumption 2'. $F(k) = \gamma + k$.

Remark 2 *The effect of conflict on the credit constraint can alternatively be formalized by assuming that conflict increases the cost of imposing a penalty, so that $\beta(K)$ is increasing in K. While the qualitative effects are similar in this case, the analysis is less transparent as $\beta(K)$ enters into both $\overline{k}$, as well as r.*

3.1

We first examine a case where $\overline{k}(k_1^C + k_2^C)$ is a linear function in the level of conflict. We show that, despite the presence of the feedback loop, in this case there is a unique equilibrium. In contrast to the result in the preceding section though, we find that a "relaxation in the credit constraint" may lead to a decrease in the level of conflict.

Assumption 3'. Let $\overline{k}(k_1^C + k_2^C) = A - \alpha K$, where $A, \alpha > 0$.

Let $\tilde{k} = \frac{A}{\alpha}$, so that $\overline{k}(k_1^C + k_2^C)$ is zero for all conflict level exceeding $\tilde{k}$. Under this assumption the first order condition of group i simplifies to:

$$-f'(\overline{k} - k_i^C)(1 + \alpha) + r\alpha + \frac{\gamma + k_j^C}{(2\gamma + k_1^C + k_2^C)^2}X = 0. \qquad (11)$$

Note that the second order condition is also satisfied as:

$$\frac{\partial^2 U_i}{\partial k_i^{C2}} = f''(1 + \alpha)^2 - \frac{2(\gamma + k_j^C)}{(2\gamma + k_1^C + k_2^C)^3} < 0. \qquad (12)$$

We show that in this case a unique, symmetric equilibrium exists. Moreover, the comparative statics result with respect to a change in X are very similar to the case where the credit constraint is unaffected by the level of conflict.

Proposition 2 *Let A1, A2' and A3' hold.*

(i) There is a unique, symmetric equilibrium.

(ii) The equilibrium level of conflict is increasing in X.

(iii) Consider an increase in α. There is an increase in conflict if and only if $f' - r < 0$ in equilibrium.

Proof. (i) Existence can be proved along lines very similar to that of Proposition 1.

We then establish symmetry. Suppose to the contrary there is an asymmetric equilibrium (x, y), where $k_1^C = x, k_2^C = y$, with $x > y$. Then the first order condition for group 1 satisfies:

$$-f'(\overline{k}(x+y)-x))(1+\alpha)+r\alpha+\frac{\gamma+y}{(2\gamma+x+y)^2}X=0. \tag{13}$$

But this implies that $-f'(\overline{k}(x+y)-y))(1+\alpha)+r\alpha+\frac{\gamma+x}{(2\gamma+x+y)^2}X>0$, which violates the first order condition for group 2.

Finally, uniqueness follows from the fact that $-f'(\overline{k}(2k)-k)+r\alpha+X/4$ is decreasing in k.

(ii) Using (11) and the fact that the equilibrium is symmetric, we obtain that

$$\frac{X}{4(\gamma+k^C)}=(f'-r)\alpha+f'. \tag{14}$$

The result follows from totally differentiating this equation with respect to X and k^C.

(iii) Suppose that in equilibrium, $f'-r>0$. Then as α increases, the RHS of (14) increases, so that k^C must fall. By a symmetric argument, if $f'-r<0$ in equilibrium, then an increase in α leads to an increase in k^C. ■

Remark 3 *Observe that the result in Proposition 2(iii) differs from that in Proposition 1(ii), thus demonstrating the importance of allowing for the effect of conflict on the credit constraint. In contrast to Proposition 1(ii), in this case it is possible that a relaxation in the credit constraint, as formalized by a decline in α, may lead to a* decrease *in conflict. The result is intuitive in that it happens if and only if the agricultural technology is productive in the sense that $f' > r$ in equilibrium .*

Remark 4 *The fact that $\overline{k}(k_1^C + k_2^C)$ is linear in the level of conflict is not central to the argument in Proposition 2. It can be shown that the results are qualitatively similar in case $\overline{k}$ is concave in the level of conflict.*

3.2

We then examine a scenario where $\overline{k}(K)$ is convex in K, i.e. the marginal impact of conflict on the credit-constraint is decreasing. We find that in this case multiple equilibria may exist.

Formally, let $\overline{k}(K)$ satisfy

Assumption 3". $\overline{k}(K)$ is decreasing and convex.

Further, for simplicity we shall focus on the case where the production function $f(.)$ is also linear.

Assumption 1'. $f(.)$ is linear with $f'(.) > r$.[2]

The reaction function of group i is given by the first order condition:

$$f'(\overline{k} - k_i^A)(\overline{k}'(k_1^C + k_2^C) - 1) - r\overline{k}'(k_1^C + k_2^C) + \frac{\gamma + k_j^C}{(2\gamma + k_1^C + k_2^C)^2} X \leq 0. \tag{15}$$

The slope of the reaction function $R_i(k_j^C)$ is given by

$$\frac{\partial R_i}{\partial k_j^C} = \frac{(f'(\overline{k} - k_i^C) - r)\overline{k}''(k_1^C + k_2^C) + \frac{(k_i^C - k_j^C)X}{(2\gamma + k_1^C + k_2^C)^3}}{\frac{2k_j^C X}{(2\gamma + k_1^C + k_2^C)^3} - (f'(\overline{k} - k_i^C) - r)\overline{k}''(k_1^C + k_2^C)}. \tag{16}$$

We begin by establishing existence and some comparative statics properties of stable equilibria.

