

Growth, Democracy, and Civil War

by

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Abstract

Are civil wars partly caused by low economic growth? And do democratic institutions attenuate the impact of low growth on the likelihood of civil war? Our approach to answering these questions exploits that international commodity prices have a significant effect on income growth in Sub-Saharan African countries. We show that lower income growth makes civil war more likely in non-democracies. This effect is significantly weaker in democracies. So much so, that we do not find a link between growth and civil war in countries with democratic institutions. Our results therefore point to an interaction between economic and institutional causes of civil war.

Key words: Commodity prices, rainfall, growth, civil war
JEL codes: O0, P0, Q0

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1. Introduction

Between 1945 and 1999 there were around 127 civil conflicts with at least 1000 battle deaths. Total casualties as a direct result of these wars are estimated to be at least 16.2 million (Fearon and Laitin, 2003), with many more killed or disabled by diseases caused by civil wars (e.g. Sambanis, 2002; Ghobarah, Huth, and Russett, 2003; Montalvo and Reynal-Querol, 2007). Two main questions are whether civil wars are partly caused by low economic growth, and whether democratic institutions attenuate the effect of growth on the likelihood of civil war (e.g. Collier and Hoeffler, 1998, 2004; Sambanis, 2002; Miguel, Satyanath, and Sergenti, 2004).¹

Estimating the causal effect of economic growth on civil war is difficult, as expected future wars will tend to reduce investment and therefore growth. There are also many difficult-to-measure economic, social, political, and institutional factors that may affect both growth and the likelihood of civil war. These concerns can be addressed by using an instrumental-variables estimation method and employing a panel-data setup to control for unobservables. This is the approach of Miguel, Satyanath, and Sergenti (2004), who use rainfall as an instrument for income growth in Sub-Saharan Africa. We exploit that income growth in these countries is affected by international commodity prices (see also Deaton and Miller, 1995; Deaton, 1999). Another novelty is that our approach accounts for unobservables affecting the risk of civil war throughout Sub-Saharan Africa.

Our reduced-form analysis yields that lower international commodity price growth raises the likelihood of civil war incidence and onset. This link is significantly weaker in democracies than non-democracies. So much so, that there is no statistical evidence of a connection between international commodity price growth and civil war in democracies.

The empirical impact of international commodity price growth on income growth and the likelihood of civil war are the basis for our instrumental-variables investigation of the causal effect of growth on civil war. When we pool countries, we find that economic growth does not have a statistically significant effect on civil war incidence once unobservable

¹ If low growth makes it more likely for civil wars to break out, persistently low growth in civil war prone regions like Sub-Saharan Africa may partly be the result of a vicious circle of low growth and civil war (e.g. Easterly and Levine, 1997; Collier and Hoeffler, 2002; World Bank, 2003).

common risk factors are accounted for (these factors are highly statistically significant).² But lower growth significantly increases the likelihood of both civil war incidence and onset in non-democracies: a 5 percentage point fall in income growth raises the likelihood of civil war by around 6%. This effect is significantly weaker in countries with democratic institutions, where we find no impact of income growth on civil war.

Our work is closely related to Miguel, Satyanath, and Sergenti (2004), on whom we build. The two main differences in the empirical approach are that we account for unobservable time-varying factors affecting the likelihood of civil conflict throughout Sub-Saharan Africa, and that we add international commodity prices to their set of (rainfall) instruments. The new instrument is key as current and lagged rainfall do not have statistically significant effects on civil war incidence or onset according to the latest civil war data.³ Results also differ. Miguel, Satyanath, and Sergenti find that lower growth raises the likelihood of civil war and civil conflict (civil conflict refers to all conflicts with more than 25 annual battle deaths; civil war to civil conflicts with more than 1000 annual battle deaths).⁴ Moreover, surprisingly, this effect is not attenuated by democratic institutions. We do not find evidence of a causal effect of income growth on civil conflict or civil war incidence when we pool Sub-Saharan African countries.⁵ Our results also differ in that we find a significantly weaker effect of income growth on the likelihood of civil war in democracies compared to non-democracies. Hence, our findings do not support the view that lower income growth raises the chance of civil war independently of a country's institutional setup. Instead, they point to an interaction between economic and institutional causes of civil war.

For broader empirical studies of the causes of civil conflict, including countries' economic performance, see Collier and Hoeffler (1998, 2004) and Sambanis (2002). Hegre

² Results regarding civil war onset depend on the estimation method used. Two-stage least squares estimation yields statistically insignificant estimates.

³ The 2007 Armed Conflict Dataset of the International Peace Research Institute and the Uppsala Conflict Data Program. Miguel, Satyanath, and Sergenti used an earlier version of this dataset.

⁴ Miguel, Satyanath, and Sergenti point out that this result could partly be due to greater rainfall reducing civil conflict directly by making it more difficult to engage in combat, but do not find that rainfall reduces the usable road network using World Bank data. Artadi (2006) argues that rainfall may have a direct effect on civil conflict by increasing malaria incidence.

⁵ When we consider all civil conflicts with more than 25 annual battle deaths, we do not find evidence of a causal negative effect of income growth on civil conflict even when we restrict the analysis to non-democracies.

and Sambanis (2006) provide an empirical robustness study; one of their principal findings is that the partial negative correlation between economic growth and civil conflict is robust across specifications. Fearon (2005) and Chassang and Padró i Miquel (2006, 2007) develop theoretical models explaining why and when low income growth triggers civil conflict.

