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Economic Shocks and Democratization in Africa*

MANUEL BARRON, EDWARD MIGUEL AND SHANKER SATYANATH

The literature on the determinants of democratization has long been dominated by a view that claimed a central role for economic development ('modernization'). Acemoglu et al. (2008, 2009) have recently challenged the robustness of empirical support for the modernization hypothesis. As an alternative, they claim that democratization is likely to occur in moments of economic crisis. Brückner and Ciccone (2011) appear to offer strong support for this latter view, and claim that lagged adverse GDP shocks generated by poor rainfall generate 'windows of opportunity' for democratization in contemporary Sub-Saharan Africa. The current article presents evidence that Brückner and Ciccone's provocative finding does not survive several sensible robustness checks, calling into question whether their claim in fact offers new insights into the process of democratization.

Since the 1950s, the literature on the determinants of democratization has been dominated by the so-called modernization hypothesis, essentially the claim that higher per capita income leads to more democracy (Lipset 1959). Acemoglu *et al.* (2008, 2009) have recently demonstrated that empirical support for the modernization hypothesis is not robust to the addition of country fixed effects. As an alternative they have asserted the importance of 'critical junctures' in influencing democratization:

[I]n our theory, democratizations occur because of the transitory nature of *de facto* political power. In some situations, the collective-action problem is easier to solve, opponents of the regime are easier to coordinate, and revolutions are easier and less costly to carry out. These are typically times of crises—for example, harvest failures, economic depressions, international financial or debt crises, and even wars. Such crises and macroeconomic shocks are intrinsically transitory and lead to fluctuations in *de facto* political power. Our theory therefore predicts that democratizations are more likely to arise in a situation of economic or political crisis (Acemoglu and Robinson 2006, 31–2).

A recent article by Brückner and Ciccone (2011) appears to offer strong support for the view that economic crises significantly influence democratization. Controlling for country fixed effects, they find a statistically significant link between adverse lagged country-level rainfall shocks, negative economic growth shocks and subsequent democratization in Sub-Saharan Africa in recent decades. Brückner and Ciccone examine the reduced-form relationship between lagged rainfall levels and subsequent changes in democracy, as well

* Manuel Barron is PhD candidate, Department of Agricultural and Resource Economics, University of California, Berkeley, 207 Giannini Hall #3310, Berkeley, CA 94720 (manuel.barron@berkeley.edu). Edward Miguel is Professor, Department of Economics, University of California, Berkeley and Research Associate, NBER, 530 Evans Hall #3880 Berkeley, CA 94720 (emiguel@econ.berkeley.edu). Shanker Satyanath is Associate Professor, Department of Politics, New York University, 19 West Fourth Street, New York, NY 10012 (ss284@nyu.edu). We thank Michael Aklin and Thomas Zeitzoff for excellent research assistance, and Marshall Burke for sharing precipitation data. All errors remain our own.

as the link between GDP levels and subsequent changes in democracy using rainfall levels as instruments for GDP.

We show that the Brückner and Ciccone (2011) result does not survive several basic robustness checks and conclude that it does not offer compelling support for the ‘critical junctures’ view of democratization. Our analytical approach is deliberately minimalist: we stick as closely as possible to Brückner and Ciccone’s econometric strategy. The basis for all analysis is the replication dataset and computer statistical program (namely, a STATA do-file) provided by Brückner and Ciccone on the *Econometrica* website. We then extend their analysis in three natural ways.¹

First, we simply check the robustness of their results (which are based on Polity data) to different measures of democracy. The first of these was developed by Przeworski *et al.* (2000) and later updated by some of Przeworski’s co-authors (Cheibub, Gandhi and Vreeland 2010). This robustness check is especially important since Polity is a subjective measure of democracy, and some scholars of democracy have long been concerned that exclusively relying on subjective measures of democracy may result in capturing *perceptions* of democracy rather than the phenomenon itself. The Przeworski *et al.* measure is based on behavior and is thus less subjective; a country is coded as a democracy only if there has been a turnover in government following an election. Since Brückner and Ciccone’s dependent variable is change in democracy, we convert Przeworski *et al.*’s binary measure into a change measure (which can take on values of +1, 0 or -1).

Second, it is important to check whether the results based on one subjective perception of democracy (Polity) are robust to using another subjective perception of democracy. We do this by conducting additional robustness checks with the political rights index developed by Freedom House (2007). This widely used dataset aims to measure how freely people participate in the political process, including the rights to vote freely, run for office, join political parties and organizations, and elect representatives (Freedom House 2010).

A third reason to subject Polity to a robustness check relates to recently expressed concerns about whether it correctly captures the length of spells of authoritarian rule (Geddes, Wright and Frantz 2012, 19). Barbara Geddes and her colleagues offer the most systematic examination of autocratic government (Geddes, Wright and Frantz 2012). Her procedures for data collection – which are arguably more objective than Polity’s – find autocratic spells that are very similar in length to those in the Przeworski *et al.* dataset, and are significantly different from those in the Polity dataset (Geddes, Wright and Frantz 2012, 19).² Our third democracy robustness check thus employs the Geddes, Wright and Frantz dataset. Like for the Przeworski *et al.* measure, we convert a binary measure into a measure that can take a positive, negative or zero value.³

In addition to robustness checks using alternative democracy measures, we correct an omission in Brückner and Ciccone’s analysis: their failure to include contemporaneous economic and rainfall shocks as explanatory variables. The structure of their IV regressions,

¹ In addition to these three extensions, there is a third adjustment that could be made, using the small sample regression correction in STATA (Baum, Schaffer and Stillman 2003). This leads to slight changes in standard errors (not shown). However, since this change does not lead to substantive variation in the results, we do not emphasize it in this article.