Proposition 3 *Let A1', A2', and A3" hold.*

(i) A Nash equilibrium exists. Moreover, any Nash equilibrium must be symmetric.

(ii) In any stable interior equilibria, conflict is increasing in X.

Proof. (i) The proofs of existence and symmetry mimic that in Propositions 1 and 2.

(ii) Let us plot the reaction functions of the two groups, $R_1(k_2^C)$ and $R_2(k_1^C)$ in the $k_1^C - k_2^C$ plane. First note that an increase in X leads to a rightward shift of $R_1(k_2^C)$, and an upwards shift of $R_2(k_1^C)$. The result now follows since in any stable equilibrium, then R_1 intersects R_2 from below if the reaction functions are positively sloped, and from above if the reaction functions are negative sloped. ■

Interestingly, in this case multiple equilibria may obtain. Multiplicity is of more than of just theoretical interest, as it will play an important role in providing an explanation for regime switch. Clearly a necessary conditions for multiple equilibria is that there exists some equilibrium (k^*, k^*) such that the reaction functions are positively sloped at this equilibrium. Note that this implies that

$$\frac{\partial R_i}{\partial k_i^C}|_{k_1^C = k_2^C = k^*} = \frac{(f' - r)\overline{k}''(2k^*)}{\frac{X}{4(k^* + \gamma)^2} - (f' - r)\overline{k}''(2k^*)} > 0,$$

which in turn requires that $\overline{k}''(2k^*) > 0$.

We then derive some sufficient conditions for multiple equilibria. Given the feedback loop working in this setup, from credit constraint to conflict to credit constraint, the

[2]The results for the case where $f'() \leq r$ is qualitatively similar to that for the previous sub-section.

reaction functions can take many different forms. For ease of exposition, we focus on a particular case that brings out the essential argument cleanly.

Let $\tilde{X}$ be the smallest X such that $R_i(0)|_{X=\tilde{X}} = 0$.

Let $\hat{k}$ solve $\overline{k}(\hat{k} = \hat{k}$.

We then provide sufficient conditions such that multiple equilibria exist. These conditions essentially ensure that a version of the Inada conditions hold for the reaction functions.

Assumption 4.

(i) $\frac{\partial R_i}{\partial k_i^C}|_{k_1^C=k_2^C=0, X=\tilde{X}} > 1$.

(ii) $f' - (f' - r)\overline{k}'(\tilde{k}) > \max_{k \leq \hat{k}} \frac{\gamma+k}{2(\gamma+\overline{k})^2} X$.

Proposition 4 *Let A1', A2', A3" and A4 hold.*

(i) Then there exists $X' < \tilde{X}$ such that multiple stable equilibria exist whenever $X \in [X', \tilde{X})$. Further, one of these equilibria involve a zero level of conflict.

(ii) For $X > \tilde{X}$, all equilibria involve a positive level of conflict.

Proof. (i) First note that for $X < \tilde{X}$ but close to $\tilde{X}$, there exists an equilibrium with zero conflict. This follows since for $X < \tilde{X}$, there exists $k'' > 0$ such that $R_i(k_j^C) = 0$ for all $k \leq k''$. (See Figure 3).

We then argue that a stable equilibrium with a positive level of conflict exists. First, from A4(i), for $X = \tilde{X}$, the reaction functions have slopes that are bounded away from 1, hence for X close to $\tilde{X}$, the reaction functions must intersect the 45 degree line at a positive level of conflict. Next given that $-(f'-r)\overline{k}'(\tilde{k}) + f' > \max_k \frac{\gamma+k}{(2\gamma+\overline{k})^2} X$, $R_i(k_j^C) = 0$ for k_j^C large. This implies that another equilibrium with a positive level of conflict exists. Moreover, this equilibrium must be stable. ■

Thus we find that conflict is more likely for X large. For X not very large, a zero conflict equilibrium always exists.

4 Empirical Analysis

In line with the predictions of the theoretical model, a number of propositions can be put to empirical test. To be specific, we will examine the following hypotheses which are derived from the theoretical model:

Hypothesis 1: The level of conflict increases with a relaxation in credit constraint, i.e., ceteris paribus, there is a positive relationship between the level of conflict and credit availability.

Hypothesis 2: There is a feedback from the level of conflict to credit constraint, i.e., there is evidence of reverse causality from level of conflict to credit availability.

Hypothesis 3: Within a setup of feedback from the level of conflict to credit constraint, the relaxation in the credit constraint or credit availability may lead to a decrease in the level of conflict.

Hypothesis 4: Within an environment where credit constraint affects the level of conflict and the credit constraint is affected by the level of conflict, there is evidence of multiple equilibria, i.e., low level of conflict is associated with low credit availability and high level of conflict is associated with high credit availability.

