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## Economic Consequences of Civil Wars in the Post-World War II Period

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### Abstract

*What are the economic consequences of civil wars in the post-World War II period? In particular, what is the standard post-conflict dynamics? The paper addresses this issue by using synthetic control methods to simulate the counterfactual economic outcome and investigate the effect of civil war on post-war economic dynamic on a case-by-case basis. Focusing on civil wars initiated between 1970 and 1997, our results support the argument of the “war ruin” school that more destructive than constructive effects the civil wars have. Even 10 years after the civil war, GDP per capita in countries suffered civil war is still 40% lower than its potential level. The post-war growth rates for countries suffered from civil wars in general are also not higher than what they would be if there are no wars at all.*

Keywords: *Civil wars, economy*

### 1. Introduction

Together with the decline in interstate war, the number of ongoing civil wars rises dramatically after World War II. According to the Correlates of War Project’s data sets, there have been 103 intrastate wars from 1946 to 1997; while there have been only 23 interstate wars<sup>1</sup>. This increase of civil wars was a result of the increased number of states, the fragility of states formed after 1945 and the Cold War rivalry<sup>2</sup>.

The new ex-colonial states are usually far weaker than the Western states they were modeled after. In Western states, the structure of governments closely matched states' actual capabilities, which had been developed over centuries. Only states with effective and impersonal bureaucracies, efficient tax systems and integrated national territory survived predation by their fellow states. In sharp contrast, decolonization was a sudden and entirely different process of state formation. Like Western states of previous centuries, the new ex-colonies lacked autonomous bureaucracies, which would make decisions based on the benefit to society as a whole. In such a situation, factions manipulate the state to benefit themselves or, alternatively,

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<sup>1</sup> The New COW War Data, 1816 - 2007

<sup>2</sup> Hironaka (2005)

state leaders use the bureaucracy to further their own self-interest. Such "weak" or "fragile" states are very vulnerable to the outbreak of civil conflict.

The Cold War (1945–1989) is also a cause of the increase of civil wars. It provided a global network of material and ideological support that perpetuated civil wars, which were mainly fought in weak ex-colonial states, rather than the relatively strong states that were aligned with the Warsaw Pact and North Atlantic Treaty Organization. Guatemala (1960–1996), El Salvador (1979–1991) and Nicaragua (1970–1990) are good examples of the Cold War civil wars. In some cases, superpowers would superimpose Cold War ideology onto local conflicts; while in others local actors using Cold War ideology would attract the attention of a superpower to obtain support.

What are the economic consequences of civil wars in the post-World War II period? In particular, what is the standard post-conflict dynamics? In the fields of economics and political science, the effects of war on economies have been widely studied, especially on factors affecting postwar economic growth<sup>3</sup> for a good review of the literature. Nonetheless, no generalized theory has been established on the timing, duration, and contributing factors of war on postwar economic growth. The "war renewal" school<sup>4</sup> as examples of thought maintains that wars can produce beneficial effects as they improve efficiency in the economy, especially by reducing the power of special interests, bring technological innovation, and advance human capital. The "war ruin" school<sup>5</sup> of thought sees mostly detrimental effects resulting from war<sup>6</sup>. To state this differently, any war involves some "obvious and subtle mixture of destructive and constructive effects" on states, and the "net war impact on economic growth may be positive, negative, variable, or simply insignificant"<sup>7</sup>.

The paper will address this issue by using synthetic control methods to simulate the counterfactual economic outcome and investigate the effect of civil war on post-war economic dynamic on a case-by-case basis. We focus on civil wars initiated between 1970 and 1997 due to the data availability constraint and the need of leaving at least 10 years to pre-intervention and post-intervention time window. The list of eligible civil wars are shown in Table 1<sup>8</sup>.

