

Transitory Economic Shocks and Civil Conflict

by

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Abstract

I examine whether civil conflict is partly driven by transitory economic shocks. My approach follows Miguel, Satyanath, and Sergenti (2004) in using rainfall as an exogenous source of economic shocks in Sub-Saharan African countries. The main difference is that my empirical specifications take into account that rainfall shocks are transitory. Failure to do so may, for example, lead to the conclusion that conflict follows negative economic shocks when it follows positive shocks, and that positive shocks reduce conflict when conflict is only shifted to the immediate future.

Key words: Shocks, mean reversion, rainfall, civil conflict

JEL codes: O0, P0, Q0

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1. Introduction

Is civil conflict triggered by transitory economic downturns? Answering this question is complicated by many difficult-to-measure economic, social, political, and institutional factors that may affect both income and the likelihood of civil conflict. In addition, economic downturns may partly be driven by the expectation of future civil conflict. Miguel, Satyanath, and Sergenti (2004) show how both these issues can be addressed. Their approach employs a panel-data setup to control for unobservables and uses rainfall variation as an instrument for income growth in Sub-Saharan Africa. Their main empirical results are that civil conflict is more likely following years of low rainfall growth and that (rainfall-driven) reductions in income growth raise the chance of civil conflict. These results are in line with the findings of Collier and Hoeffler (1998, 2002, 2004) and Fearon and Laitin (2003), who have argued that economic variables are often more important determinants of civil conflict than political or social grievances. Miguel, Satyanath, and Sergenti's results are also important from a policy perspective. If a transitory drop in income raises the chance of civil conflict it might be possible to reduce conflict by a well-designed income insurance program.

Estimating the effect of transitory economic shocks on civil conflict involves an interesting issue that has not been analyzed so far. Consider Miguel, Satyanath, and Sergenti's finding that civil conflict is more likely following years of low rainfall-driven income growth. This result is consistent with conflict being triggered by low income due to droughts. But it is also consistent with the diametrically opposite interpretation that conflict is most likely when a high-income year due to exceptionally good rainfall

conditions is followed by a normal year. The first interpretation indicates that civil conflict may be triggered by a temporary fall in the opportunity cost of fighting. This explanation of the effect of income on civil conflict was suggested by Collier and Hoeffler (1998) and is also put forward by Miguel, Satyanath, and Sergenti (for a theory of the link between transitory negative shocks and civil conflict, see Chassang and Padró i Miquel, 2006 and 2007). But according to the second interpretation, civil conflict would be most likely following years with exceptionally high rainfall-driven income. This ambiguity is due to the transitory nature of rainfall shocks. It can be resolved by relating civil conflict to rainfall levels instead of growth rates. If conflict is triggered by transitory economic downturns, civil conflict should be more likely following low rainfall. On the other hand, if conflict is most likely when economies return to normality after transitory booms, civil conflict should be most probable following high rainfall.

Analyzing the consequences of rainfall shocks on civil conflict using a growth specification has another important disadvantage. Consider the following example. Suppose that using a growth specification we find that the probability of civil conflict onset at t , $P(Onset)_t$, is related to rainfall growth between $t-1$ and t by $P(Onset)_t = -0.1(\log Rain_t - \log Rain_{t-1})$. What are the consequences of a (transitory) positive rainfall shock at t ? The probability of civil conflict onset at t is reduced by $-0.1(\sigma - 0) = -0.1\sigma$ where σ is the size of the shock. But the probability of civil conflict onset at $t+1$ increases by 0.1σ , as $-0.1(0 - \sigma) = 0.1\sigma$. Hence, the (transitory) positive rainfall shock reduces the probability of conflict on impact but has an offsetting

effect a year later.¹ To put it differently, a positive rainfall shock shifts civil conflict into the future. A simple way to avoid imposing such a conclusion is to relate conflict onset to rainfall levels using $P(\text{Onset})_t = \alpha \log \text{Rain}_t + \beta \log \text{Rain}_{t-1} + u_t$ where u is a regression residual. This regression equation contains the growth specification as a special case, but also allows for positive rain shocks to reduce the likelihood of civil conflict on impact and not increase it in the immediate future ($\alpha < 0$; $\beta = 0$).