5 Data

Dependent variable: level of conflict

The dependent variable, level of conflict is measured by the number of battle deaths as a result of fighting between government forces and insurgent groups or rebel forces within a country. Note that this fighting is not influenced by any external state actors or parties, therefore, the death from the fighting represents a fairly true measure of domestic conflict. This dataset is provided by the International Peace Research Institute, Oslo (PRIO)s Battle Deaths Dataset version 3.0. More information about the dataset is outlined in Lacina and Gleditsch (2005). We use the best estimate of battle deaths in our empirical analysis. In cases where the best estimates were unavailable, we employ the high estimate of the battle deaths.[3] A number of papers in the literature employ the above battle deaths measure in their analysis (see, for example, Besley and Persson, 2011). There are 158 countries in our dataset and the time period of analysis is from 1950 to 2010, which gives us a large panel of countries.[4]

Independent variable

The explanatory variable, availability of credit or credit constraint, is represented by the measure, private credit by deposit money banks and other financial institutions as a proportion of GDP, which determines credit allocation by financial institutions. This

[3]The results remain qualitativey similar if we use best death estimates only.

[4]However, the country size drops to 138 when the analysis involves controls. The literature also identifies other measures of conflict (see, among others, Blattman and Miguel, 2010; Esteban, Mayoral and Ray, 2012) which will be explored as competing dependent variables to check additional robustness of our findinggs in the future.

proxy is the most suitable for our analysis as it directly captures the credit availability mentioned in the theoretical section of the paper. The measure is frequently used in the literature to emulate the extent of financial development across countries (see, among others, Ramacharan, 2010). We download the private credit data from Beck, Demirg-Kant, and Levine (2009) and the World Banks World Development Indicator database (2013).

Additional variables

We also use a number of control variables in our analysis. These are in line with Esteban, Mayoral and Ray (2012a) with the difference that we use controls in the structural equations whereas Esteban et al (2012a) employ controls in the reduced form analysis. In a number of influential papers, Esteban, Mayoral, and Ray (SCIENCE, 2013; AER, 2012) show that domestic conflict can be explained by ethnicity differences, and especially, ethno-linguistic fractionalization and ethno-linguistic polarization can jointly characterize a number of domestic conflicts across the world. The above finding is in line with the theoretical proposition of Esteban and Ray (2011). The measures for ethno-linguistic fractionalization and polarization are the main explanatory variables for the Esteban et al (2012) paper. In our analysis, we only use the polarization measures as controls since the theoretical model does not explicitly distinguish whether the conflict is over public good or private good. Since we are employing an conflict outcome variable without imposing any assumption regarding the reasons for conflict, therefore, it is reasonable to control for factors like polarization and fractionalization which are shown to be driving violent domestic conflict in the recent wave of research.[5] However, we do not use the fractionalization measures as controls since we use a deep determinant of fractionalization as an instrument for conflict. This instrumental variable is described in detail when we outline the identification strategy in the following section.

Additionally, in line with Montalvo and Reynal-Querol (2005) and Esteban et al. (2012a, 2012b), we use the following controls variables: (i) log of per capita income (ii) log of population and (iii) dummy variable for countries with non-contiguous territory. The extant literature (see, inter alia, Collier and Hoeffler, 2004; Fearon and Laitin, 2003; Bruckner and Ciconne, 2010) establishes causal relationships between domestic conflict, per capita income and population which need to be controlled to decipher the true effect of the financial development on conflict. Similarly, countries with non-contiguous territory, i.e., countries with territory holding at least 10,000 people and separated from the land area containing the capital city either by land or by 100 kilometers of water are found to influence conflict (see, Fearon, 2003) which we control for in some of our estimation

[5]Note that the polarization measure generally measure generally drops out in the analysis when used in the presence of fixed effects estimation.

setup. Following Fearon and Laitin (2003), we control for oil exporter countries as well. Oil exporter countries, i.e., countries for which the main state revenue is driven by oil exports tend to be associated with weak governments or autocratic governments and may suffer from a political Dutch Disease type syndrome (see, Fearon and Laitin, 2003 and references therein). These countries, according to the theorization of Esteban and Ray (2011) may also experience conflict over the control of oil and associated rents from it, which can be termed as conflict over a private good. Therefore, controlling for oil exporting revenue generating countries will help in determining the relationship between domestic conflict and financial development.

6 Econometric Methodology

Credit constraint affecting the level of conflict

Let D_{it} denote the number of battle deaths in country i at time t which represents the level of domestic conflict in country at time. Let CRE_{it} denote the amount of credit available in country i at time t. First, we estimate the following equation in line with the Hypothesis 1 mentioned above:

$$BD_{it} = \alpha_{it} + \phi_t + \alpha_2 CRE_{it} + \epsilon_{it}. \tag{17}$$

The underlying assumption in the above specification is that the amount of credit available is purely exogenously determined, it is free from any measurement error, and the regression specification does not have any omitted variable, i.e., it is correctly specified. In addition, we also assume that there is no reverse causality running from the number of battle deaths to the amount of credit available. The above equation is estimated with country-specific cross-sectional and time fixed effects. The country-specific fixed effects take care of any time-invariant factors like geographical terrain which may influence domestic conflict in a country (see, for instance, Esteban, Mayoral, Ray, 2012a; Fearon and Laitin, 2003; Collier and Hoeffler, 2004). The time fixed effects controls for time-varying issues like conflict cycle or change of ideology over time which may be affecting domestic conflict. According to the theoretical hypothesis we expect that α_2 to be positive, ceteris paribus.

