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Economic Shocks, Weather, and Civil War

Edward Miguel*

Civil War and Economic Development

Internal civil conflict has been common during the past half century, a fact that until recently escaped the notice of most economists.¹ Civil wars—internal conflicts with more than 1,000 battle deaths in a single year—have afflicted one third of all nations. Adding in civil conflicts, which involve at least 25 battle deaths per year, increases the incidence figure to more than half.² And, internal warfare is not just extremely common, it is also persistent. Figure 1 presents the cumulative proportion of all nations experiencing wars and conflicts since 1960: 20 percent of nations have experienced at least ten years of civil war during the period.

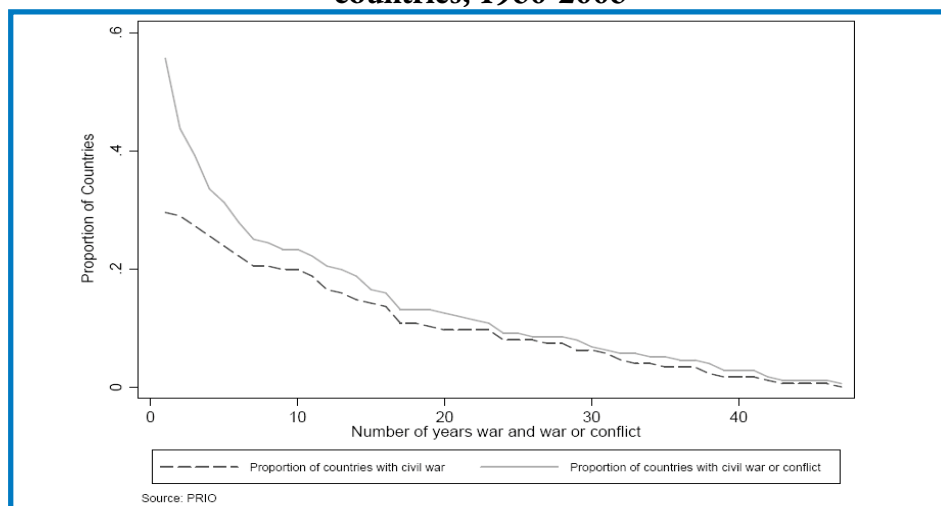
The proportion of countries embroiled in civil conflict at a single point in time also has increased steadily through the last half of the twentieth century, peaking at over 20 percent in the 1990s. In sub-Saharan Africa, the world's poorest region, nearly a third of countries experienced active civil wars or conflicts during the mid-1990s. But why is this so?

The outbreak of internal wars is commonly attributed to poverty. Indeed, the correlation between low per capita incomes and higher propensities for internal war is one of the most robust empirical relationships in the economic literature. Figure 2 illustrates the relationship between per capita income (percentiles) and civil war using a non-parametric Fan regression; the countries towards the bottom of the world's income distribution—many in Africa—have several times more wars than those in the top quartile, while the middle income countries still face considerable conflict risk.

Still, we should be cautious about infer-

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Figure 1: The distribution of civil war or conflict years across countries, 1960-2006