In the remainder of the paper, I estimate the effect of rainfall levels on civil conflict in Sub-Saharan Africa and contrast these results with the effect of rainfall growth. My main results control for unobservable time-varying factors affecting the likelihood of civil conflict throughout Sub-Saharan Africa (an example of such an event would be the end of the Cold War, see Fearon and Laitin, 2003). For comparison with Miguel, Satyanath, and Sergenti (2004), I also present results that do not account for common shocks however. The empirics yield that civil conflict is triggered by low rainfall levels, not by low rainfall growth. Negative (positive) rainfall shocks raise (reduce) the likelihood of civil conflict in the short run and do not have a subsequent offsetting effect.

2. Estimation Framework and Data

The main estimating equation relates civil conflict to rainfall levels, country-specific time-invariant unobservable risk factors (α_c), country-specific time trends ($\beta_c \text{Year}_t$), and common time-varying unobservable risk factors (δ_t),

¹ The transitory nature of the shock is key; there would not be an offsetting effect in $t+1$ if the shock was permanent.

$$(1) \text{ conflict}_{c,t} = \alpha_c + \beta_c \text{Year}_t + \delta_t + \gamma_1 \log \text{Rain}_{c,t} + \gamma_2 \log \text{Rain}_{c,t-1} + \gamma_3 \log \text{Rain}_{c,t-2} + \varepsilon_{c,t}$$

where α , β , δ , γ denote parameters to be estimated and ε a disturbance term. The *conflict* variable is either conflict onset or conflict incidence. Conflict incidence is captured by an indicator variable that takes the value of 1 in a country-year with civil conflict and 0 otherwise. Conflict onset is an indicator variable that is 1 in a country-year with civil conflict if there was no conflict in the previous year; the onset indicator is 0 if there is no conflict in a country-year and there was no conflict in the previous year. I also estimate (1) with income per capita levels on the right hand side and rain levels as instruments.²

The specification to estimate the effect of rainfall growth on conflict follows Miguel, Satyanath, and Sergenti (2004),

$$(2) \quad \text{conflict}_{c,t} = \alpha_c + \beta_c \text{Year}_t + \delta_t + \gamma_1 \text{RainGrowth}_{c,t} + \gamma_2 \text{RainGrowth}_{c,t-1} + \varepsilon_{c,t}$$

where $\text{RainGrowth}_{c,t}$ ($\text{RainGrowth}_{c,t-1}$) is the growth rate of rainfall levels between $t-1$ and t ($t-2$ and $t-1$). The main difference with Miguel, Satyanath, and Sergenti is that I add controls for common time-varying risk factors (δ_t) in some specifications. I estimate (1) and (2) for two time periods: 1981-2006; and 1981-1999, which is the period of estimation of Miguel, Satyanath, and Sergenti. For the 1981-1999 period, I provide results with the conflict data employed by Miguel, Satyanath, and Sergenti, and with the 2007 version of the same conflict dataset.

² The main estimation method is IV-2SLS, which is usually preferred in case with a dichotomous explanatory variable as alternative estimation approaches require strong specification assumptions (Angrist and Krueger, 2001; Wooldridge, 2002).

The data on civil conflict comes from the UCDP/PRIO Armed Conflicts 2007 Dataset of the International Peace Research Institute's (PRIO) Centre for the Study of Civil War and the Uppsala Conflict Data Program.³ This is an updated and extended version of the database used by Miguel, Satyanath, and Sergenti (2004). Rainfall data for the period 1981-2001 come from Miguel, Satyanath, and Sergenti (2004) and their data website; the original data source is the NASA GPCP (NASA Global Precipitation Climatology Project).⁴ I extend the GPCP rainfall database to 2006 using the same methodology and data source (NASA Global Precipitation Climatology Project, Version 2).⁵ The income per capita data is taken from the Penn World Tables 6.2 and is available until 2003.⁶

3. Empirical Results

I start by estimating the effect of rainfall on civil conflict onset and then turn to civil conflict incidence. The main result is that there is a consistent positive effect of low $t-1$ rainfall levels on the probability of civil conflict at t . The rainfall growth specifications yield insignificant results or results that switch from negative effects of rainfall growth on civil conflict to positive effects once common time-varying risk factors are accounted for.

Rainfall and conflict onset Table 1, Panel A shows the effect of rainfall levels on the probability of civil conflict onset for three different samples. The results for the longest possible sample are in columns (1)-(3). Column (1) includes country fixed effects and country-specific time trends but not common time effects. The log rainfall level at $t-1$

³ The dataset is available at <http://new.prio.no/CSCW-Datasets/Data-on-Armed-Conflict>.