Level of conflict affecting the credit constraint

In order to test Hypothesis 2, we estimate the following regression:

$$CRE_{it} = \delta_{1t} + \kappa_t + \delta_2 BD_{it} + \xi_{it} \tag{18}$$

The above equation specifies the direct, causal impact from the level of conflict to credit constraint. Since equation (1) looks at the causal impact of credit constraint to

the level of conflict, there is evidence of reverse causality in equation (2). We estimate equation (2) in two ways. First we ignore reverse causality and estimate it with least squares under fixed effects. Second, we account for reverse causality or endogeneity and estimate equation (2) with instrumental variable or two-stage least squares (IV-2SLS) estimation technique. For IV-2SLS estimation strategy, choice of instruments plays the most significant role.

Identification strategy

In this version of the paper, we use a novel instrument for the level of conflict. The instrument is used in the first stage of the regression when we regress level of conflict over the instrument and a set of controls. In the second stage, the instrumented value of the level of conflict is used as a regressor with the level of the credit as the dependent variable. The instrument for battle death in conflict is the variation in elevation across regions of countries as reported in Michalopoulos (2012). There is evidence in the literature that ethnicity and various traits of ethnic and linguistic differences affect domestic conflict across a number of countries (see, inter alia, Esteban, Mayoral, Ray, 2012; Esteban and Ray, 2011; Montalvo and Reynal-Querol, 2005; Fearon and Laitin, 2003). In a recent contribution, Michalopoulos (2012) shows that variation in regional land quality and elevation is a fundamental determinant of contemporary linguistic diversity across countries. Therefore, variation in elevation can be used as a plausible exogenous instrument for domestic conflict in our empirical framework. Since land quality may have possible influence on land productivity and income, therefore, variation in land quality may determine the amount of credit availability as well. As a result, we only use the variation in elevation as a potential instrument for level of conflict. Note that the extant literature on domestic conflict identifies difficult geographical terrain as a pointer towards domestic conflict (see, for example, Collier and Hoeffler, 2004; Fearon and Laitin, 2003), and, consequently, our instrument choice also addresses this pertinent issue. The first stage regressions show that the variation of elevation is a very good instrument for the level of conflict proxied by battle deaths. The statistical tests also confirm that this is a strong and relevant instrument.[6]

Simultaneous equation

Next, we use the following systems setup to address possible endogeneity arising out of simultaneity and multiple equilibria as hypothesized in theoretical Proposition ??? and

[6]We also cross-check our results with terrain ruggedness (see, Nunn and Puga, 2009) as an alternative instrument for domestic conflict and genetic distance or genetic difference within countries (see Galor and Ashraf, 2013) as another alternative instrument for domestic conflict, but the results remain qualitatively similar.

empirical Propositions 3 and 4. Regarding endogeneity, the idea is that the level of credit availability is endogenous to the level of conflict because of the reverse causality which arises due to the fact that the level of conflict may in turn affect the amount of credit available. We represent the above argument in the following simultaneous equation setup:

$$\begin{aligned} BD_{it} &= \beta_{0i} + \psi_t + \beta_1 CRE_{it} + \beta_2 CRE_{it}^2 + \beta_3 Z_{it} + \nu_{i1t}, \\ CRE_{it} &= \gamma_{0i} + \eta_t + \gamma_1 BD_{it} + \gamma_2 X_{it} + \nu_{i2t} \end{aligned} \tag{19}$$

The first equation in the above system shows that the level of credit availability affects the level of conflict in a non-linear way, which is represented by both the level of credit availability and the square of credit availability measures on the right hand side of the equation. The non-linearity is introduced to capture any second order effect the credit constraint may have. This will also be useful in deciphering any possible multiple equilibria as hypothesized in the theoretical part. The second equation in the system represents the reverse causality in an explicit way. Now, the number of battle deaths, which proxies the level of conflict is affecting the level of credit availability simultaneously. The first equation also includes a set of controls identified in the literature explicitly affecting conflict. Similarly, the second equation incorporates a number of controls guided by the literature. Note that we use country-specific fixed effects and time effects in the systems setup which makes the system setup very restrictive in the sense that we control for a large number of factors which may change over time and across countries over and above the structural equation specific explicit exogenous controls.

The multiple equilibria can be depicted by the linear and non-linear explanatory terms in the structural equations. If in the first structural equation the signs of the credit constraint estimators are negative and positive for the linear and non-linear terms, then we can say that the credit availability was mitigating conflict up to a certain threshold, which also means, low credit constraint is associated with low conflict. Now once the credit availability passes a certain threshold and the non-linear term becomes positive, then the interpretation would be that higher credit availability after a certain threshold will end up abetting conflict. Therefore, high level of conflict is associated with high credit availability. Before the switching of the sign, the researcher can interpret the negative feedback from credit availability to conflict as signalling the theoretically conjectured multiple equilibria with low credit, low conflict as one equilibrium. On a similar vein, from the second equation, if higher conflict makes it difficult to ease the credit constraint, then it can also be treated as an equilibrium outcome, as conjectured by theory. Note that the presence of non-linear terms in the first structural equation as well as the inclusion of equation-specific controls play the important role of identifying both the equations and

consequently, all the relevant rank and order conditions for system identification are taken care of.