One of the issues analyzed in the civil conflict literature is whether democratic institutions are associated with fewer wars (e.g. Stewart and O’Sullivan, 1999; Hegre et al., 2001; Reynal-Querol, 2002, 2005). The basic idea is that democracies may mediate latent conflict better than autocracies and thereby avoid the outbreak of civil wars. In fact, one of the robust findings of Hegre and Sambanis (2006) is that inconsistent democratic institutions make civil war onset more likely.⁶ The empirical results in the democracy and civil war literature are not directly comparable to our findings however, as we focus on the interaction between economic growth and democratic institutions.

The remainder of this paper is organized as follows. Section 2 discusses data and measurement, and Section 3 presents the estimation framework and results. A Web Appendix contains additional findings.⁷

2. Data and Measurement⁸

Civil conflict data. The data on civil conflict comes from the 2007 Armed Conflict Dataset of the Uppsala Conflict Data Program (UCDP) and the Centre for the Study of Civil War at the International Peace Research Institute, Oslo (PRIO).⁹ This is an updated version of the database used by Miguel, Satyanath, and Sergenti (2004). The UCDP/PRIO Armed Conflict Database defines civil conflict as a “contested incompatibility which 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 deaths”.¹⁰ Civil war is defined as a civil conflict that results in at least 1000 battle deaths in a given year. Conflict incidence is captured by an indicator variable that takes the value of 1 in a country-year with civil

⁶ Easterly, Gatti, and Kurlat (2006) show that discrete improvements in democracy in the 20th century were also associated with fewer mass killings of unarmed civilians.

⁷ The Web Appendix is available at www.antonioiciccone.eu.

⁸ A Stata file with the data and the estimation programs used is available at www.antonioiciccone.eu.

⁹ The dataset is available at <http://new.prio.no/CSCW-Datasets/Data-on-Armed-Conflict>.

¹⁰ See www.prio.no/cwp/ArmedConflict or www.pcr.uu.se for more on the definition and coding of civil conflicts.

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. Table 1, Panel A provides some descriptive statistics.

Income growth data. The real income per capita data is taken from the Penn World Tables 6.2.¹¹ We use the terms-of-trade adjusted GDP series as the short-run effect of commodity prices on income could come through a terms-of-trade effect.¹² See Table 1, Panel B for descriptive statistics.

International commodity price growth data. We obtain 1980-2003 international commodity prices for the 39 Sub-Saharan African countries in our sample following Deaton (1999). The starting point is monthly international commodity price data for 19 commodities starting in 1980 from the International Monetary Fund.¹³ Averaging across all observations in a calendar year yields an annual price series for each commodity i , $P_{i,t}$ (the 1990 value is set equal to unity for all commodities). We then obtain each country's export share of these commodities from Deaton for 1990 and, for countries and commodities not covered by Deaton, from the UN Commodity Trade Statistics Database for the year closest to 1990.¹⁴ This allows us to calculate the commodity price index (*ComPI*) for country c at time t as $ComPI_{ct} = \sum_{i=1}^{19} P_{it} w_{ic}$, where w_{ic} is the time-invariant export share of commodity i in country c . The commodity price growth rate for country c used in our empirical analysis is the average of the available annual growth rates of $ComPI_{ct}$ between t and $t-3$. Table 1, Panel C gives some descriptive statistics.

Rainfall data. Data on rainfall for the 1981-2001 period come from Miguel, Satyanath, and

¹¹ The dataset is available at <http://pwt.econ.upenn.edu>.

¹² The Web Appendix contains results using real non-terms-of-trade-adjusted GDP per capita, which are similar.

¹³ The commodities are: aluminium, bananas, cocoa, coffee, copper, cotton, fish, gold, groundnuts, iron, livestock, nickel, oil, phosphates, sugar, tea, tobacco, wood, uranium. The dataset comes from <http://www.imf.org/external/np/res/commod/externaldata.csv>. See Web Appendix Table 1 for the price series.

¹⁴ The data is available at <http://comtrade.un.org>. Web Appendix Table 2 lists the commodities and weights used for each country.

Sergenti (2004) and their data website.¹⁵ We extend the rainfall database to 2003 using the same methodology and data source (NASA Global Precipitation Climatology Project, Version 2).¹⁶ See Table 1, Panel C for some descriptive statistics.

Democracy data. Our principal measure is based on the combined polity score of the Polity IV database (Marshall and Jaggers, 2002), which ranges from +10 (full democracy) to -10 (full autocracy). The Polity project assigns scores to democracy according to three elements: (i) the presence of institutions and procedures through which citizens can express effective preferences about alternative policies and leaders; (ii) the existence of institutional constraints on the exercise of power by the executive; (iii) the guarantee of civil liberties to all citizens in their daily life and in the act of political participation. Our democracy indicator takes the value of 1 if the polity score is strictly positive and the value 0 otherwise.¹⁷ We also use an alternative indicator of democracy based on the political rights and civil liberties score of Freedom House (Freedom House, 2007). The political rights score considers the electoral process, political pluralism and participation, and the functioning of government. The civil liberties score accounts for freedom of expression and belief, associational and organizational rights, rule of law, and personal autonomy and individual rights.¹⁸ Based on these scores, Freedom House classifies countries into “free”, “partly free”, and “not free”, which we code as 2, 1, and 0 respectively. Descriptive statistics for the two measures of democracy are provided in Table 1, Panel D.

3. Estimation Framework and Empirical Results

Estimation framework. Following Miguel, Satyanath, and Sergenti (2004), our estimation framework consists of two equations. The first-stage equation links income growth ($growth_{c,t}$) to rainfall growth ($\Delta Rain_{c,t}, \Delta Rain_{c,t-1}$) and commodity price growth ($\Delta Index_{c,t}$), controlling for country fixed effects (a_c), country-specific growth trends ($b_c Year_t$), and—in some specifications—time effects that are common to Sub-Saharan African countries (τ_t),

¹⁵ The data is available at <http://elsa.berkeley.edu/~emiguel/data.shtml>.