⁴ The data is available at <http://elsa.berkeley.edu/~emiguel/data.shtml>.

⁵ See Adler et al. (2003). The data is available at <http://precip.gsfc.nasa.gov>.

⁶ The dataset is available at <http://pwt.econ.upenn.edu>.

enters negatively and highly significantly (at the 97% confidence level). According to the point estimate, each 10% drop in rainfall levels raises the probability of civil conflict by 1.1 percentage points. Column (2) includes a dummy variable for the period after 1990s to capture effects due to the end of the Cold War (e.g. Fearon and Laitin, 2003). The dummy indicates that after 1990, civil conflict outbreak was 10 percentage points more likely than before. Allowing for a different probability of civil conflict onset after 1990 does not change the effect of rainfall levels. Column (3) includes common time effects to capture time-varying factors that affect civil conflict outbreak in all Sub-Saharan African countries. The common time effects are jointly significant at the 99.99% confidence value (p-values are reported in the time effects row). This actually increases the effect of rainfall on civil conflict outbreak somewhat. Now a 10% drop in the rainfall levels at $t-1$ is found to raise the probability of civil conflict at t by 1.5 percentage points (the effect is statistically significant at the 98% confidence level).

Columns (4)-(6) contain the empirical results using the 2007 PRIO data but only until 1999. The time period is therefore that of Miguel, Satyanath, and Sergenti but I am using the 2007 update of their conflict data set. The results are in line with those for the longest possible period in the previous columns. Results are however quite different when using the PRIO conflict data of Miguel, Satyanath, and Sergenti in columns (7)-(9). In this dataset there is no effect of rainfall levels on civil conflict onset once common time effects are accounted for (the common time effects continue to be highly statistically significant, see the p-value in the table). In the specifications without common time effects, the effect of rainfall is just the opposite of the effect with the updated PRIO data. Now civil conflict outbreak is most likely following years of high rainfall, although this

effect sets in with a lag. This will play an important role when interpreting the results of the rainfall growth specifications.

Table 1, Panel B, estimates the effect of rainfall growth on the probability of civil conflict onset. There are two main results. First, according to the 2007 PRIO civil conflict data there is not much evidence of a statistically significant link between rainfall growth and civil conflict onset. Second, while there is a negative effect of rainfall growth on conflict onset with the PRIO conflict data of Miguel, Satyanath, and Sergenti (2004), this effect appears to be due to high-rainfall years being followed by a lower probability of civil conflict as well as low rainfall growth due to mean reversion.

The rainfall growth results for the longest possible sample are in columns (1)-(3). According to the estimates without common time effects in column (1), rainfall growth does not have a statistically significant effect on civil conflict onset. The effect of rainfall growth on civil conflict onset is also absent in column (2) where I allow for a different probability of civil conflict after 1990; the after-1990 dummy is statistically significant and shows a 10 percentage points increase. Accounting for common time effects in column (3) actually yields the opposite result of Miguel, Satyanath, and Sergenti (the common time effects are highly statistically significant, see the p-value in the table). Now civil conflict onset is most likely following high rainfall growth. This seemingly unintuitive result is consistent with the key finding of the rainfall level specification in column (3) of Panel A (civil conflict is more likely following low-rainfall years) as the transitory nature of rainfall shocks implies that high rainfall growth is most likely following low-rainfall years.

The results for 1981-1999 are very similar to those for the longest possible sample when I use the 2007 PRIO update for this period. The baseline in column (4) yields no statistically significant effects of rainfall on civil conflict onset, and this continues to be the case when I allow for a change in the probability of civil conflict after 1990 in column (5). In column (6), which includes common time effects in the estimating equation, civil conflict is again most likely to break out following high rainfall growth.