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<sup>3</sup> See Van Raemdonck and Diehl (1989)

<sup>4</sup> See Olson (1982), Organski and Kugler (1980)

<sup>5</sup> Chan (1985), Diehl and Goertz (1985) and Russett (1970)

<sup>6</sup> Kang, S. and J. Meernik (2005)

<sup>7</sup> Rasler and Thompson (1985)

<sup>8</sup> From [http://en.wikipedia.org/wiki/List\\_of\\_civil\\_wars](http://en.wikipedia.org/wiki/List_of_civil_wars) and I selected countries for which we have a complete record of GDP per capita in 2000 USD

**Table 1. Eligible Civil Wars**

Country	World Bank Code	Year of Civil War Started	Year of GDP Record Started	Important Var. Missing
Cambodia	KHM	1970	n.a.	gdppccteus
Pakistan	PAK	1971	1960	
Lebanon	LBN	1975	1988	gdppccteus
Mozambique	MOZ	1975	1980	gdppccteus
Nicaragua	NIC	1979	1960	
El Salvador	SLV	1979	1960	
Rwanda	RWA	1990	1960	pol2
Georgia	GEO	1991	1965	
Yemen	YEM	1994	1960	
Yugoslav	YUG	1991	n.a.	gdppccteus
Liberia	LBR	1989	1960	
Tajikistan	TJK	1992	1985	gdppccteus
Russia	RUS	1994	1989	gdppccteus
Iraq	IRQ	1994	1960	avelf
Angola	AGO	1975	1985	gdppccteus
Afghanistan	AFG	1978	n.a.	gdppccteus
Sudan	SDN	1983	1960	
Sri Lanka	LKA	1983	1960	
Senegal	SEN	1990	1960	
Sierra Leone	SLE	1991	1960	
Algeria	DZA	1991	1960	
Burundi	BDI	1993	1960	pol2
Nepal	NPL	1996	1960	pol2
Albania	ALB	1997	1980	gdppccteus
Congo, Republic of	COG	1997	1960	

In the following sections, we only focus on civil wars happened in countries without any important variables missing. The rest of the paper is organized as follows: Section 2 explains how the synthetic control estimator introduced by Abadie and Gardeazabal (2003) can be used in our setting, Section 3 describes the data sources and summary statistics, in Section 4 results of the synthetic control estimator are shown and compared to the results of simple difference-in-difference estimator and Section 5 concludes.

## 2. Empirical Strategy: A Synthetic Control Approach

### 2.1 Econometric Model

Because only country "zero" is exposed to the civil war and only after period  $T_0$  it is exposed to the civil war, we have that:

$$D_{st} = \begin{cases} 1, & \text{if } s = 1 \text{ and } t > T_0 \\ 0, & \text{otherwise} \end{cases}$$

We aim to estimate  $(\beta_{0,T_0+1}, \beta_{0,T_0+2}, \dots, \beta_{0,T})$ . For  $t > T_0$ ,  $\beta_{0t} = Y_{0t}^W - Y_{0t}^N$ . Since  $Y_{0t}^W$  is

observed, to estimate  $\beta_{0t}$  we just need an estimate for GDP per capita in the counterfactual situation,  $Y_{0t}^N$ .

Suppose that  $Y_{0t}^N$  is given by factor model

$$Y_{0t}^N = \delta_t + \theta_t Z_s + \lambda_t \mu_s + \varepsilon_{st}$$

where  $\delta_t$  is an unknown common factor with constant factor loadings across countries,  $Z_s$  is a  $r * 1$  vector of observed exogenous predictors for the per capita GDP,  $\theta_t$  is a  $1 * r$  vector of unknown parameters,  $\lambda_t$  is a  $1 * F$  vector of unobserved common factors,  $\mu_s$  is an  $F * 1$  vector of unknown factor loadings, and the error terms  $\varepsilon_{st}$  are unobserved transitory shocks at the country level with zero mean. This model does not rule out the existence of time-varying measured determinants of  $Y_{0t}^N$ . The vector  $Z_s$  may contain pre- and post-intervention values of time-varying variables, as long as they are not affected by the civil war. The standard fixed-effects model, estimable by simple difference-in-differences, can be obtained if we impose that  $\lambda_t$  is constant for all  $t$ .

Consider a  $S * 1$  vector of weights  $W = (w_1, w_2, \dots, w_S)'$  such that  $w_s \geq 0$  for  $s = 1, 2, \dots, S$  and  $w_1 + w_2 + \dots + w_S = 1$ . Each particular value of the vector  $W$  represents a potential synthetic control, that is, a particular weighted average of control states.