¹⁶ See Adler et al. (2003). The data comes from <http://precip.gsfc.nasa.gov>.

¹⁷ Our democracy indicators follows Przeworski et al. (2000) and Marshall and Jaggers (2002).

¹⁸ For a more detailed description of these criteria see <http://www.freedomhouse.org>.

$$(1) \quad growth_{c,t} = a_c + b_c Year_t + \tau_t + c_1 \Delta Rain_{c,t} + c_2 \Delta Rain_{c,t-1} + d \Delta Index_{c,t} + e_{c,t},$$

where e captures a disturbance term that can be correlated across years for the same country.¹⁹ Following Deaton (1999) we measure $\Delta Index_{c,t}$ as average international commodity price growth between t and $t-3$.²⁰

The second-stage equation is

$$(2) \quad conflict_{c,t} = \alpha_c + \beta_c Year_t + \delta_t + \gamma_1 growth_{c,t} + \gamma_2 growth_{c,t-1} + \varepsilon_{c,t},$$

where α , β , δ , γ denote parameters to be estimated and ε a disturbance term. The dependent variable in (2) will either be conflict incidence or conflict onset. The main estimation method is two stage least squares (IV-2SLS), which is usually preferred in case of a dichotomous explanatory variable because alternative estimation approaches require strong specification assumptions (Angrist and Krueger, 2001; Wooldridge, 2002).

First-stage results. Table 2 presents the results of estimating the first-stage regression in (1). Column (1) reproduces the specification of Miguel, Satyanath, and Sergenti (column (1) of their Table 2), which referred to the 1981-1999 period. In particular, the specification includes country fixed effects and country-specific time trends (but not time effects). The novelty is that we employ the latest income growth data from the PWT, which turns out to be of no consequence for the estimates however.²¹ Column (2) re-estimates column (1) for the 1981-2003 period using all country-years for which the data necessary for our analysis is available (including the data for international commodity price growth). It can be seen that the positive effect of rainfall on income growth becomes somewhat stronger, both economically and statistically.

Column (3) examines the relationship between income growth and the growth rate of the international commodity price index in the sample of column (2). The effect of international commodity prices on income growth turns out to be highly significant. A 10 percentage point increase in international commodity price growth raises income growth by 0.43

¹⁹ Miguel, Satyanath, and Sergenti also present results without the country fixed effect. These specifications yield similar results.

²⁰ Web Appendix Table 4 contains results when the three lags of commodity price growth are entered separately into the first-stage equation.

²¹ Miguel, Satyanath, and Sergenti used income growth data from Fearon and Laitin (2003), who combined the PWT with other sources (because PWT data was not yet available for their entire period of analysis).

percentage points, and the effect is significant at the 1% level (the t-statistic is 3.96). Column (4) considers the rainfall growth and commodity price growth variables jointly. This has almost no effect on point estimates or standard errors of the rainfall and international commodity price variables. Column (5) adds time effects to the specification. These effects are meant to capture all factors affecting Sub-Saharan countries in a similar way in a given year (e.g. international politics, business cycles, Sub-Saharan weather factors). The inclusion of time effects leaves the first-stage results almost unaffected (the time effects are jointly significant at the 0.001% level). The main conclusion of Table 2 is therefore that higher rainfall and international commodity price growth have a highly significant positive effect on income growth, even when controlling for unobserved country and time effects.²²

Reduced-form results. Table 3 contains the results of reduced-form regressions of conflict incidence on rainfall growth and international commodity price growth. Panel A considers all civil conflicts with more than 25 annual battle deaths. Column (1) uses the same specification and sample of Miguel, Satyanath, and Sergenti but the latest UCDP/PRIO conflict data. Like Miguel, Satyanath, and Sergenti, we find a negative effect of lagged rainfall on conflict incidence, but our estimate is statistically insignificant at the 10% level.²³ Column (2) re-estimates the previous column for the 1981-2003 period using all country-years for which the data necessary for our analysis is available (including the data for international commodity price growth). This turns the negative effect of lagged rainfall on conflict incidence significant at the 10% level. Column (3) considers the effect of international commodity price growth only, while column (4) estimates the joint effects of commodity price and rainfall growth. The main result is that international commodity price growth is unrelated to civil conflict incidence in both cases. Column (5) adds time effects to the regression, which turn out to be jointly significant at the 0.0001% level.²⁴ Now lagged rainfall becomes insignificant too. Most likely this is because weather conditions across

²² Web Appendix Table 5 shows that results are similar when we use non-terms-of-trade-adjusted real income growth instead.

²³ Miguel, Satyanath, and Sergenti found the negative effect of lagged rainfall on conflict incidence to be statistically significant at the 5% level using an older version of the same UCDP/PRIO Armed Conflict dataset. In Web Appendix Table 6 we show that this effect turns insignificant in their sample when one uses the 2007 version of the data (for comparison, we also give the Miguel, Satyanath, and Sergenti estimates).

²⁴ Country effects as well as country-specific time trends are also highly jointly significant.

Sub-Saharan African countries are often similar. In fact, regressing country-year rainfall growth over the 1981-2003 period on time effects yields an R^2 of 22.5%. Hence, it is possible that time effects end up capturing a link between Sub-Saharan African rainfall and conflict risk.²⁵ Still, social, political, and institutional factors affecting the whole of Sub-Saharan Africa could also be at work.