We use the legal origin as the main instrument variable for credit availability in the above systems setup. Following the seminal contribution by La Porta, Lopez-de-Silanes, Andrei Shleifer and Robert Vishny (1997, 1998), a large body of research uses countries legal origin as markers for financial development (see, recent overview by La Porta et al, 2008). Note that the financial development indicator is the credit availability or credit constraint variable for our analysis. Therefore, it is plausible to use the legal origin of countries as instruments for financial development. In addition, we also use the lending interest rate and interest rate spread as two additional controls for private credit availability. The interest rate spread, which captures the difference between the interest rate charged by the banks to private sector customers and interest paid to the depositors, is potentially a good determinant of credit availability as it captures the willingness of financial institutions to disburse loans after taking care of their own earning channel. The lending interest rate determines the overall level of credit availability and therefore, can be used as an alternative instrument for credit availability.

7 Discussion of results

In the following, we present the main benchmark results. We are currently doing a number of robustness checks which so far, generally validate the benchmark findings. The robustness check results will be reported in the full version of the paper.

Benchmark results

Hypothesis 1

Table 2, columns (4) to (6) presents results for hypothesis 1. In column (4), the OLS results are reported and in columns (5) and (6), the limited information maximum likelihood (LIML) results are presented. The difference between columns (5) and (6) is that in column (6), the LIML results are reported only for developing countries in the dataset. From the OLS result, we find no support for the conjectured hypothesis 1, as the coefficient is statistically insignificant and negative. This can be explained in terms of possible endogeneity, i.e., the credit availability variable may be endogenous in terms of either reverse causality or some omitted variable issue and the OLS estimator is not a good estimator in this setup. However, when we use LIML estimator in column (5) with British, French and German legal origins as instruments for credit availability, we find statistically significant but negative relationship between credit availability and domestic conflict. This is not in line with the conjecture in hypothesis 1. Note that, hypothesis 1 infers a direct relationship between credit constraint and conflict without looking at

the possible reverse causality issue which may be driving the negative outcome. But in practical terms, this result can be interpreted as a good one, as it shows that, after controlling for possible endogeneity, the credit availability, on an average is mitigating conflict by possibly creating more productive income earning opportunities. In terms of magnitude, the constant elasticity at the mean is around 0.30, which can be interpreted as if credit availability as a proportion of GDP increases by 1%, then, on an average, this will be mitigating battle death by 0.30. This, in turn, can be translated to an approximation of around 10 less death in conflict. This direct impact resonates with the findings of Miguel, Satyanath, and Sergenti (2004) which shows improvements in economic conditions attributed to rainfall lead to mitigation of conflict in Africa. This result is however statistically insignificant for developing countries (see column 6) though the sign is negative.

Hypothesis 2

The empirical test for hypothesis 2 is also presented in Table 2, columns (1) (3). Similar to the OLS finding for hypothesis 1 above, we do not find any statistically significant impact from conflict to credit availability. This result, again, can be attributed to possible endogeneity problem involving domestic conflict. Once we control for that using 2SLS estimator and using variation in elevation across regions of countries as the instrument for conflict, there is a statistically significant and positive impact from domestic conflict to private credit availability as a proportion of GDP. This is in line with hypothesis 2, which says that there is a feedback from the level of conflict to credit constraint without shedding any light on whether the feedback will be positive or negative. In this case we find, on an average, a positive impact of domestic conflict on private credit availability i.e., there is easing of credit constraint in presence of higher domestic conflict. This finding can be explained in terms of a short run positive externality generated by domestic conflict in which civil conflict opens up some broader financial opportunities which will most probably be appropriated by the parties engaged in conflict. The LIML estimation, however, does not reveal any statistically significant link (column 3).

Hypothesis 3 and Hypothesis 4

Table 3 reports results for hypothesis 3 and hypothesis 4. Since hypothesis 3 and 4 assumes explicit feedback from domestic conflict to credit constraint and credit constraint to domestic conflict, the systems estimation is the most appropriate framework incorporating those feedbacks. We report two sets of results in Table 3, with the difference that Model 3.2 has more external controls for domestic conflict than in Model 3.1.

The first interesting result from this table is that the credit availability now has a non-linear effect on domestic conflict (see columns 2 and 4). The non-linearity is important to

decipher the theoretically conjectured relationships in hypothesis 3 and 4. The negative sign associated with credit availability is in line with hypothesis 3 and it is significant at 15% level of significance. The researcher should interpret the statistical significance carefully as there may be a possibility to discard this finding as it is not statistically significant at the conventional 5% or 10% level of significance. Since private credit availability depends on a number of country-specific factors which may also change over time and the fact that we control for these effects in the systems setup can explain the statistically muted response we have in our setup.[7] In terms of its interpretation, it shows that on an average, more private credit availability would reduce domestic conflict, i.e., low credit constraint will be associated with low conflict. This is exactly what is conjectured in hypothesis 4 within a setup when there is a feedback from credit availability to domestic conflict and vice versa.

