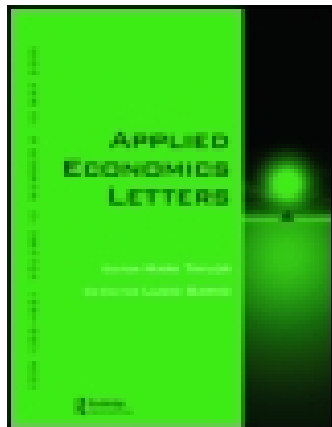


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Destroying collateral: asset security and the financing of firms

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Posting collateral encourages credit provision under the assumption that lenders can appropriate the pledged assets in case of default. When institutions work imperfectly, though, banks discount the value of effective collateral, thereby reducing lending volume. This process has been described in US states with difficult foreclosure procedures, but here we show that it also matters for poor countries after a violent conflict, when collateralizable assets have a heightened probability of being destroyed. We use firm-level data on loans in Sub-Saharan Africa to show that to get a loan, firms in countries with recent conflict need to pledge additional collateral. While some OLS offer supporting evidence, the effect is larger and more precisely estimated when we use quantile regressions to focus on the subgroup of firms that face tougher collateral requirements, which suggests that this effect is heterogeneous within countries. This mechanism is a novel channel that relates peace to economic growth and convergence through financial markets.

Keywords: mortgage; political risk; pledge-ability; social conflict; economic recovery; peace dividend

JEL Classification: G33; G21; K42

I. Introduction

Posting collateral for a loan aligns the incentives of borrowers and lenders, reducing the probability of default. That well-known mechanism rests on the assumption that collateral can be enforced. When it is hard to foreclose or repossess assets, lenders anticipate these problems and adjust their contracts accordingly. For example, Pence (2006) shows that costly foreclosure procedures required in some US states add to lenders' transaction costs and result in a

contraction of credit supply, with loan size reduced by 3% to 7%. Administrative costs associated with reclaiming collateral may also lead lenders to raise collateral requirements to offset the extra red tape (Francis, 2003).

In this article, we focus on a different type of problem that can reduce the quantity of effective collateral, namely the probability that assets are destroyed due to violent conflict. This matters for finance research both to understand how loan contracts adapt to extreme environments and to

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understand yet another cost that violent conflict imposes on economic recovery and investment.¹

This article relates to the literature on conflict and growth; which usually explores how an unstable environment lowers returns on investment (see Serven, 1997; Acemoglu and Robinson, 2010; Loureiro and Silva, 2010; Brück *et al.*, 2011). The channel investigated here is different, though, because we do not focus on decreases in the expected return of projects, but propose that violence undermines the usefulness of collateral to finance projects. We test this proposition using firm-level data from the World Bank Enterprise Surveys (WBES).

Our results suggest that in countries affected by recent conflict, firms that obtain loans have between 37 and 85 percentage point higher Value-to-Loan (VTL) requirements. The effect is more precisely estimated when we use quantile regressions and focus on the subgroup of firms that face tougher collateral requirements. We find that the 90th percentile of VTL is between 134 and 200 percentage points higher in conflict-affected countries. We interpret this as evidence that protracted violence impacts the finances of some firms and is therefore one additional channel that can explain the connection between financial development and convergence (Aghion *et al.*, 2005).²

II. Framework

Standard models imply that to align borrowers' incentives with their own, risk-neutral banks require collateral V of at least λ times the loan size L (see Tirole (2006) Ch 3).³ We instead consider *expected* collateral $(1 - \delta)V$, accounting for the risk of asset-destruction δ due to violence in a protracted conflict. Risk neutral banks require $(1 - \delta)V \geq \lambda L$. If the constraint binds in the optimal contract, then $V/L = \lambda/(1 - \delta)$.