One reason for the absent link between international commodity price growth and civil war incidence may be that commodity prices rise when markets expect civil conflict in countries that are large producers. This could be partly offsetting the direct effect whereby lower international commodity prices raise the likelihood of civil conflict. In columns (6)-(7) we therefore drop commodities from a country's commodity basket if the country produces more than 3% of world supply of the commodity.²⁶ This results in a somewhat stronger, but still statistically insignificant, effect of international commodity price growth on civil conflict.

Panel B considers only civil conflicts with more than 1000 annual battle deaths (civil wars). Column (1) and (2) show that—according to the latest UCDP/PRIO data—rainfall does not affect civil war incidence, whether we use Miguel, Satyanath, and Sergenti's sample (column (1)) or our largest sample (column (2)). Column (3) examines the effect of international commodity price growth only, while column (4) estimates the joint effects of commodity price and rainfall growth. The key result is that lower international commodity price growth is associated with a significantly higher likelihood of civil war in both cases. Moreover, the effect of international commodity price growth on civil war remains highly significant in column (5) where we include time effects (which are jointly significant at the 0.0001% level). We obtain similar results when dropping commodities from a country's basket if the country produces more than 3% of world supply (columns (6)-(7)).²⁷

²⁵ When rainfall is positively correlated across neighboring countries, there may be a direct and indirect effect of rainfall on the likelihood of civil conflict in a given country. The direct effect is that rainfall improves economic conditions in the country. The indirect effect is that it does the same in neighboring countries, which reduces the chance of civil conflict spilling across the border. Hegre and Sambanis (2006) find robust evidence for such spillovers.

²⁶ See Web Appendix Table 3 for details.

²⁷ The results where we drop commodities from a country's commodity basket if the country produces more than 3% of world supply of the commodity are always similar to those with all commodities, see Web Appendix Tables 7-8.

Reduced-form results with democracy interactions. Table 4 allows for different effects of rainfall and international commodity price growth on civil war in democracies and non-democracies (results for all civil conflicts continue to be weak even in non-democracies and are therefore relegated to the Web Appendix²⁸). In column (1) we augment the standard specification by interactions of rainfall and commodity price growth with the Polity IV democracy indicator (0=non-democracy; 1=democracy) in $t-2$.²⁹ Hence, now the estimate corresponding to “ComPI Growth Rate” (-0.149; cell 3 from the top) is the effect of commodity price growth on the likelihood of civil war in non-democracies (the estimates in cells 1-2 are the effects of current and lagged rainfall on civil war incidence in non-democracies). The estimate corresponding to “ComPI Growth Rate * Lagged Democracy” (0.169; in cell 6 from the top) gives the differential effect of commodity price growth in democracies compared to non-democracies. The effect of international commodity prices on civil war in democracies can therefore be obtained by summing cells 3 and 6. (The differential effects of rainfall are in cells 4-5 from the top.)

The results in column (1) indicate a negative, highly statistically significant, effect of international commodity price growth on civil war in non-democracies. The differential effect in democracies (the interaction of commodity price growth with the democracy indicator) is positive and highly significant.³⁰ Summing the two estimates yields a small positive effect (0.02) of international commodity price growth on civil war incidence in democracies, but this effect is not statistically significant at any conventional level. Hence, lower commodity price growth raises the likelihood of civil war incidence in non-democracies; the effect is significantly weaker in countries with democratic institutions; and there is no link between commodity price growth and civil war incidence in democracies.

In column (2) we repeat the analysis of the previous column, except that now the democracy indicator comes from Freedom House (0=not free; 1=partially free; 2=free). The coding of the indicator implies that the estimates in cells 1-3 are the effect of rainfall and international commodity price growth on civil war in countries that are not free. Summing

²⁸ In Web Appendix Tables 9-10 we show that there is no statistically significant negative effect of lower rainfall or international commodity price growth on civil conflict incidence or onset, even when we distinguish countries by their democratic institutions.

²⁹ Results are unchanged when we consider democratic institutions one period earlier or later.

³⁰ The effects of rainfall follow the same pattern, but are never statistically significant.

the estimates in cells 1-3 and 1 (partially free) or 2 (free) times the estimates in cells 7-9 yields the effect in countries that are partially free or free.³¹ The pattern of results is similar to what we found using the Polity IV democracy indicator. In countries that are not free, commodity price growth has a negative and highly statistically significant effect on civil war incidence (the point estimate is similar to that obtained for Polity IV non-democracies). The interaction between commodity price growth and the Freedom House indicator is positive and statistically significant, which indicates a weaker effect of commodity price growth on civil war incidence in (partially) free countries. The effect in countries that are free is equal to 0.018 $(-0.156+2*0.087)$ when we include time effects and 0.030 $(-0.166+2*0.098)$ when we do not. Formal hypothesis testing shows that the effect of commodity prices on civil war incidence in (partially) free countries is statistically insignificant at all conventional levels.³²

The Web Appendix presents reduced-form results for civil war incidence and onset when we allow the effect of international commodity price growth to differ across countries according to income levels; ethnic fractionalization; political and institutional checks and balances; whether they have been a British colony; and British legal origin. In addition, we also present the corresponding second-stage regression results.³³ We find the interactions of these variables with income growth to be statistically significant in some specifications. But the democracy/non-democracy (free/non-free) distinction is the only one that yields coherent reduced-form and second-stage results for civil war incidence and onset.

Second-stage results. Table 5, Panel A summarizes our estimates of the effect of current and lagged income growth on the likelihood of civil war (results for all civil conflicts are in

³¹ In Web Appendix Table 13 we estimate the effect without the (implicit) assumption that the effect in free compared to non-free countries is twice the effect in partially free countries compared to non-free countries. We find statistically weaker effects of commodity price growth on civil war in both free and partially free countries when compared to countries that are not free. Moreover, the effect in free countries is weaker than in partially free countries in most specifications, but the difference is not statistically significant. Web Appendix Table 14 contains the corresponding second-stage estimates.