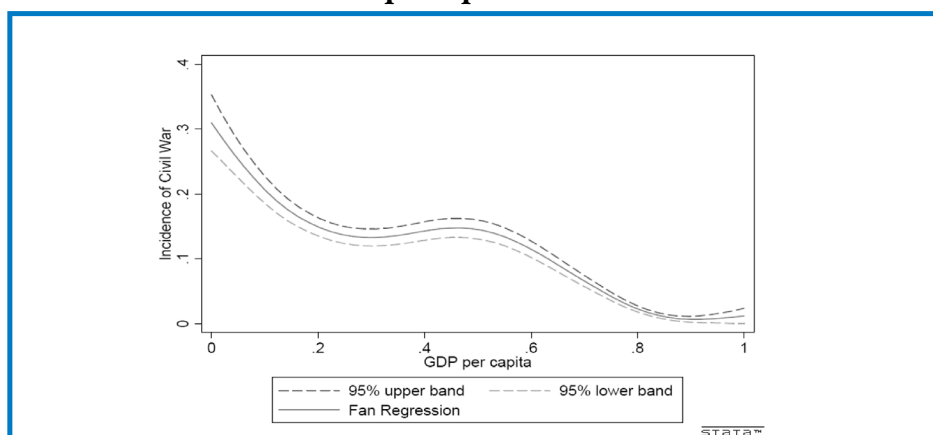


Notes: Data based on UCDP/PRIO armed conflict database. Civil wars are internal conflicts that count more than 1,000 battle deaths in a single year. "Civil war or conflict" includes cases with at least 25 battle deaths in a single year.

ring a direct causal link from poverty to conflict because the reverse is also true: conflicts devastate life, health, and living standards. The Democratic Republic of Congo, where surveys suggest millions may have died as a

result of the recent civil war, primarily due to hunger and disease, is a chilling example³. Although the accuracy of mortality figures in such war zones is open to question, the estimated mortality figures for Rwanda,

Figure 2: Incidence of civil war by country income per capita, 1960-2006



Notes: Figure 2 displays the results of a Fan regression of the incidence of civil war on GDP per capita percentiles (bandwidth=0.3, bootstrapped standard errors). Population and GDP data are drawn from the World Bank's World Development Indicators database. Civil war incidence is drawn from the UCDP/PRIO armed conflict database (Gleditsch et al., 2002; Harbom and Wallensteen, 2007).

Angola, and Sudan are likewise shocking. Massive loss of life inevitably affects the economy. Warfare also destroys physical infrastructure and human capital, as well as possibly altering some social and political institutions. Moreover, internal wars are contagious; refugee flows, disease, lawlessness, and the illicit trades in drugs, arms, and minerals have generated “spillover” effects into the countries neighboring the conflict zones.

A seeming paradox, however, is that warfare is also sometimes credited for the technological and institutional development that underpins Western economic prosperity. Both internal and external wars are commonplace in European history. Several scholars have claimed that inter-state wars and wars of territorial conquest served a critical role in enabling the development of strong and capable government institutions in Europe and Asia⁴.

Civil war is clearly central in the study of international economic development, yet leading development economists have often overlooked it, and some undergraduate textbooks do not even mention the issue. Over the past decade, however, many economists and other social scientists have worked to better understand the causes and the economic legacies of internal warfare, often in collaboration with political scientists and other scholars. The main goal of this research summary is to describe some of this progress, with a particular focus on the role of economic shocks, weather, and climate in driving the patterns laid out above.

Cross-Country Evidence on the Causes of Armed Conflict

The correlation between civil conflict and low income levels and negative income shocks is clear, but the direction of causality remains contested. Even the use of lagged national income growth (as in earlier studies⁵) does not eliminate this concern, because the anticipation of *future* political instability and conflict can affect *current* investment behavior, and thus living standards. In other words, there are likely to be permanent fixed differences between countries that are correlated with their income levels, economic growth rates, and civil war.

To address this concern, several papers seek to isolate exogenous variation in income. In sub-Saharan Africa, where most households rely on rain-fed agriculture, falling rainfall and the existence of drought cause large reductions in income. Shanker Satyanath, Ernest Sergenti, and I⁶ therefore use annual rainfall growth as an instrument for income growth. We find a statistically significant relationship in our sub-Saharan Africa sample, but it is weaker in other regions of the world, where much less economic activity relies on rain-fed agriculture. This makes Africa the natural region for the application of our approach. In our main statistical specification, we find that a 5 percent drop in income growth increases the likelihood of a civil conflict in the following year by up to 10 percentage points, or nearly one half. This effect is not substantially dampened in countries with stronger democratic institutions, greater ethno-linguistic fractionalization, or oil exporters.