The 1981-1999 results with the PRIO conflict data of Miguel, Satyanath, and Sergenti in columns (7)-(9) are somewhat different. In the baseline in column (7), rainfall growth reduces the probability of civil conflict onset. But the interpretation of this finding is not as straightforward as it may seem at first. The rainfall level specification in column (7) of Panel A shows that it is high rainfall that makes conflict more likely (with a lag) in the PRIO conflict data of Miguel, Satyanath, and Sergenti. Hence, conflict appears to follow low rainfall growth because high-rainfall years tend to be followed by more conflict and, due to mean reversion, by low rainfall growth. In any case, the effect of rainfall growth in column (7) becomes insignificant in column (8) when I allow for a different likelihood of civil conflict outbreak in the 1990s. Finally, column (9) shows no significant link between rainfall growth and civil conflict onset once common time effects are included (the common time effects continue to be highly statistically significant).⁷

Figure 1 shows the response of the conflict onset probability to a positive rainfall shock using the rainfall growth specification and the parameters estimated in column (7)

⁷ Miguel, Satyanath, and Sergenti (2004) also analyze the effect of rainfall on civil conflicts with more than 1000 annual battle deaths. According to the 2007 PRIO conflict data, there is no statistically significant link between the outbreak of such civil conflicts and rainfall levels or growth rates whether I include (the highly statistically significant) time effects in the empirical analysis or not.

of Panel B (which corresponds to the time period, data, and specification of Miguel, Satyanath, and Sergenti). The calculated impulse response is based on the following AR(1) process for rainfall, $\log Rain_t = 0.07 \log Rain_{t-1} + u_t$, where I obtained the persistence parameter by regressing log rainfall on its lag, country fixed effects, country-specific time trends, and common time effects. This process implies that a rainfall shock at time t translates into $\log Rain_t = 1$; $\log Rain_{t+1} = 0.07$; $\log Rain_{t+2} = (0.07)^2$; etc. The log change in rainfall levels is therefore $\log Rain_t - \log Rain_{t-1} = 1$; $\log Rain_t - \log Rain_{t-1} = -0.93$; etc. Using the estimates in column (7) Panel B, the corresponding response of the probability of conflict onset is $P(Onset)_t = -0.66 * 1$ with a standard error of 0.047; $P(Onset)_{t+1} = -0.66 * (-0.93) - 0.126 * 1 = -0.65$ with a standard error of 0.057; $P(Onset)_{t+2} = -0.66 * (-0.06) - 0.126 * (-0.93) = 0.121$ with a standard error of 0.066; etc.⁸ Figure 1 illustrates the response of the probability of conflict onset at t , $t+1$, $t+2$, etc. to the rainfall shock at t and the 95% confidence bands of this response. It can be seen that there is a negative effect of the rainfall shock on impact and after one period. But there is a positive effect on the probability of conflict onset after two periods. This is the offsetting effect of rainfall growth specifications discussed earlier.

Civil conflict incidence The empirical results for civil conflict incidence in Table 2 mirror those for onset. Table 2, Panel A contains the estimates of the effect of rainfall

⁸ The standard error of $P(Onset)_{t+1}$ and $P(Onset)_{t+2}$ cannot be read off directly from the standard errors in column (7). This is because it involves the two standard errors in column (7) and the covariance of the effects at time t and $t+1$ (which is 0.0018). For example, the standard error of the impulse response at $t+1$ is obtained as $0.057 = \sqrt{0.047^2 0.93^2 + 0.068^2 1^2 - 2 * 0.93 * 1 * 0.0018}$.

levels on the probability of a country going through a civil conflict in any given year. The results using the 2007 PRIO data in columns (1)-(6) are very consistent. All specifications show that civil conflict is more likely following years of low rainfall. This also holds with the PRIO dataset used by Miguel, Satyanath, and Sergenti once common time effects are included in the specification.

Table 2, Panel B, shows the civil conflict incidence results for the rainfall growth specifications. The two main results are similar to those in Table 1. First, according to the 2007 PRIO civil conflict data there is not much statistical evidence of a consistent link between rainfall growth and civil conflict. In some specifications, conflict is more likely following low rainfall growth, in some following high rainfall growth. Second, while there is a negative effect of rainfall growth on conflict with the PRIO conflict data of Miguel, Satyanath, and Sergenti (2004), this effect again appears to be due to high-rainfall years being followed by low conflict incidence and, due to mean reversion, low rainfall growth.

In the rainfall growth specification for the longest possible sample in column (1) there is a negative effect of lagged rainfall growth on civil conflict incidence. But this effect becomes statistically insignificant in column (2) where I allow for a different likelihood of civil conflict after 1990 (civil conflict again appears to have been significantly more likely after 1990). Accounting for common time effects in column (3) yields that civil conflict is most likely following high rainfall growth, the opposite result of Miguel, Satyanath, and Sergenti (the common time effects are highly statistically significant).