³² In Web Appendix Tables 15-16, we distinguish between the effect of agricultural commodity prices and natural resource commodity prices. The main findings are: (i) commodity price growth reduces the likelihood of civil war in non-democracies for both types of commodities and the democracy interactions are positive for both types of commodities; (ii) we cannot reject the hypothesis that the effect of natural resource price growth is the same as the effect of agricultural commodity price growth.

³³ For the reduced-form results see Web Appendix Table 17-18; the second-stage results are in Tables 19-20.

the Web Appendix; these are of less interest, as we do not find a significant reduced-form effect of international commodity price or rainfall growth in this case³⁴).³⁵ Columns (1) and (4) indicate that when we do not distinguish countries according to their democratic institutions, the negative effect of current and lagged income growth on civil war incidence becomes insignificant once we account for time effects (income growth remains insignificant at the 10% level when we test current and lagged income growth jointly; time effects are jointly significant at the 0.001% level).³⁶

When we distinguish countries according to their democratic institutions, we find a statistically significant negative effect of income growth on civil war whether or not time effects are accounted for (time effects are jointly significant at the 0.001% level). The point estimates indicate that a 5 percentage point fall in economic growth raises the likelihood of civil war by around 8% in non-democracies (non-free countries). We also find a significantly positive interaction effect between current income growth and our democracy indicators. The effect of growth on civil war incidence is therefore weaker in democratic (free) countries than in non-democracies (non-free countries). In Polity IV democracies, the significant estimates in column (2) imply a small effect of income growth on the likelihood of civil war incidence (the point estimate is 0.162, which implies that a 5 percentage point fall in growth raises the likelihood of civil war incidence by less than 1%). Moreover, this effect is statistically insignificant at all conventional levels. The estimates with time effects yields a larger but still statistically insignificant effect of income growth on civil war incidence in democracies. When we split countries according to the Freedom House indicator we get the same pattern of results. The effect of economic growth on the likelihood of civil war incidence is significantly negative in non-free countries and weaker in (partially)

³⁴ See Appendix Tables 11-12. Some specifications yield a statistically significant negative effect of income growth on conflict incidence. These findings are spurious however, as Web Appendix Tables 9-10 indicate that lower rainfall or international commodity price growth do not have a statistically significant negative effect on conflict incidence in the corresponding reduced forms.

³⁵ Panel B contains least-squares effects of income growth on civil war incidence. The main differences with Panel A are that two-stage-least-squares estimates are larger in absolute value than least-squares effects. This is consistent with the view that income growth is measured with considerable error in Sub-Saharan Africa (Behrman and Rosenzweig, 1994; Heston, 1994; Miguel, Satyanath, and Sergenti, 2004). Moreover, least-squares estimation does not yield a statistically significant weaker effect of growth on civil war in democracies compared to non-democracies.

³⁶ This continues to be the case when we use non-terms-of-trade adjusted real income growth, see Web Appendix Table 21.

free countries. Formal hypothesis testing shows that there is no statistically significant link between income growth and civil war in (partially) free countries.³⁷

Civil war onset. Tables 6 and 7 consider the effects of commodity price growth and income growth on civil war onset.³⁸ Table 6 contains the reduced-form estimates. In columns (1) and (4), it can be seen that international commodity price growth has a significantly negative effect on the likelihood of civil war onset (while the effect of rainfall growth is statistically insignificant). Columns (2) and (3) include interactions with the Polity IV democracy indicator (column (2)) and the Freedom House indicator (column (3)). The corresponding results with time effects are in columns (5) and (6) (time effects are jointly significant at the 0.001%). The results indicate that lower international commodity price growth raises the likelihood of civil war onset in non-democracies (columns (2) and (5)) and non-free countries (columns (3) and (6)), and that this effect is statistically significant. The significantly positive effects of international commodity price growth when interacted with the democracy indicators indicate that the effect of commodity price growth on civil war onset is weaker in democracies and (partially) free countries respectively. For Polity IV democracies, the effect of international commodity price growth on civil war onset is almost exactly zero, as the estimates in cells 3 and 6 sum to 0.01 ($-0.107+0.108$) in column (2) and to 0.06 ($-0.107+0.113$) in column (4). The effect is quite small for Freedom House free countries also. In this case, the effect of commodity price growth on civil war onset is 0.017 ($-0.117+2*0.067$) in columns (3) and 0.009 ($-0.113+2*0.061$) in column (6). Hypothesis testing shows that the effect of international commodity prices is statistically insignificant at all conventional levels in Polity IV democracies and countries that are (partially) free according to Freedom House.

³⁷ In Web Appendix Tables 22-25, we re-estimate all specifications using Fuller limited-information maximum-likelihood (LIML) estimators and find similar results. Fuller LIML estimators are more robust to weak instruments than 2SLS (Stock, Wright, and Yogo, 2002; Hahn and Hausman, 2003).

³⁸ The corresponding results for the onset of civil conflicts with more than 25 battle deaths are in Web Appendix Table 10. There we do not find significant effects of rainfall or commodity price growth on civil conflict onset whether or not time effects are accounted for. Moreover, this remains the case when we consider non-democracies/non-free countries only. In the second-stage regressions in Web Appendix Table 12 we find no statistically significant link between income growth and civil conflict onset whether we consider all countries or non-democracies/non-free countries only.