Antonio Ciccone⁷ argues that “log rainfall” is a conceptually more appealing instrument than rainfall growth, but Satyanath and I⁸ show that the main relationship between economic growth and civil conflict is nearly unchanged with this alternative specification. These papers also demonstrate that the relationship between rainfall shocks and civil conflict appears to become weaker in Africa since roughly 2000. It is unclear why this is the case, but it may be related to Africa’s unprecedented economic growth in non-agricultural sectors in the past decade, as well as to public policy changes perhaps stemming from spreading democratization⁹.

This analysis highlights the role of income shocks in generating armed conflict in Africa. Unfortunately, this econometric strategy does not allow the authors to definitively pin down a unique causal mechanism: rainfall shocks may provoke conflict because they lower the opportunity cost of fighting among rural populations (those most affected by weather shocks), or because crop failure also reduces government revenues and state capacity, or both.

Recent research has emphasized the role that climate might play in driving future armed conflict. Solomon M. Hsiang, Kyle Meng, and Mark A. Cane¹⁰ show that armed conflict increases significantly in El

Nino Southern Oscillation (ENSO) years in tropical regions, and that poor countries are the most prone to increased violence. Their estimates imply that ENSO may have played a role in 21 percent of all civil conflicts since 1950.

How might future climate change heighten or dampen the risk of armed conflict in sub-Saharan Africa, the world’s poorest and most violence-prone region? Marshall Burke, John Dykema, David Lobell, Satyanath, and I¹¹ combine historical estimates of the weather-conflict relationship with a wide range of leading global climate model projections and conclude that future climate change is likely to increase conflict risk in Africa by 54 percent. The expected rise in future temperatures serves as the key driver of this relationship. These relationships remain speculative by necessity, given the inherent uncertainty about future global political, economic, and emissions trends, but this exercise serves as a useful benchmark for the risk that climate change poses for political stability in Africa.

Building on the approach taken in that paper, our related research explores the impact of incorporating climate uncertainty into estimates of how climate change will affect agriculture in the United States and sub-Saharan Africa.¹² A growing body of research projects the effects of global climate change on economic outcomes, but climate scientists often criticize these articles because nearly all of them ignore the well-established uncertainty in future temperature and rainfall changes. Therefore, they are likely to have downward biased standard errors and potentially misleading point estimates. Our paper finds that accounting for climate uncertainty leads to a much wider range of projected effects on agricultural profits, with the 95 percent confidence interval featuring drops of between 17 percent and 88 percent. An application to African agriculture yields similar results.

The Way Forward: New Research Using Microeconomic Data

A number of researchers of cross-country conflict have called for more disaggregated analyses, which allow for more sophisticated econometric methods and

for data that is closer to the phenomena being studied. This change is already underway. An emerging literature finds strong links between adverse economic shocks and political violence in a wide range of settings, including as a significant cause of land invasions in Brazil, more intense armed conflict in Colombia, increased rebel recruitment in Burundi, and the outbreak of Hindu-Muslim communal riots in India.¹³ Taking the cross-country research together with this emerging literature, there is a growing body of evidence that adverse economic shocks contribute to political violence in less developed countries, with potentially severe welfare consequences for the world's poor.

Related papers focus on understanding how best to help post-conflict societies emerge from poverty. One example is my recent work with Katherine Casey and Rachel Glennerster that uses a randomized experimental methodology to evaluate the impact of a local institutional reform on public goods outcomes in post-war Sierra Leone.¹⁴

While deriving policy implications is not the main goal of this summary, the literature does have certain implications. For example, the empirical relationship between violence and low and falling incomes suggests that implementing insurance schemes to protect poor societies from negative income shocks might reduce future rounds of bloodshed. One possibility is expanded regional drought insurance for farmers. Another is foreign aid contingent on objective conflict risk indicators (for example, weather or commodity price shocks, or a coming El Niño year)—what I have elsewhere called “rapid conflict prevention support”¹⁵—to bolster local economic conditions when the risk of particularly political violence is high.

Conflict 1946–2001: A New Dataset,” *Journal of Peace Research*, 39:5, 2002, and extended in L. Harbom and P. Wallensteen, “*Armed Conflict, 1989–2006*,” *Journal of Peace Research*, 44:5, pp. 623–34, 2007. UCDP/PRIO defines conflict as “a contested incompatibility that concerns government and/or territory where the use of armed force between two parties, of which at least one is the government of a state, results in at least 25 battle-related deaths.”