Proposition: *The VTL ratio for those getting a loan is increasing in the risk of destruction δ .*

Proof: *See the formula given above.*

III. Data and Preliminary Trends

We test the proposition using cross-sectional, firm-level data from the WBES. Since we do not want to compare countries with extreme differences in levels of development, we restrict our sample to firms in Sub-Saharan Africa. This provides sufficient variation in recent conflict activity without comparing countries with extremely different economic structures. VTL as a fraction comes directly from WBES. The main explanatory variable is a dummy for the presence of conflict at the country level, equal to 1 if the country is classified as conflict-affected and 0 otherwise. Our baseline measure is membership in the G7+, an association of conflict-affected states (<http://www.g7plus.org>). We use alternative measures as a robustness check in the Supplemental data. GDP per capita PPP and inflation rate are from World Development Indicators. We winsorize observations over 10 SDs from the mean, losing less than 1% of our final sample. For the regressions, additional control variables at the firm level are obtained from WBES.

Out of the 15 250 firms surveyed, 3046 had a bank loan at the time of the survey. Out of these, 1707 answered the question about collateral value (56% of those with a loan and 11.2% of the total sample). The average VTL ratio is 128%, and the 90th percentile is 200%. Based on membership in the G7+, 16% of observations were located in conflict-affected countries.

Figure 1 makes a raw comparison of collateral requirements (VTL) in conflict and nonconflict countries. The point estimates of the mean VTL are higher

¹ Berman *et al.* (2013) theoretically model the relationship between rebellion and investment, empirically finding a negative correlation between investment and violence along with a positive correlation between changes in those variables. They claim that investment attracts rebels who seize part of profits, which in turn discourages further investment. Collier and Duponchel (2013) use firm-level data from Sierra Leone to show that conflict harms firms through loss of human capital when operations are disrupted and skills atrophy. Without disagreeing with those channels, our effort is to highlight a different effect: collateral destruction. We investigate the way that conflict interacts with the inherent risks of finance caused by asymmetric information and moral hazard, regardless of expected return.

² At the macroeconomic level, Malamud and Assane (2013) show that Sub-Saharan Africa has not only low growth, but also low convergence. Chaudhuri and Srivastava Sr (1999) shows that domestic fundamentals in Africa could be behind the limited traction of capital inflows to that region.

³ Of course, there are limits to collateral, as pointed out by Stiglitz and Weiss (1981).

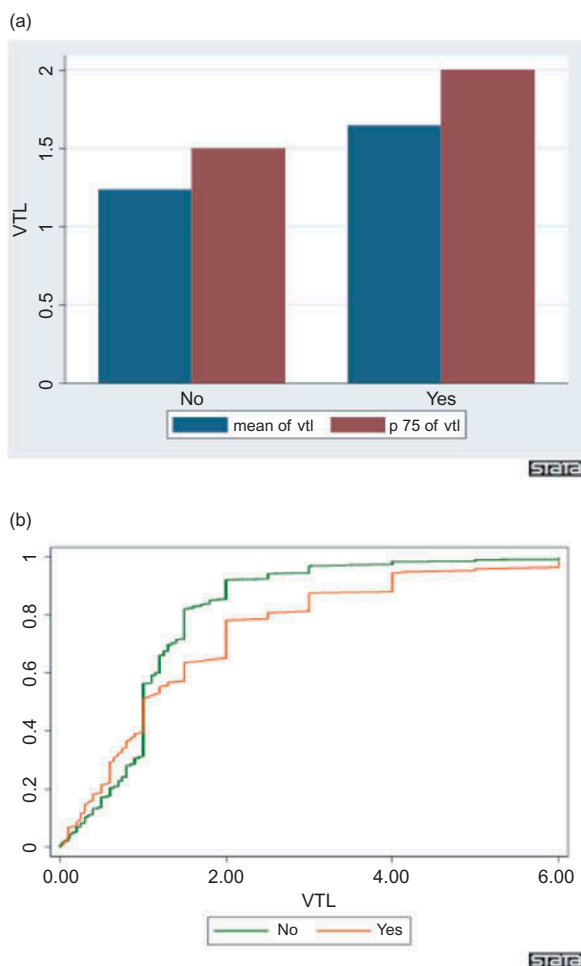


Fig. 1. Comparison of the distribution of Value-to-Loan ratios for the most recent loan of firms. (a) Means and upper quartile of VTL, by post-conflict status, (b) cumulative distribution of VTL, by post-conflict status