The per capita GDP for each synthetic control associated with  $W$  is

$$\sum_{s=1}^S w_s Y_{st}^N = \delta_t + \theta_t \sum_{s=1}^S w_s Z_s + \lambda_t \sum_{s=1}^S w_s \mu_s + \sum_{s=1}^S w_s \varepsilon_{st}$$

Suppose that there is  $(w_1^*, w_2^*, \dots, w_S^*)$  such that

$$\sum_{s=1}^S w_s^* Y_{st} = Y_{0t}, \quad \forall t = 1, 2, \dots, T_0$$

$$\sum_{s=1}^S w_s^* Z_s = Z_0$$

$$\sum_{s=1}^S w_s^* = 1$$

Then, it can be shown that if  $\sum_{t=1}^{T_0} \lambda_t' \lambda_t$  is non-singular, then

$$Y_{0,t}^N - \sum_{s=1}^S w_s^* Y_{st} = \sum_{s=1}^S w_s^* \left[ \sum_{\tau} \lambda_{\tau} \left( \sum_{n=1}^{T_0} \lambda_n' \lambda_n \right)^{-1} \lambda_{\tau}' - 1 \right] (\varepsilon_{st} - \varepsilon_{0\tau})$$

Abadie, Diamond and Hainmueller (2008) show that, under standard conditions, the

average of the right hand side of this equation will be close to zero if the number of pre-intervention periods is large relative to the scale of the transitory shocks. Therefore, they suggest using  $\widehat{\beta}_{0t} = Y_{0,t}^W - \sum_{s=1}^S w_s^* Y_{st}$  for  $t \in \{T_0 + 1, T_0 + 2, \dots, T\}$  as an estimator for  $\beta_{0t}$ .

The system of equations determines  $\{w_s\}_{s=1}^S$  can hold exactly only if  $(Y_{0,1}, Y_{0,2}, \dots, Y_{0,T}; Z')$  falls into the convex hull of

$$\{(Y_{1,1}, Y_{1,2}, \dots, Y_{1,T}; Z_1'), (Y_{2,1}, Y_{2,2}, \dots, Y_{2,T}; Z'), \dots, (Y_{S,1}, Y_{S,2}, \dots, Y_{S,T}; Z_S')\}$$

In practice, it is often the case that no set of weights exists such that these equations hold exactly in the data. Then, the synthetic control state is selected so that they hold approximately.

## 2.2 Computational Issues

Let  $T_1 = T - T_2$ , be the number of available post-intervention periods. Let  $Y_0$  be the  $T_1 * 1$  vector of post-intervention per capita GDP of treated country, and  $Y_C$  be  $T_1 * S$  a matrix of post-intervention crime rates observed in the donor states. Let the  $T_0 * 1$  vector  $K = (k_1, \dots, k_{T_0})$  define a linear combination of pre-intervention outcomes  $\bar{Y}_S^K = \sum_{\tau=1}^{T_0} k_\tau Y_{S\tau}$ . Consider  $M$  of such linear combinations defined by the vectors  $K_1, K_2, \dots, K_M$ . Let  $X_0 = (Z_0'; Y_0^{\bar{K}_1}, Y_0^{\bar{K}_2}, \dots, Y_0^{\bar{K}_M})'$  be a  $k * 1$  vector of pre-intervention GDP per capita linear combinations and GDP per capita predictors which are not affected by the breakout of civil war, with  $k = r + M$ . Similarly, let  $X_C$  be a  $k * S$  matrix that contains the same variables for the donor states. That is, the  $s$ th column of  $X_C$  is  $(Z_s'; Y_s^{\bar{K}_1}, Y_s^{\bar{K}_2}, \dots, Y_s^{\bar{K}_M})'$ .

The vector  $W$  is chosen to minimize some distance,  $\|X_C - X_0 W\|$ , subject to  $\sum_{s=1}^S w_s = 1$  and  $w_s > 0$  for all  $s$ . In particular, we will consider

$$\|X_C - X_0 W\|_V = \sqrt{(X_C - X_0 W)' V (X_C - X_0 W)}$$

where  $V$  is some  $k * k$  symmetric and positive semidefinite matrix. Although the inferential procedures we use are valid for any choice of  $V$ , the choice of  $V$  influences the mean square error of the estimator. The optimal choice of  $V$  assigns weights to a linear combination of the variables in  $X_C$  and  $X_0$  to minimize the mean square error of the synthetic control estimator. The choice of  $V$  can also be data-driven. One possibility is to choose  $V$  such that the resulting synthetic control country approximates the trajectory of the GDP per capita in country “zero” as well as GDP per capita predictors in the pre-war periods. We choose  $V$  such that the mean squared prediction error of the outcome variable is minimized for the pre-intervention periods.