Now, looking at the non-linear term of the credit availability, there is positive support for domestic conflict at 10% level of significance. This finding, along with the result discussed above also points to a threshold level of private credit availability beyond which the feedback from credit availability to domestic conflict becomes positive. Therefore, after a certain level of private credit availability, the opportunity cost of engaging in conflict becomes less and there is a tendency towards engaging in more domestic conflict. As a result, higher credit availability is now associated with higher conflict which is in line with the conjecture in hypothesis 4. This finding is similar to the rent-seeking behaviour highlighted in Grossman (1991) and Collier and Hoeffler (2004) as well as in Angrist and Kugler (2008) for Colombia.

Focusing on the simultaneous relationship from domestic conflict to private credit availability (see columns 1 and 3), we find that domestic conflict has a positive impact on private credit availability which means domestic conflict creates a positive opportunity in terms of credit availability by easing the credit constraint. This is in line with the reduced form analysis reported earlier in hypothesis 2. The magnitude of this impact is also in line with the reduced form analysis and can be interpreted as equilibrium with high conflict and high credit availability in presence of a feedback from credit availability to conflict. Therefore, it lends some support to hypothesis 4.

Deciphering the channel effect

Table 4 presents the empirical counterpart of the theoretical channel presented in the paper. Our interpretation of the effect of financial development on civil conflict is that a relaxation in credit constraint increases the level of domestic conflicts if and

[7]We cross-check this conjecture after excluding the country-specific fixed effects and common time effects in the systems setup. In line with our expectation, the private credit availability now gained statistical significance even at 1% with the negative sign.

only if the groups choose to invest in strengthening their capacities of contesting the opposition. If we theorise this correctly, the effect of agricultural production on the level of conflicts should be negative in countries where financial development accelerates the primary sector. It is, therefore, intuitive to investigate whether there is evidence of positive effects of credit availability on the level of conflicts through agriculture channel. We check this implicit hypothesis by using data from the statistical database of United Nations Statistics Division (UNSD) to calculate the agricultural GDP share for each country. The estimates in Column 1 (and 3) of Table 4 show that a decrease in lending interest rate (and interest rate spread) increases the agriculture share of GDP, which is strongly statistically significant at 1 per cent level. So, in columns 2 and 4 of Table 4 we instrument the agricultural share of GDP by the lending interest rate and the interest rate spread in the lower panel and found that an increase in agricultural share of GDP significantly decreases the number of battle deaths in internal armed conflict shown in the upper panel.

Moreover, given that investment in agriculture is productive whereas investment in conflict is contemporaneously orthogonal to GDP, the level of conflicts should be downward in case of an increase in investment share of real GDP per capita. In column 6 of Table 4, this explanation holds when we instrument investment share of GDP per capita with the lending interest rate in the lower panel and find in the upper panel that an increase in investment share of GDP per capita decreases the number of battle deaths in internal conflicts in a given year. That is, the finding suggests that a relaxation in credit constraint decreases the level of conflict through increasing investment share of GDP per capita.

8 Conclusion

In this study, we focus on the potential link between domestic conflict and credit constraint or lack of credit availability. We build a stylized theoretical model where the conflict can arise due to credit constraint. The theoretical model shows an interesting multiple equilibria where low credit constraint is associated with low conflict and high conflict is related to high credit constraint in presence of feedback from domestic conflict to credit constraint and vice versa. Using a large cross-country panel dataset covering a long time span (1960-2010), we empirically test the theoretical conjectures. The empirical setup takes care of potential endogeneity issue using instrumental variables estimation. The theoretical feedback and multiple equilibria is handled using a simultaneous systems equation technique. The empirical findings, in general, support the theoretical predictions and lend credence to the multiple equilibria concept. The findings may have important

policy implications in understanding and mitigating domestic conflicts across the world.

9 References

Angrist, , J. D. and Kugler, A. (2008), Rural Windfall or a New Resource Curse? Coca, Income and Civil Conflict in Colombia, The Review of Economics and Statistics, 90, 191215.

Banerjee, A. V. and Newman, A. F. (1993), Occupational Choice and the Process of Development, Journal of Political Economy, 101 (2), 274-298.

Beck, Demirg-Kant, and Levine (2009), Financial Institutions and Markets across Countries and over time data and analysis, World Bank Policy Research Working Paper No. 4943, World Bank.

Besley, T. and Persson, T. (2011), The Logic of Political Violence, The Quarterly Journal of Economics 126, 14111445.

Blattman, Christopher, and Miguel, E. (2010). Civil War. Journal of Economic Literature 48(1): 357.

Brckner, Markus, Ciccone, Antonio, (2010). International commodity prices, growth and the outbreak of civil war in sub-Saharan Africa, The Economic Journal 120 (544), 519534.

Collier, P. and Hoeffler, A. (2004), Greed and Grievance in Civil War, Oxford Economic Papers, 56, 563595.

Dube, O., and Vargas, J.F. (2013), Commodity Price Shocks and Civil Conflict: Evidence from Colombia, Review of Economic Studies, 1-38 (doi:10.1093/restud/rdt009)

Esteban, J. and Ray, D. (2011), Linking Conflict to Inequality and Polarization. American Economic Review 101 (4): 134574.

Esteban, J., Mayoral, L., and Ray, D. (2012a), Ethnicity and Conflict: An Empirical Study, American Economic Review, 102 (4), 1310-1342.

Esteban, J., Mayoral, L., and Ray, D. (2012b), Ethnicity and Conflict: Theory and Facts, Science, 336, 858-865.