for the conflict group, although not statistically different (Fig. 1(a)). The difference becomes clearer in the upper quartile of the distribution (Fig. 1(a)), with a 50 percentage point higher mean VTL for conflict countries (clustered SE; p -value = 0.1). When plotting the cumulative distribution in Fig. 1(b), it becomes clear that upper tail of the conflict group’s VTL distribution is shifted to the right. A formal Kolmogorov–Smirnov test shows that the two empirical distributions are statistically different (p -value = 0.001).

IV. Regression

Baseline

The ideal experiment would randomly assign firms to conflict and nonconflict countries and later

measure collateral (VTL) associated with each firm’s last loan. Since we cannot perform that experiment, we proceed with a controlled regression analysis. Our identification assumption is that once observable controls are included, firms are otherwise similar. To make this method operational, on top of industry i dummies, μ_i , in some specifications we control for a vector of firm f characteristics X_f : non-linear functions of employment, sales, value of loan, firm age and managerial experience, as well controlling for other country c attributes, X_c , like GDP per capita and inflation, which could be potential confounders of the conflict variable. The estimated equation is

$$VTL_{fic} = \alpha + \beta \cdot 1[\text{Conflict}_c] + \gamma[X_f \ X_c]' + \mu_i + \varepsilon_{fc}$$

Regression results are displayed in Table 1. The OLS results show some positive effects with little statistical power. Column (1) controls for industry dummies, with a point estimate $\hat{\beta} = 0.4$, meaning 40 percentage points of higher VTL in conflict countries, although the estimate is not statistically significant. Column (3) includes all the controls X and gets a similar estimate, but with a slightly smaller sample due to availability of covariates. Column (2) estimates the same model as in column (1) but with the sample used in column (3), obtaining a $\hat{\beta} = 0.85$ (p -value < 0.1).

As expected from the cumulative-density plots, the action is imprecisely captured by the means; we therefore focus on the upper quantiles of the VTL distribution. Columns (4) to (6) display the same specifications as in columns (1) to (3) using a quantile regression of the 75th percentile. Results become stronger and more precisely estimated, with $\hat{\beta}$ between 50 and 150 percentage points of extra collateral required, depending on the specification. Finally, columns (9) to (11) perform the same exercise but focus on the top decile, showing a systematic and statistically significant difference in VTL for all specifications. At the top, collateral requirements in post-conflict countries are around 200 percentage points higher, or twice as large as those in the nonconflict countries (seen by comparing the coefficient estimate with the intercept).

The quantile results are more statistically significant than the OLS. We can interpret the discrepancy in light of several limitations of the data and analysis. Firstly, the conflict indicator is assigned a value at the

Table 1. Baseline regression estimates of the Value-to-Loan ratio on conflict (OLS and quantile)

	Left-hand side variable: Value-to-Loan ratio (as fraction)										
	75th percentile						90th percentile				
OLS	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Conflict	0.41 (0.70)	0.85* (1.75)	0.37 (0.95)	0.50 (1.52)	1.50*** (5.37)	0.92** (2.25)	0.92** (2.2)	0.92*** (2.62)	2.00*** (11.45)	2.00*** (5.13)	1.34*** (3.53)
GDP per capita (log)			-0.23** (-2.45)			-0.24*** (-3.48)	-0.25*** (-3.48)	-0.24*** (-2.83)			-0.30 (-1.51)
Strength of legal rights index (0-10)							0.00006 (0.00)				
Depth of credit information index (0-6)								-0.014 (-0.39)			
Constant	1.24*** (12.42)	1.29*** (12.13)	45.98*** (2.94)	1.50*** (14.42)	1.50*** (13.82)	41.41*** (4.54)	41.41*** (5.25)	42.42*** (4.24)	2.00*** (16.61)	2.00*** (20.40)	91.75*** (2.08)
Industry dummies	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Additional controls	no	no	yes	no	no	yes	yes	yes	no	no	yes
Observations	1707	1550	1550	1707	1550	1550	1550	1550	1707	1550	1550
R ²	0.018	0.055	0.107	0.016	0.052	0.095	0.095	0.094	0.016	0.046	0.092