The civil conflict incidence results for 1981-1999 with the 2007 PRIO update in column (4) show a negative effect of lagged rainfall growth on conflict incidence (just

significant at the 90% confidence level) but the effect turns statistically insignificant when I allow for the after-1990 effect and becomes significantly positive when I account for common shocks using time effects.

The 1981-1999 results with the PRIO conflict data of Miguel, Satyanath, and Sergenti in columns (7)-(9) are roughly in line with the previous findings. For example, according to column (7), conflict follows low rainfall growth. But just as in the case of onset, the rainfall level results in column (7) of Panel A indicate that this finding may be partly driven by mean reversion following high-rainfall years. Column (8) where I control for after-1990 effects still yields a negative effect of rainfall growth on conflict incidence. But the link between rainfall growth and conflict incidence becomes statistically insignificant when the (highly significant) common time effects are included in the specification.

Income shocks and civil conflict Table 3 contains the results for the effect of income per capita on civil conflict onset and incidence. The estimation method is IV-2SLS with (log) rainfall at t , $t-1$, and $t-2$ as instruments for (log) income per capita at t and $t-1$. The sample period is 1981-2003 as there is no PWT income data after 2003.

Column (1)-(2) contain the results of the first-stage regression of log income per capita at t on country fixed effects, country-specific time trends, and log rain at t and $t-1$, which yields a highly significant positive effect of rain at t (t-statistic=2.61). This effect becomes stronger (t-statistic=2.85) when I also include common time effects (the common time effects are significant at the 99.99% confidence level), which seems

reasonable as Sub-Saharan African countries are exposed to international economic shocks.

The second-stage results for civil conflict onset are in columns (3)-(4) and for civil conflict incidence in column (5)-(6). In the onset specification without common time effects in column (3), $t-1$ income enters negatively but is insignificant at the 90% confidence level. The effect becomes significant at the 92% confidence level once common time effects are included in the specification. Including these time effects is necessary for efficiency as they are highly significant in the first-stage.⁹ The effect of income shocks on civil conflict onset is quite large. According to the significant point estimate (-4.561), a 1% drop in income raises the probability of civil conflict onset by 4.5 percentage points. The civil conflict incidence results in columns (5)-(6) confirm the findings for onset. The effect of $t-1$ income on conflict incidence is negative but statistically insignificant at the 90% confidence level. But once I control for common time effects, the effect of $t-1$ income shocks becomes statistically significant at the 96% confidence level. The magnitude of the effect is somewhat smaller than for onset. Now a 1% drop in income is estimated to increase the probability of civil conflict by 2.5 percentage points.

4. Conclusion

If civil conflict is partly driven by the opportunity cost of revolt, civil conflict should be more likely after a (transitory) drop in rainfall levels in Sub-Saharan Africa, where lower rainfall levels result in significantly lower aggregate income. This appears to be the case.

⁹ In the second stage, 22 of the 23 time effects are statistically significant at the 90% confidence level at least.

A 25% fall in rainfall levels increases the probability of civil conflict onset in the subsequent year by more than 3.5 percentage points, and the effect is statistically significant at the 98% confidence level. On the other hand, there is little evidence of a link between rainfall growth and the outbreak of civil conflict. I have argued that this is not that surprising once one takes into account the transitory nature of rainfall shocks.

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Table 1: Rainfall and Civil Conflict Onset