Table 7, Panel A estimates the effect of income growth on the likelihood of civil war onset *using two stage least squares*.³⁹ We only include current income growth because lagged income growth is never statistically significant at any conventional confidence level. Columns (1) and (4) show that when we do not distinguish countries according to their democratic institutions, lower income growth raises the likelihood of civil war onset in the specifications without time effects only (time effects are jointly significant at the 0.001% level). Distinguishing countries according to their democratic institutions yields that lower income growth does make it more likely for a civil war to break out in non-democracies (columns (2) and (5) and countries that are not free (column (3) and (6)). Moreover, in the specifications with time effects, we also find significantly positive interaction effects. Hence, the effect of income growth on civil war onset is weaker in democracies compared to non-democracies (column (4)), and (partially) free countries compared to countries that are not free (column (6)). In fact, according to our estimates, there is no statistically significant link between income growth and civil war onset in democracies and (partially) free countries.

4. Summary

Are civil wars partly caused by low economic growth? We find that low growth increases the likelihood of civil war incidence and onset in autocracies. This effect is significantly weaker in countries with democratic institutions. So much so, that we do not find a statistically significant impact of economic growth on civil war in democracies. Hence, our findings do not support the view that lower income growth raises the chance of civil war independently of a country's institutional setup. Instead, they point to an interaction between economic and institutional causes of civil war.

³⁹ Panel B contains least-squares effects of income growth on civil war onset. Just like in the case of civil war incidence, two-stage-least-squares estimates are larger in absolute value than least-squares effects; and least-squares estimation does not yield a statistically significant weaker effect of growth on civil war in democracies compared to non-democracies.

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TABLE 1: Descriptive Statistics

<u>A. Measures of Civil Conflict</u>			
	Mean	Std. Dev.	No. Obs.
Civil Conflict Incidence >25 Annual Battle Deaths	0.258	0.438	859
Civil Conflict Onset >25 Annual Battle Deaths	0.076	0.266	511
Civil Conflict Incidence >Annual 1000 Battle Deaths (Civil War Incidence)	0.125	0.330	859
Civil Conflict Onset >Annual 1000 Battle Deaths (Civil War Onset)	0.030	0.170	704
<u>B. Economic Growth</u>			
Per Capita GDP, Terms of Trade Adjusted	-0.022	0.086	859
<u>C. Instruments</u>			
Rainfall Growth Rate	0.034	0.237	859
Com. Index Growth Rate	-0.011	0.280	859
<u>D. Democracy</u>			
Democracy, level (Polity IV)	0.251	0.434	849
Democracy, level (Freedom House)	0.513	0.673	859

TABLE 2: Economic Growth, Rainfall, and Commodity Price Variations

<u>Per Capita GDP Growth Rate</u>					
	(1)	(2)	(3)	(4)	(5)
Current Rainfall Growth Rate	0.054*** (2.95)	0.053*** (3.38)		0.053*** (3.42)	0.053*** (3.00)
Lagged Rainfall Growth Rate	0.034** (2.27)	0.037*** (2.58)		0.035** (2.50)	0.036** (2.21)
Commodity Price Index Growth Rate Growth Rate (3 Year MA)			0.043*** (3.96)	0.043*** (3.85)	0.044*** (3.96)
Country Fixed Effects and Country Specific Time Trends	Yes	Yes	Yes	Yes	Yes
Time Effects	No	No	No	No	Yes
F-Stat (p-value) Instrument = 0	5.25	6.58	15.65	7.25	7.44
Number of Observations	743	859	859	859	859

Note: Method of estimation is least squares with Huber robust standard errors clustered at the country level; t-values in brackets. *Significantly different from zero at 90 percent confidence, ** 95 percent confidence, *** 99 percent confidence.

TABLE 3: Civil Conflict Incidence, Rainfall, and Commodity Price Variations

<u>PANEL A: Civil Conflict > 25 Battle Deaths</u>							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
						no commodities > 3% world supply	
Current Rainfall Growth Rate	0.025 (0.59)	-0.010 (-0.30)		-0.010 (-0.30)	0.039 (1.05)	-0.011 (-0.32)	0.038 (1.02)
Lagged Rainfall Growth Rate	-0.071 (-1.61)	-0.085* (-1.87)		-0.083* (-1.87)	-0.063 (-1.52)	-0.081* (-1.85)	-0.063 (-1.52)
ComPI Growth Rate			-0.048 (-0.90)	-0.045 (-0.87)	-0.025 (-0.45)	-0.073 (-1.46)	-0.066 (-1.16)
Country Fixed Effects and Country Specific Time Trends	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Effects	No	No	No	No	Yes	No	Yes
Number of Observations	743	859	859	859	859	859	859
<u>PANEL B: Civil Conflict >1000 Battle Deaths</u>							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
						no commodities > 3% world supply	
Current Rainfall Growth Rate	-0.036 (-1.31)	-0.022 (-0.92)		-0.023 (-0.94)	0.012 (0.48)	-0.024 (-0.99)	0.011 (0.48)
Lagged Rainfall Growth Rate	-0.040 (-1.31)	-0.035 (-0.90)		-0.031 (-0.80)	-0.012 (-0.30)	-0.030 (-0.78)	-0.011 (-0.27)
ComPI Growth Rate			-0.110*** (-2.96)	-0.110*** (-2.93)	-0.105** (-2.59)	-0.112*** (-2.96)	-0.109*** (-2.85)
Country Fixed Effects and Country Specific Time Trends	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Effects	No	No	No	No	Yes	No	Yes
Number of Observations	743	859	859	859	859	859	859

Note: Method of estimation is least squares with Huber robust standard errors clustered at the country level; t-values in brackets. Columns (7)-(8) drops commodities from a country's (time-invariant) commodity basket if the country produces more than 3% of world supply of the commodity. *Significantly different from zero at 90 percent confidence, ** 95 percent confidence, *** 99 percent confidence. *Significantly different from zero at 90 percent confidence, ** 95 percent confidence, *** 99 percent confidence.