## 3. Data

Our data is a yearly data includes 87 countries from 1960 to 2007. Table 2 is the variable descriptions and sources.

**Table 2. Variable Descriptions and Sources**

gdppccteus	Log GDP per capita (constant 2000 US\$)	World Bank, World Development Indicators
landarea	Land area (sq. km)	World Bank, World Development Indicators
pop	Population, total	World Bank, World Development Indicators
topen	Trade Openness (X+M)/GDP	World Bank, World Development Indicators
pol2	ICRG index of the quality of institutions, takes values between 0 and 18.	PRS Group's political risk indicator
lat	Latitude above Equator (Above +; Below -)	La Porta et al (1999)
avelf	Average of five different indices of ethnolinguistic fragmentation	Easterly and Levine (1997), La Porta et al (1999)
protmg80	Percentage of the population that belonged to Protestant in 1980	La Porta et al (1999)
catho80	Percentage of the population that belonged to Roman Catholic in 1980	La Porta et al (1999)
muslim80	Percentage of the population that belonged to Muslim in 1980	La Porta et al (1999)

Interpolation on topen landarea pop pol2 is done to solve the minor missing data problem on the predictors. Table 3 shows the summary statistics of the main variables.

**Table 3. Summary Statistics**

Variable	Obs	Mean	Std. Dev.	Min	Max
gdppccteus	41767	7.70	1.58	4.03	10.94
postwar	41760	0.06	0.23	0.00	1.00
log landarea	41761	2.33	1.97	5.77	16.05
log pop	41761	6.11	1.62	11.60	21.00
topen	41767	0.68	54.45	0.68	462.46
pol2	41768	8.99	4.31	0.80	18.20
lat	41761	7.15	25.29	-41.00	65.00
avelf	41760	0.32	0.29	0.00	0.87
protmg80	41761	4.91	23.12	0.00	97.80
catho80	41764	0.13	38.63	0.00	97.30
muslim80	41761	7.60	31.60	0.00	99.50

## 4. Results

### 4.1 Results of DID estimator

Before we go into a detailed country specific analysis using synthetic control estimator, we first show the results of difference-in-difference (DID) estimator as a bench mark. Table 4 shows the effect of civil wars on subsequent economic performances using DID estimator.

**Table 4. Effect of Civil Wars on Subsequent Economic Performances**

VARIABLES	GDP PER CAPITA				
	full sample		excluding SDN and LKA		
postwar	-0.393*** (0.0516)	-0.389** (0.189)	-0.357*** (0.0657)	-0.487** (0.224)	
landarea	0.0923*** (0.0118)	15.83* (9.449)	0.0901*** (0.0123)	13.90 (10.72)	16.50*** (3.907)
pop	-0.0938*** (0.0140)	-0.740*** (0.166)	-0.0913*** (0.0141)	-0.697*** (0.168)	-0.789*** (0.161)
topen	0.00428*** (0.000345)	0.00351*** (0.00109)	0.00436*** (0.000360)	0.00371*** (0.00119)	0.00328** (0.00126)
pol2	0.174*** (0.00373)	0.0105 (0.0115)	0.173*** (0.00376)	0.00836 (0.0116)	0.00615 (0.00964)
postwar00					-0.0527 (0.0609)
postwar01					-0.193* (0.109)
postwar02					-0.224* (0.119)
postwar03					-0.288* (0.161)
postwar04					-0.362* (0.206)
postwar05					-0.398* (0.235)
postwar06					-0.439* (0.237)
postwar07					-0.446* (0.231)
postwar08					-0.370** (0.164)
postwar09					-0.365*** (0.127)
postwar10					-0.334*** (0.105)
Constant	5.890*** (0.234)	-176.6 (115.9)	5.940*** (0.237)	-153.2 (131.5)	-183.2*** (47.66)
Observations	4,176	4,176	4,032	4,032	3,192