Notes: SEs clustered by country. *t*-statistics are shown in parentheses. Asterisks (*, **) and (***) indicate statistical significance at the 10%, 5% and 1% levels. Conflict is our baseline measure, defined as membership in the G7+. Columns (1) to (3) are OLS/FE regressions of VTL expressed as a fraction; columns (4) to (8) are quantile regressions for the 75th percentile; the variables depth of credit information and strength of legal rights at the country level come from the World Bank Doing Business indicators; columns (9) to (11) are quantile regressions for the 90th percentile of the same variable. The first column in each group regresses collateral (VTL) on conflict with an industry dummy: textiles, leather, † garments, food, † metals and machinery, electronics, † chemicals and pharmaceuticals, wood and furniture, nonmetallic and plastic materials, other manufacturing, † retail and wholesale trade, hotels and restaurants, other services † and other (construction, transportation, etc.). The second column in each group estimates the same model as in the first column of each group while limiting the sample to the observations that are also included in the third. The third column, on top of the abovementioned fixed effects, adds controls for number of permanent, full-time workers (log), dummy variables for firm size (small, † medium and large), total sales in year prior to survey (log), GDP per capita measured at PPP in constant international dollars (log), inflation in the year of survey, value of firm's most recent loan (log), year of most recent loan's approval, firm age (log) and manager's years of experience in the industry. Variables marked † were omitted from the regressions due to collinearity.

country level. However, there is probably substantial within-country variation in the extent to which firms are affected by conflict. This would attenuate the increase in mean VTL that OLS detects. An ideal analysis would classify firms as conflict-affected or not conflict-affected on an individual basis depending on the circumstances in their specific area, but that analysis is beyond the scope of this study. We expect our proposition to operate primarily for the potentially small group of firms within a country most affected by everyday instability and violence, an effect that would be most visible in the upper quantiles of VTL (and is, empirically). We also keep in mind that as collateral requirements rise, the amount of wealth required for obtaining a loan also rises, meaning that potential borrowers are cut off. The most drastic increases in collateral requirements would be unobservable in that case. Finally, the sample is probably biased due to the constraints of data-gathering. Firms in the most violent and conflict-ridden areas, which we would expect to most dramatically support our hypothesis, are also the least likely to have been accessed by data collectors. Our significant empirical results in spite of these attenuating factors provide supporting evidence for our proposition.

As a potential alternative explanation, one could think that conflict may be correlated with corruption or weak protection of legal rights for lenders. In column (7), we account for this factor including the country's legal strength as explanatory variable, but our results remain robust, reducing concerns about this alternative explanation. In column (8), we include a credit information index to account for possible correlation between corruption and poor information that could be driving our results, but the estimates also remain robust. Additional tests (in the Supplemental data) show that our results are also robust to various methodological changes like using alternative definitions of conflict, importance weights and the logarithm of VTL.

V. Conclusion

We show that some firms need to pledge more collateral when they are located in countries with recent violent conflict, which we interpret as a consequence of a higher risk of asset destruction, equivalent to foreclosure problems for mortgages in the US, generating less effective collateral per unit of net worth and making it harder to mitigate credit market

imperfections. This collateral-destruction channel could be a factor slowing economic recovery in areas that faced a violent conflict. While for methodological reasons we analysed Sub-Saharan Africa, this collateral-destruction channel could also be important for other more developed economies that face sub-national violence (e.g. 'maras' and narco-violence in Latin America). Peace is valuable by itself, but it is also instrumental for financing growth.

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Supplemental data

Supplemental data for this article can be accessed [here](#).

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