TABLE 4: Civil Conflict Incidence, Rainfall, Commodity Prices, and Democracy

	Dependent Variable: Civil Conflict >1000 Battle Deaths			
	Without Common Time Effects		Common Time Effects Included	
	(1)	(2)	(3)	(4)
Current Rainfall Growth Rate	-0.031 (-0.84)	-0.031 (-0.81)	-0.001 (-0.00)	-0.013 (-0.32)
Lagged Rainfall Growth Rate	-0.042 (-0.76)	-0.051 (-0.89)	-0.027 (-0.44)	-0.041 (-0.67)
ComPI Growth Rate	-0.149*** (-3.54)	-0.166*** (-3.91)	-0.145*** (-3.44)	-0.156*** (-3.48)
Current Rainfall Growth Rate * Lagged Democracy (Polity IV)	0.018 (0.52)		0.038 (0.98)	
Lagged Rainfall Growth Rate * Lagged Democracy (Polity IV)	0.010 (0.18)		0.025 (0.42)	
ComPI Growth Rate * Lagged Democracy (Polity IV)	0.169*** (3.27)		0.178*** (3.19)	
Current Rainfall Growth Rate * Lagged Democracy (Freedom House)		0.008 (0.38)		0.029 (1.09)
Lagged Rainfall Growth Rate * Lagged Democracy (Freedom House)		0.018 (0.60)		0.030 (0.95)
ComPI Growth Rate * Lagged Democracy (Freedom House)		0.098*** (3.58)		0.087*** (2.86)
Country Fixed Effects and Country Specific Time Trends	Yes	Yes	Yes	Yes
Time Effects	No	No	Yes	Yes
No of Observations	849	859	849	859

Note: Method of estimation is least squares with Huber robust standard errors clustered at the country level; t-values in brackets. ComPI stands for commodity price index. Democracy (Polity IV) is an indicator variable that is one if the (lagged) Polity IV score exceeds a value of zero. Democracy (Freedom House) is a trivariate variable that takes on a value of 2 if the averaged score of Freedom House's rating of civil liberties and political rights is between 1.0 to 2.5; the variable is coded as 1 (0) if the average score of Freedom House's rating of civil liberties and political rights is between 3.0 to 5.0 (5.5 to 7.0). *Significantly different from zero at 90 percent confidence, ** 95 percent confidence, *** 99 percent confidence.

TABLE 5: Civil Conflict Incidence, Economic Growth, and Democracy

<u>Dependent Variable: Civil Conflict Incidence >1000 Battle Deaths</u>						
<u>Panel A: IV-Two Stage Least Squares Estimation</u>	<u>Without Common Time Effects</u>			<u>Common Time Effects Included</u>		
	(1)	(2)	(3)	(4)	(5)	(6)
Current GDP Growth Rate	-1.241** (-2.15)	-1.500*** (-2.59)	-1.751** (-2.49)	-0.764 (-1.16)	-1.343** (-2.12)	-1.691** (-2.09)
Lagged GDP Growth Rate	-1.196* (-1.75)	-1.051 (-1.26)	-1.606* (-1.78)	-1.185 (-1.59)	-0.776 (-0.82)	-1.437 (-1.47)
Current GDP Growth Rate * Lagged Democracy (Polity IV)		1.662* (1.65)			2.474* (1.82)	
Lagged GDP Growth Rate * Lagged Democracy (Polity IV)		1.691 (1.41)			1.134 (0.96)	
Current GDP Growth Rate * Lagged Democracy (Freedom House)			1.118** (1.99)			2.023* (1.67)
Lagged GDP Growth Rate * Lagged Democracy (Freedom House)			0.802 (1.14)			-0.404 (-0.38)
Country Fixed Effects and Country Specific Time Trends	Yes	Yes	Yes	Yes	Yes	Yes
Time Effects	No	No	No	Yes	Yes	Yes
No of Observations	859	849	859	859	849	859
<u>Panel B: Least Squares Estimation</u>	<u>Without Common Time Effects</u>			<u>Common Time Effects Included</u>		
	(1)	(2)	(3)	(4)	(5)	(6)
Current GDP Growth Rate	-0.259*** (-2.99)	-0.223** (-2.36)	-0.279*** (-2.80)	-0.286*** (-3.02)	-0.252** (-2.34)	-0.274** (-2.56)
Lagged GDP Growth Rate	-0.134 (-1.15)	-0.136 (-1.14)	-0.162 (-1.21)	-0.215* (-1.86)	-0.218* (-1.83)	-0.216 (-1.62)
Current GDP Growth Rate * Lagged Democracy (Polity IV)		-0.162 (-0.60)			-0.150 (-0.68)	
Lagged GDP Growth Rate * Lagged Democracy (Polity IV)		0.039 (0.16)			0.025 (0.13)	
Current GDP Growth Rate * Lagged Democracy (Freedom House)			0.041 (0.36)			-0.027 (-0.25)
Lagged GDP Growth Rate * Lagged Democracy (Freedom House)			0.064 (0.54)			0.002 (0.02)
Country Fixed Effects and Country Specific Time Trends	Yes	Yes	Yes	Yes	Yes	Yes
Time Effects	No	No	No	Yes	Yes	Yes
No of Observations	859	849	859	859	849	859

Note: Method of estimation in Panle A (B) is two stage least squares (least squares) with Huber robust standard errors clustered at country level; t-values in brackets. The instruments are the growth rate of current and lagged rainfall as well as the commodity price index growth rate. Democracy (Polity IV) is an indicator variable that is one if the (lagged) Polity IV score exceeds a value of zero. Democracy (Freedom House) is a trivariate variable that takes on a value of 2 if the averaged score of Freedom House's rating of civil liberties and political rights is between 1.0 to 2.5; the variable is coded as 1 (0) if the average score of Freedom House's rating of civil liberties and political rights is between 3.0 to 5.0 (5.5 to 7.0). *Significantly different from zero at 90 percent confidence, ** 95 percent confidence, *** 99 percent confidence.