	PRIO 2007 (1981-2006)			PRIO 2007 (1981-1999)			Miguel et al. (1981-1999)		
Panel A: Rainfall Levels									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	LS	LS	LS	LS	LS	LS	LS	LS	LS
Log Rainfall, t	0.024 (0.45)	0.052 (0.96)	0.067 (1.13)	-0.011 (-0.15)	0.032 (0.45)	0.072 (0.91)	-0.083 (-1.05)	-0.034 (-0.41)	0.015 (0.18)
Log Rainfall, t-1	-0.111** (-2.29)	-0.112** (-2.23)	-0.145** (-2.59)	-0.099* (-1.95)	-0.093* (-1.77)	-0.114** (-2.02)	-0.034 (-0.45)	-0.029 (-0.36)	-0.112 (-1.23)
Log Rainfall, t-2	0.053 (1.31)	0.031 (0.85)	0.030 (0.77)	0.055 (0.96)	0.028 (0.55)	0.048 (0.68)	0.157** (2.12)	0.124* (1.85)	0.082 (0.92)
After 1990		0.105* (1.92)			0.102* (1.94)			0.119* (1.94)	
Country + Trend	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Effect, p-value	No	No	0.0000	No	No	0.0000	No	No	0.0000
No Observations	800	800	800	574	574	574	555	555	555
Panel B: Rainfall Growth									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	LS	LS	LS	LS	LS	LS	LS	LS	LS
Rainfall Growth, t	0.033 (0.75)	0.055 (1.26)	0.076* (1.67)	0.019 (0.49)	0.047 (1.23)	0.075* (1.86)	-0.066 (-1.39)	-0.032 (-0.65)	0.043 (0.86)
Rainfall Growth, t-1	-0.064 (-1.63)	-0.044 (-1.20)	-0.049 (-1.44)	-0.062 (-1.19)	-0.033 (-0.70)	-0.037 (-0.75)	-0.126* (-1.83)	-0.091 (-1.47)	-0.071 (-1.01)
After 1990		0.104* (1.91)			0.104** (1.98)			0.123** (2.00)	
Country + Trend	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Effect, p-value	No	No	0.0000	No	No	0.0000	No	No	0.0000
No Observations	800	800	800	574	574	574	555	555	555

Note: Method of estimation is least squares with Huber robust standard errors clustered at the country level; t-values in brackets. Columns (1)-(3) use the PRIO 2007 civil conflict data for the period 1981-2006; columns (4)-(6) use the PRIO 2007 civil conflict data for the period of the Miguel, Satyanath, and Sergenti (2004) sample; columns (7)-(9) use the Miguel, Satyanath, and Sergenti (2004) data on civil conflict, which is based on an earlier version of the PRIO civil conflict database. All regressions include country fixed effects and country specific time trends. The regressions of columns (3), (6), and (9) include also year fixed effects. The dependent variable is civil conflict onset. *Significantly different from zero at 90 percent confidence, ** 95 percent confidence, *** 99 percent confidence.

Table 2: Rainfall and Civil Conflict Incidence

	PRIO 2007 (1981-2006)			PRIO 2007 (1981-1999)			Miguel et al. (1981-1999)		
Panel A: Rainfall Level									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	LS	LS	LS	LS	LS	LS	LS	LS	LS
Log Rainfall, t	-0.030 (-0.61)	0.004 (0.08)	0.011 (0.21)	-0.007 (-0.13)	0.014 (0.24)	0.026 (0.43)	-0.061 (-0.97)	-0.039 (-0.58)	-0.032 (-0.42)
Log Rainfall, t-1	-0.143*** (-2.84)	-0.146*** (-2.81)	-0.177*** (-3.14)	-0.094* (-1.92)	-0.094* (-1.90)	-0.131** (-2.15)	-0.102 (-1.39)	-0.102 (-1.37)	-0.183** (-2.00)
Log Rainfall, t-2	-0.002 (-0.03)	-0.032 (-0.52)	-0.043 (-0.57)	0.061 (0.96)	0.044 (0.70)	0.019 (0.23)	0.124* (1.64)	0.105 (1.45)	0.001 (0.01)
After 1990		0.134* (1.85)			0.055 (1.01)			0.060 (0.86)	
Country + Trend	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Effect, p-value	No	No	0.0000	No	No	0.0313	No	No	0.0000
No Observations	1049	1049	1049	743	743	743	743	743	743
Panel B: Rainfall Growth									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	LS	LS	LS	LS	LS	LS	LS	LS	LS
Rainfall Growth, t	0.018 (0.48)	0.046 (1.35)	0.062** (1.96)	0.014 (0.35)	0.030 (0.75)	0.062* (1.70)	-0.024 (-0.55)	-0.005 (-0.11)	0.066 (1.38)
Rainfall Growth, t-1	-0.071** (-1.99)	-0.044 (-1.39)	-0.048 (-1.42)	-0.070* (-1.65)	-0.054 (-1.33)	-0.041 (-0.96)	-0.122** (-2.35)	-0.103** (-2.17)	-0.052 (-0.95)
After 1990		0.132* (1.84)			0.056 (1.04)			0.064 (0.94)	
Country + Trend	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Effect, p-value	No	No	0.0000	No	No	0.0464	No	No	0.0000
No Observations	1049	1049	1049	743	743	743	743	743	743