Fearon, James D. (2003), Ethnic and Cultural Diversity by Country. Journal of Economic Growth 8(2): 195222

Fearon, James D., (2005). Primary commodities exports and civil war, Journal of Conflict Resolution 49 (4), 483507.

Fearon, James D., Laitin, David, (2003). Ethnicity, insurgency, and civil war, American Political Science Review 97 (1), 7590.

Galor. O. and Zeira, J. (1993), Income Distribution and Macroeconomics, Review of Economic Studies, 60 (1), 35-52.

Global Burden of Armed Violence, Geneva Declaration (2008), http://www.genevadeclaration.org/;

Grossman, Herschel I. (1991), A General Equilibrium Model of Insurrection, American Economic Review 81, 912921.

Humphreys, Macartan, (2005), Natural resources, conflict and conflict resolution: uncovering the mechanisms, Journal of Conflict Resolution 49 (4), 508537.

Janus, Thorsten. (2012), Natural Resource Extraction and Civil Conflict, Journal of Development Economics, 97, 24-31.

Keen, David, (1998). The Economic Functions of Violence in Civil Wars. Oxford University Press, Oxford.

Lacina, B. and Gleditsch, N.P. (2005), Monitoring Trends in Global Combat: A New Dataset of Battle Deaths, European Journal of Population. 21 (2-3), 145-166.

La Porta, R., Lopez-de-Silanes, F., and Shleifer, A. (2008), "The Economic Consequences of Legal Origin", Journal of Economic Literature, 46 (2), 285-332.

La Porta, R., Lopez-de-Silanes, F., Shleifer, A., and Vishny, R. (1997), Legal determinants of external finance. Journal of Finance, 52(3): 1131-50.

La Porta, R., Lopez-de-Silanes, F., Shleifer, A., and Vishny, R. (1998), Law and finance. Journal of Political Economy, 106(6): 1113-55.

Le Billon, P., (2000), The Political ecology of transition in Cambodia 19891999: war, peace and forest exploitation. Development and Change 31 (4), 785805.

Michalopoulos, Stelios. (2012), The Origins of Ethnolinguistic Diversity, American Economic Review, 102(4), 1508-1539.

Miguel, E., Satyanath, S., and Sergenti, E. (2004), Economic Shocks and Civil Conflict: An Instrumental Variables Approach. Journal of Political Economy 112 (4): 72553.

Montalvo, J. G., and Reynal-Querol, M. (2005), Ethnic Polarization, Potential Conflict, and Civil Wars American Economic Review 95 (3): 796816.

Ramcharan, Rodney, (2010), The Link between the Economic Structure and Financial Development, The B.E. Journal of Macroeconomics, 10 (1: Topics), 1-35

Ross, Michael, (2004), What do we know about natural resources and civil war? Journal of Peace Research 41 (3), 337356.

Table 1: Descriptive statistics

Variables	Mean	Max	Min	Std. Dev.	Observations
Battle fatalities in internal armed conflict	296.913	250000	0	3973.937	10823
Private credit by deposit money banks and other financial institutions / GDP	37.554	361.690	0.007	37.360	5927
Dummy variable for countries with non-contiguous territory	0.108	1	0	0.310	8145
Variation in elevation across regions	0.359	1.946	0.013	0.364	9605
Lending interest rate (%)	48.233	121906	0	1846.695	4366
Interest rate spread (%)	12.662	14526.860	-1027.885	232.478	4078
Agricultural GDP share	15.892	94.460	0.035	15.600	7962
Employment share in agriculture	19.263	90.100	0	18.307	2152
Investment share of per capita	22.937	111.291	-33.141	11.675	8647
Esteban-Ray index of ethno-linguistic polarization	0.047	0.246	0	0.054	4968
Oil exporter	0.138	1.000	0	0.345	5378
Log of per capita income	7.729	11.108	4.890	1.052	5226
Log of population	2.153	7.122	-1.505	1.464	5224

Table 2: Civil conflict and credit constraint, 1950-2010 (Benchmark)

Variables	**Private credit / GDP**			**Battle fatalities in internal armed conflict**		
	LS	**2SLS**	**LIML**	**LS**	**LIML**	**LIML**
	(1)	(2)	(3)	(4)	(5)	(6)
Battle fatalities in	4.49e-05	0.010	0.001			
internal armed conflict	(5.10e-05)	[0.006]***	(0.0005)			
	0.379		0.156			
Private credit/GDP				-8.086	-2.430	-23.640
				(7.155)	(0.537)***	(20.20)
				0.258	0.001	0.242
Log of population				-2040.626		
				(1714.939)		
				0.234		
		First stage for battle fatalities			**First stage for private credit / GDP**	
Variation in elevation across regions		2,686	2,686			
		(405.0)***	(405.0)***			
		0.000	0.000			
British legal origin					-68.030	-0.947
					(1.354)***	(0.833)
					0.000	0.256
French legal origin					-79.68	
					(0.176)***	
					0.000	
Observations	5,927	4,883	4,883	3,352	5,869	4,073