TABLE 6: Civil Conflict Onset, Rainfall, Commodity Prices and Democracy

<u>Dependent Variable: Civil Conflict >1000 Battle Deaths</u>						
	<u>Without Common Time Effects</u>			<u>Common Time Effects Included</u>		
	(1)	(2)	(3)	(4)	(5)	(6)
Current Rainfall Growth Rate	-0.019 (-0.98)	-0.019 (-0.65)	-0.029 (-0.86)	0.011 (0.53)	0.013 (0.45)	0.001 (0.00)
Lagged Rainfall Growth Rate	-0.019 (-0.58)	-0.038 (-0.71)	-0.027 (-0.49)	0.004 (0.09)	-0.015 (-0.24)	-0.003 (-0.05)
ComPI Growth Rate	-0.074* (1.81)	-0.107** (-2.17)	-0.117** (-2.20)	-0.072* (-1.70)	-0.107** (-2.28)	-0.113** (-2.24)
Current Rainfall Growth Rate * Lagged Democracy (Polity IV)		-0.001 (-0.04)			-0.006 (-0.18)	
Lagged Rainfall Growth Rate * Lagged Democracy (Polity IV)		0.037 (0.65)			0.035 (0.57)	
ComPI Growth Rate * Lagged Democracy (Polity IV)		0.108** (2.06)			0.113** (2.42)	
Current Rainfall Growth Rate * Lagged Democracy (Freedom House)			0.010 (0.53)			0.010 (0.58)
Lagged Rainfall Growth Rate * Lagged Democracy (Freedom House)			0.005 (0.16)			0.003 (0.07)
ComPI Growth Rate * Lagged Democracy (Freedom House)			0.067** (2.35)			0.061** (2.46)
Country Fixed Effects and Country Time Trends	Yes	Yes	Yes	Yes	Yes	Yes
Time Effects	No	No	No	Yes	Yes	Yes
No of Observations	704	704	704	704	704	704

Note: Method of estimation is least squares with Huber robust standard errors clustered at the country level; t-values in brackets. ComPI stands for commodity price index. Democracy (Polity IV) is an indicator variable that is one if the (lagged) Polity IV score exceeds a value of zero. Democracy (Freedom House) is a trivariate variable that takes on a value of 2 if the averaged score of Freedom House's rating of civil liberties and political rights is between 1.0 to 2.5; the variable is coded as 1 (0) if the average score of Freedom House's rating of civil liberties and political rights is between 3.0 to 5.0 (5.5 to 7.0). *Significantly different from zero at 90 percent confidence, ** 95 percent confidence, *** 99 percent confidence.

TABLE 7: Civil Conflict Onset, Economic Growth, and Democracy

<u>Dependent Variable: Civil Conflict >1000 Battle Deaths</u>						
Panel A: IV-Two Stage Least Squares Estimation	<u>Without Common Time Effects</u>			<u>Common Time Effects Included</u>		
	(1)	(2)	(3)	(4)	(5)	(6)
Current GDP Growth	-1.101** (-2.08)	-1.318** (-2.15)	-1.517** (-2.37)	-0.664 (-1.63)	-1.017** (-2.07)	-1.109** (-2.31)
Current GDP Growth * Lagged Democracy (Polity IV)		0.955 (1.30)			1.410* (1.80)	
Current GDP Growth * Lagged Democracy (Freedom House)			0.825** (2.19)			0.860* (1.87)
Country Fixed Effects and Country Time Trends	Yes	Yes	Yes	Yes	Yes	Yes
Time Effects	No	No	No	Yes	Yes	Yes
No of Observations	704	704	704	704	704	704
Panel B: Least Squares Estimation	<u>Without Common Time Effects</u>			<u>Common Time Effects Included</u>		
	(1)	(2)	(3)	(4)	(5)	(6)
Current GDP Growth	-0.175** (-2.03)	-0.175** (-2.10)	-0.239** (-2.11)	-0.182** (-2.14)	-0.180** (-2.19)	-0.252** (-2.33)
Current GDP Growth * Lagged Democracy (Polity IV)		0.002 (0.01)			-0.013 (-0.06)	
Current GDP Growth * Lagged Democracy (Freedom House)			0.147 (1.03)			0.159 (1.14)
Country Fixed Effects and Country Time Trends	Yes	Yes	Yes	Yes	Yes	Yes
Time Effects	No	No	No	Yes	Yes	Yes
No of Observations	704	704	704	704	704	704

Note: Method of estimation in Panel A (B) is two stage least squares (least squares) with Huber robust standard errors clustered at country level; t-values in brackets. Democracy (Polity IV) is an indicator variable that is one if the (lagged) Polity IV score exceeds a value of zero. Democracy (Freedom House) is a trivariate variable that takes on a value of 2 if the averaged score of Freedom House's rating of civil liberties and political rights is between 1.0 to 2.5; the variable is coded as 1 (0) if the average score of Freedom House's rating of civil liberties and political rights is between 3.0 to 5.0 (5.5 to 7.0). *Significantly different from zero at 90 percent confidence, ** 95 percent confidence, *** 99 percent confidence.