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⁵ P. Collier and A. Hoeffler, “*On Economic Causes of Civil War*,” *Oxford Economic Papers*, 50:4, pp. 563–73, 1998, and J. D. Fearon and D. D. Laitin, “*Ethnicity, Insurgency and Civil War*,” *American Political Science Review*, 97:1, pp. 75–90, 2003.

⁶ E. Miguel, S. Satyanath, and E. Sergenti, “*Economic Shocks and Civil Conflict: An Instrumental Variables Approach*,” *Journal of Political Economy*, 112:4, pp. 725–53, 2004.

⁷ A. Ciccone, “*Economic Shocks and Civil Conflict: A Comment*,” forthcoming in the *American Economic Journal: Applied Economics*.

⁸ E. Miguel and S. Satyanath, “*Understanding Transitory Rainfall Shocks, Economic Growth and Civil Conflict*,” NBER Working Paper No. 16461, October

2010, and “*Re-examining Economic Shocks and Civil Conflict*,” forthcoming in the *American Economic Journal: Applied Economics*.

⁹ E. Miguel, *Africa's Turn?*, MIT Press: Cambridge, MA, 2009.

¹⁰ S. Hsiang, K.C. Meng, and M.A. Cane, “*Civil Conflicts are Associated with the Global Climate: Evidence from El Niño*,” forthcoming in *Nature*.

¹¹ M. Burke, E. Miguel, S. Satyanath, J. Dykema, and D. Lobell, “*Warming Increases Risk of Civil War in Africa*,” *Proceedings of the National Academy of Sciences*, December 8 2009, 106 (49), pp. 20670–4. For a contrasting perspective, see H. Bubaug, “*Climate Not to Blame for African Civil Wars*,” *Proceedings of the National Academy of Sciences*, 2010.

¹² M. Burke, E. Miguel, S. Satyanath, J. Dykema, and D. Lobell, “*Incorporating Climate Uncertainty into Estimates of Climate Change Impacts, with Applications to U.S. and African Agriculture*,” NBER Working Paper No. 17092, May 2011.

¹³ F.D. Hidalgo, S. Naidu, S. Nichter, and N. Richardson, “*Economic Determinants of Land Invasions*,” *Review of Economics and Statistics*, 92(3), pp. 505–23, 2010; O. Dube and J. Vargas, “*Commodity Price Shocks and Civil Conflict: Evidence from Colombia*,” unpublished working paper, NYU, 2010; E. Nillesen and P. Verwimp, “*Grievance, Commodity Prices and Rainfall: A Village Level Analysis of Rebel Recruitment in Burundi*,” *HiCN Working Paper 58*, 2010; and A.T. Bohlken and E. Sergenti, “*Economic Growth and Ethnic Violence: An Empirical Investigation of Hindu Muslim Riots in India*,” *Journal of Peace Research* 47 (5), pp. 589–600, 2010.

¹⁴ K. Casey, R. Glennerster, and E. Miguel, “*Reshaping institutions: Evidence on External Aid and Local Collective Action*,” NBER Working Paper No. 17012, May 2011.

¹⁵ E. Miguel, “*Poverty and Violence: An Overview of Recent Research and Implications for Foreign Aid*,” in *Too Poor for Peace? Global Poverty, Conflict and Security in the 21st Century*, Lael Brainard and Derek Chollet, eds., Washington, DC: Brookings Institution Press, 2007.

¹ This piece draws heavily on “*Civil War*,” co-authored with Christopher Blattman, NBER Working Paper No. 14801, March 2009, and *Journal of Economic Literature*, 48(1), pp. 3–57, 2010.

² These definitions come from the well-known UCDP/PRIO dataset developed by N. P. Gleditsch, P. Wallensteen, M. Eriksson, M. Sollenberg, and H. Strand in “*Armed*