Note: All results are generated with country fixed effects and common time effect. Below each coefficient estimates, the robust standard errors (shown in parentheses) are clustered at the country level. The method of estimation used in the top panel is two-stage least squares (2SLS) in Columns 2; the standard errors of this 2SLS estimator are not robust to weak instruments, and thus inference depending on such standard errors can be misleading. Hence, below the two-stage least squares estimates, we report p-values [in square brackets] on the basis of the Anderson–Rubin test of statistical significance; this test is robust to weak instruments (see Andrews and Stock, 2005). We implement a version of the Anderson–Rubin test that is robust to heteroskedasticity and arbitrary within-country correlation of the residuals. Comparing with 2SLS estimates, Columns 3, 5 and 6 report limited information maximum likelihood (LIML) estimates for the same specification as in Column 2 and 5 respectively with standard errors (shown below the estimates of the bottom panel) that are robust to heteroskedasticity and arbitrary within- country correlation; Fuller(1) property is used for yielding the most unbiased estimator (Fuller, 1977). Unlike Column 5, only developing countries' samples are included in column 6. In the bottom panel of Columns 1-3, we instrument the best estimate of battle fatalities in internal armed conflict with the variation in elevation across regions of countries and the private credit by deposit money banks and other financial institutions as a proportion of GDP with the British, French and German legal origins respectively. *Significantly different from zero at 90 percent confidence; **95 percent confidence; ***99 percent confidence.

Table 3: Civil conflict and credit constraint, 1950-2010 (Benchmark)

Variables	Model 3.1		Model 3.2	
	Private Credit / GDP	Battle fatalities in internal armed conflict	Private Credit / GDP	Battle fatalities in internal armed conflict
	(1)	(2)	(3)	(4)
Best estimate of battle fatalities in	0.013		0.011	
internal armed conflict	(0.004)***		(0.004)***	
	0.002		0.003	
British legal origin	-54.330		-22.600	
	(9.928)***		(9.018)**	
	4.45e-08		0.012	
French legal origin	-287.700		-21.490	
	(71.60)***		(18.540)	
	5.87e-05		0.246	
Private credit by deposit money banks and		-157.0		-158.900
other financial institutions / GDP		(96.980)		(99.820)
		0.105		0.111
Square of private credit by deposit money		0.798		0.792
banks and other financial institutions / GDP		(0.414)*		(0.424)*
		0.054		0.062
Variation in elevation across regions		-6,286		-5,009
		(3,125)**		(2,790)*
		0.044		0.073
Log of per capita income		1,835		1,990
		(762.200)**		(827.200)**
		0.0161		0.016
Observations	1,735	1,735	1,669	1,669

Notes. Three-stage least squares estimation. All results are generated after including country fixed effects and common time effects. In parentheses are the robust standard errors clustered at the country level. *Significant at 10% level; **significant at 5% level; ***significant at 1% level. In columns (1) and (3) we also include Lending interest rate and German legal origin as additional controls and in columns (2) and (4) we include log of population, oil exporter and dummy variable for countries with non-contiguous territory as additional controls. Lending interest rate and German legal origin were statistically significant with negative signs, but the other three controls in columns (2) and (4) were not significant. We are not reporting these results due to space constraint.

Table 4: Credit constraint share of agricultural production in GDP and civil conflict, 1950-2010

Variables	**Agricultural GDP share**	**Best estimate of battle fatalities in internal armed conflict**	**Agricultural GDP share**	**Best estimate of battle fatalities in internal armed conflict**	**Investment share of GDP per capita**	**Best estimate of battle fatalities in internal armed conflict**
	LS	**2SLS**	**LS**	**2SLS**	**LS**	**2SLS**
	(1)	(2)	(3)	(4)	(5)	(6)
Lending interest rate (%)	-3.71e-05				-3.33e-05	
	(5.31e-06)***				(8.36e-06)***	
	0				6.88e-05	
Agricultural GDP share		-637.800		-785.400		
		[0]***		[0]***		
Interest rate spread (%)			-0.0003			
			(5.78e-05)***			
			1.74e-06			
Investment share of GDP per capita						-716.100
						[0]***
First stage:		*Agricultural GDP share*		*Agricultural GDP share*		*Investment share of GDP per capita*
Lending interest rate (%)		-3.71e-05				-3.33e-05
		(5.46e-06)***				(8.61e-06)***
		0				0.0001
Interest rate spread (%)				-0.0003		
				(5.96e-05)***		
				3.47e-06		
Observations	4,269	4,269	4,027	4,027	4,232	4,232

Note: Below each coefficient estimates, the robust standard errors (shown in parentheses) are clustered at the country level. All results are generated after including country fixed effects and common time effects. The method of estimation used in the top panel is two-stage least squares (2SLS) in Columns 2, 4 and 6; the standard errors of this 2SLS estimator are not robust to weak instruments, and thus inference depending on such standard errors can be misleading. Hence, below the two-stage least squares estimates, we report p-values [in square brackets] on the basis of the Anderson–Rubin test of statistical significance; this test is robust to weak instruments (see Andrews and Stock, 2005). We implement a version of the Anderson–Rubin test that is robust to heteroskedasticity and arbitrary within-country correlation of the residuals. In the bottom panel, we instrument agricultural GDP share with the lending interest rate and interest rate spread in column 2 and 4 respectively (Esteban, Mayoral and Ray, 2012), and investment share of GDP per capita with the lending interest rate in column 6. *Significantly different from zero at 90 percent confidence; **95 percent confidence; ***99 percent confidence.