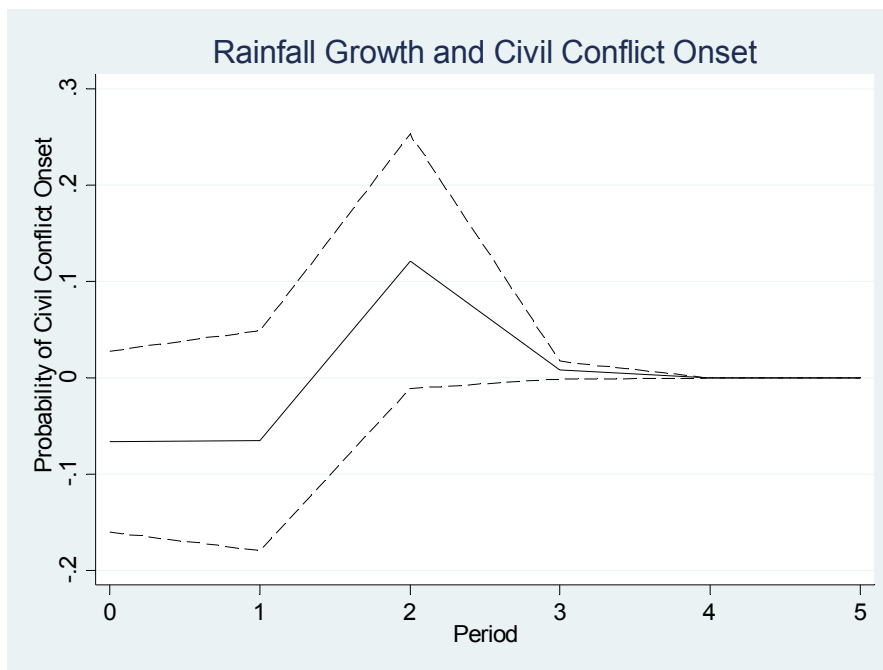
Note: Method of estimation is least squares with Huber robust standard errors clustered at the country level; t-values in brackets. Columns (1)-(3) use the PRIO 2007 civil conflict data for the period 1981-2006; columns (4)-(6) use the PRIO 2007 civil conflict data for the period of the Miguel, Satyanath, and Sergenti (2004) sample; columns (7)-(9) use the Miguel, Satyanath, and Sergenti (2004) data on civil conflict, which is based on an earlier version of the PRIO civil conflict database. All regressions include country fixed effects and country specific time trends. The regressions of columns (3), (6), and (9) include also year fixed effects. The dependent variable is civil conflict incidence. *Significantly different from zero at 90 percent confidence, ** 95 percent confidence, *** 99 percent confidence.

Table 3: GDP and Civil Conflict

	<u>Per Capita GDP</u>		<u>Conflict Onset</u>		<u>Conflict Incidence</u>	
	(1)	(2)	(3)	(4)	(5)	(6)
	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS
Log GDP, t	0.057** (2.61)	0.060*** (2.85)	0.036 (0.03)	0.587 (0.32)	-0.825 (-0.68)	-0.266 (-0.18)
Log GDP, t-1	0.045 (1.52)	0.044 (1.47)	-1.801 (-1.60)	-4.561* (-1.80)	-1.390 (-1.46)	-2.482** (-2.14)
Country + Trend	Yes	Yes	Yes	Yes	Yes	Yes
Time Effect, p-value	No	0.0000	No	0.7935	No	0.0031
No Observations	866	866	667	667	866	866

Note: Method of estimation in columns (1) and (2) is least squares and columns (3)-(6) two stage least squares. Huber robust standard errors are clustered at the country level with t-values in brackets. The excluded instruments in columns (3)-(6) are current and lagged rainfall. All regressions include country fixed effects and country specific time trends. The regressions of columns (2), (4), and (6) include also year fixed effects. The dependent variable in columns (1) and (2) is real per capita GDP. The dependent variable in columns (3) and (4) is civil conflict onset and in columns (5) and (6) civil conflict incidence. *Significantly different from zero at 90 percent confidence, ** 95 percent confidence, *** 99 percent confidence.

Figure 1: Impulse Response Function



Note: The impulse response function is based on the estimates of Table 1, Panel B, column (7). Dashed lines are two standard error confidence bands.