Robust standard errors in parentheses, \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Column (1) and Column (2) are results using our full sample, in which Column (1) and (3) controls time-invariant variables latitude, percent of protestant, percent of catholic, percent of Muslim in population and ethno-linguistic fragmentation, while Column (2), (4) and (5) controls for country fixed effects. The results show that for country which has a civil war, the average of GDP per capita for year of war started and 10 years followed are 40% lower than country which

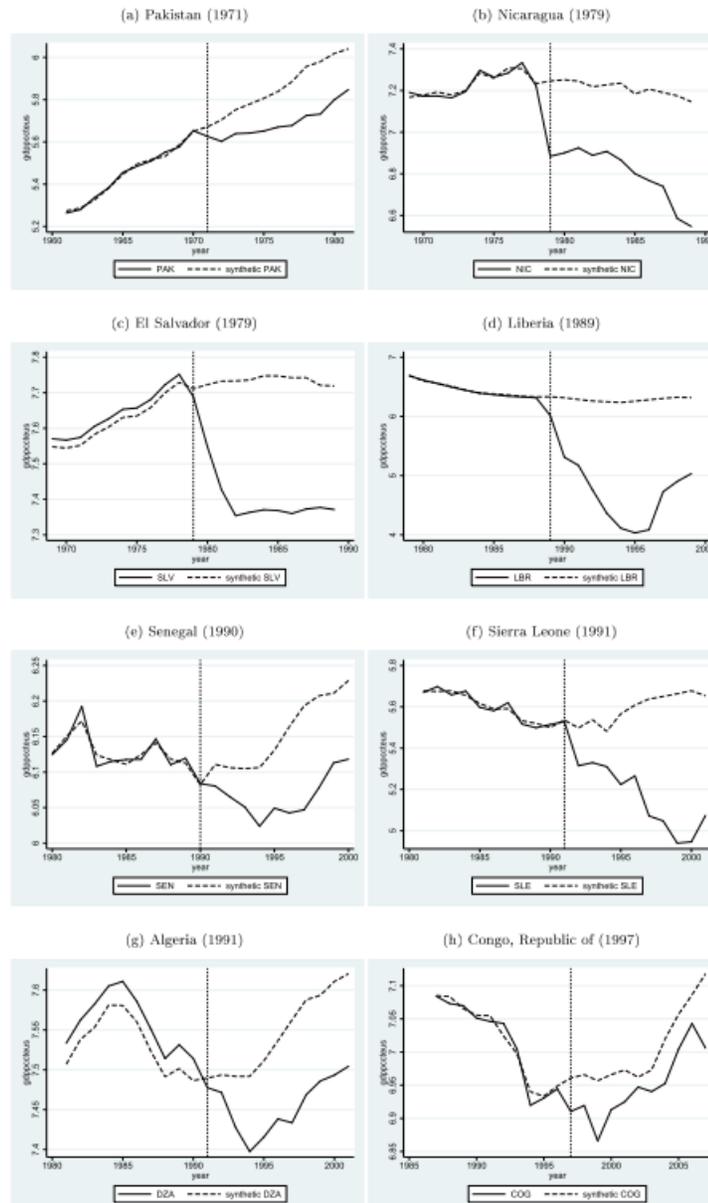
does not have a civil war. To compare the results of DID estimator and synthetic control estimator, we exclude Yemen, Sudan and Sri Lanka in the set of regressions shown in Column (3) to Column (5). Column (3) and Column (4) are similar with Column (1) and Column (2) despite the difference in sample. While in Column (5) we try to look at how the effect of civil wars on economic performance changes with time. Postwar00 is an indicator of the year in which the civil war starts; postwar01 is an indicator of the 1st year after the civil war started, etc. Column (5) shows that civil war has a significant negative effect on the GDP per capita in each year of the 10 years followed by the civil war and the accumulated effect peaks 7 years after the war started.

#### *4.2 Results of synthetic control estimator*

In this section, we re-estimate the effect of civil war on economic performance using the framework of Abadie and Gardeazabal (2003). We choose  $M=10$  and  $K_1, K_2, \dots, K_M$  such that  $\overline{Y_s^{K_m}} = Y_{s, T_0-m}$ ,  $m=1, 2, \dots, 10$ . Observed exogenous predictors for the per capita GDP  $Z_s$  consist trade openness, log of land area, log of population, political risk indicator 2, latitude, percent of protestant, percent of catholic, percent of Muslim in population and ethno-linguistic fragmentation for certain countries.

Figure 1 is the results of synthetic control estimator for Pakistan, Nicaragua, El Salvador, Liberia, Sudan, Sri Lanka, Senegal, Sierra Leone, Algeria and Congo, Republic of, respectively.

**Figure 1. Effect of Civil War on Subsequent Economic Performance**



Yemen, Sudan and Sri Lanka are drop in this analysis because no synthetic control can be built to simulate paths of Yemen, Sudan or Sri Lanka in the pre-war period

In each graph, solid line is the real economic trajectory of a country suffered from civil wars, while dash line, computed using synthetic control method, is the counterfactual economic trajectory if civil war did not break out in this country.

In these 8 cases, the accumulative effect of civil war on post-war economic performance is strictly negative. The post-war growth rates for countries suffered from civil wars in general are not higher than what they would be if there are no wars at all (solid lines in general are not steeper than dash lines). This results support the argument of the “war ruin” school that more

destructive than constructive effects the civil wars have, probably because civil wars hit the economies not only through direct destruction caused by wars, but also through inflation, surplus labor, unproductive resource allocation (military spending) by governments, and war debt.

The results obtained by synthetic control estimator are also consistent with our early results obtained by DID estimator.

**Table 5. Comparison Between the Results of 2 Estimators**

Variables	Synthetic control estimation of $\beta_{0t}$									DID estimation
	PAK	NIC	SLV	LBR	SEN	SLE	DZA	COG	Average	
t=T_0	-0.04	-0.36	-0.02	-0.32	0.00	-0.01	-0.01	-0.05	-0.10	-0.05
t=T0+1	-0.10	-0.35	-0.17	-1.00	-0.03	-0.18	-0.02	-0.05	-0.24	-0.19
t=T0+2	-0.11	-0.32	-0.31	-1.11	-0.04	-0.21	-0.06	-0.09	-0.28	-0.22
t=T0+3	-0.14	-0.33	-0.38	-1.50	-0.05	-0.17	-0.09	-0.05	-0.34	-0.29
t=T0+4	-0.16	-0.32	-0.37	-1.88	-0.08	-0.34	-0.10	-0.05	-0.41	-0.36
t=T0+5	-0.17	-0.37	-0.38	-2.12	-0.08	-0.34	-0.10	-0.01	-0.45	-0.40
t=T0+6	-0.21	-0.38	-0.38	-2.22	-0.12	-0.57	-0.13	-0.03	-0.51	-0.44
t=T0+7	-0.23	-0.44	-0.38	-2.20	-0.15	-0.60	-0.12	-0.07	-0.52	-0.45
t=T0+8	-0.25	-0.45	-0.37	-1.58	-0.13	-0.72	-0.11	-0.05	-0.46	-0.37
t=T0+9	-0.22	-0.59	-0.34	-1.42	-0.10	-0.73	-0.12	-0.04	-0.45	-0.37
t=T0+10	-0.19	-0.60	-0.35	-1.28	-0.11	-0.58	-0.12	-0.11	-0.42	-0.33

Table 5 shows the estimation of  $\beta_{0t}$  using synthetic control method for each case and the average  $\beta_{0t}$  among cases. Column (6) contains the coefficients of postwar00-postwar10 taken from Column (5) of Table 4. We can see that the average of  $\beta_{0t}$  among 8 cases has the similar pattern to the coefficients estimated by DID. Even 10 years after the civil war, GDP per capita in countries suffered civil war is still 40% lower than its potential level.

## 5. Implications for investors

Using synthetic control estimator to analyze the civil wars break out between 1970 and 1997, our results support the argument of the “war ruin” school that more destructive than constructive effects the civil wars have. Even 10 years after the civil war, GDP per capita in countries suffered civil war is still 40% lower than its potential level. The post-war growth rates for countries suffered from civil wars in general are also not higher than what they would be if there are no wars at all.

To our knowledge, this is the first research using synthetic control estimator to evaluate the economic consequence of civil wars. Employing synthetic control estimator allows us to do a case-by-case analyze and visualize the dynamic effect of civil wars on GDP per capita. We think similar method can be used to study the economic consequence of other types of war or military conflicts too and this is especially useful to investors focus on global macro trends.

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