² See Geddes, Wright and Frantz (2013) for their coding procedures.

³ We first combine the various types of autocracies identified by Geddes, Wright and Frantz to create an indicator variable that distinguishes a democracy from an autocracy. We then use the change in this variable in our regressions.

in the notation of their article, is one in which the change in democracy between years t and $t + 1$ is regressed on predicted GDP in period $t - 1$. The notation of their article and their do-file differ, but are equivalent. In the STATA do-file, the only instrumented variable is the second lag ($t - 2$) of GDP, while the dependent variable is democracy in period t minus democracy in period $t - 1$.⁴ We employ this latter do-file notation in our text and tables below. The key point to note is that contemporaneous GDP values are not included in the second stage of their IV regressions. In other words, GDP in both period t and $t - 1$ are omitted variables, even though influential recent theory—including Acemoglu and Robinson (2006, 2008) and Chassang and Padro-i-Miquel (2009)—suggests that these contemporaneous variables are the most likely determinants of sudden political change. Even if GDP in period $t - 2$ is particularly influential, there is no theoretical justification (to our knowledge) for excluding contemporaneous GDP shocks from the analysis. At best one may argue that GDP in period t should be excluded because some of the income is potentially incurred after the democratic change occurred (in an annual-level dataset). However, there is no compelling reason to exclude GDP from period $t - 1$.

As a final set of robustness checks, we use the updated versions of Brückner and Ciccone's GDP, rainfall and Polity datasets, and extend the analysis to the most recent period possible (in some specifications) to gauge the robustness of their results to the most complete and corrected data.

As we detail below, each of these three sets of robustness checks causes the main findings in Brückner and Ciccone (2011) to lose statistical significance at traditional confidence levels, suggesting that their main empirical results are rather fragile and calling into question the conclusion that their work provides rigorous support for the role of economic shocks in driving democratization in Africa. We discuss further implications of our findings for the large and growing interdisciplinary literature on the causes of democratization in the conclusion.

EMPIRICAL RESULTS

In Table 1, Column 1 we replicate Brückner and Ciccone's core instrumental variables result using the Polity2 dataset (their Table V, Column 1). To support their claim of statistical significance in their instrumental variables specifications, they rely exclusively on a single weak instruments robust significance test. The resulting p-value is robust in the sense that the standard errors are corrected to take into account the extent to which the instruments are weak. Brückner and Ciccone exclusively report the results offered by the Anderson-Rubin chi-squared test. We additionally report the results from another valid test, the Stock-Wright Lagrange Multiplier chi square test (which is also provided in the STATA output but not reported by Brückner and Ciccone)⁵. Both procedures test the joint significance of the endogenous variables.⁶

⁴ Their core measure is the change in the Polity democracy score between year t and $t + 1$ (Polity IV Project 2010), which they call the change in democracy in period t (ΔD_t) (although ΔD_{t+1} would arguably be more natural notation). Differing notation does generate one mistake in the tables. Table VIII in BC indicates that contemporaneous GDP is in the regression, but the STATA do-file shows that it is not.

⁵ There is a third test for weak instruments: the Anderson-Rubin F-statistic. We do not report its results here because this test assumes normality of the residual, which is not an attractive assumption in this context.

⁶ For details on the tests, see Andrews and Stock (2005, section 7.1).

TABLE 1 *Rainfall, GDP and Different Measures of Democracy*

	[1]	[2]	[3]	[4]
	Polity IV: p4v2004 GDP: PWT 6.2 Precip: GCPC 2.0 1981–2004	Przeworski (Cheibub, Gandhi and Vreeland 2010) GDP: PWT 6.2 Precip: GCPC 2.0 1981–2004	Political Rights (Freedom House) GDP: PWT 6.2 Precip: GCPC 2.0 1981–2004	Geddes, Wright and Frantz (2012) GDP: PWT 6.2 Precip: GCPC 2.0 1981–2004
Panel A: Second-stage (IV) regressions				
Log GDP, $t - 2$	-18.021 [11.347]	-0.374 [0.453]	-2.969 [2.168]	0.508 [0.417]
Panel B: Reduced-form regressions				
Log rainfall, $t - 2$	-1.431* [0.779]	-0.030 [0.036]	-0.211 [0.147]	0.040 [0.033]
Observations	955	955	956	955
Significance tests in Panel A:				
Anderson-Rubin Chi2 p-value	0.049	0.380	0.123	0.196
Stock-Wright LM Chi2 p-value	0.075	0.388	0.152	0.210
Joint significance Chi2-statistic	2.522	0.684	1.875	1.487
Joint significance p-value	0.112	0.408	0.171	0.223

(1) Column 1 is the original Brückner and Ciccone specification.

(2) The dependent variable in Column 2 is the change in Przeworski's democracy indicator from Cheibub, Gandhi and Vreeland (2010). In levels, a value of 1 indicates a democratic regime and 0 otherwise.

(3) The dependent variable in Column 3 is the Political Rights index from Freedom House, taken from the dataset published online by Brückner and Ciccone.

(4) The dependent variable in Column 4 is the change in the Geddes, Wright and Franz (2012) democracy indicator. In levels, a value of 1 indicates a democratic regime, and a value of 0 an autocracy.

(5) All regressions include country fixed effects, country time trends and common time effects.

(6) Robust standard errors (clustered at the country level) in brackets.

(7) The joint significance p-value and Chi2-statistic refer to tests that do not account for weak instruments.

(8) ***p < 0.01, **p < 0.05, *p < 0.1, based on p-values that do not account for weak instruments.

(9) Anderson-Rubin and Stock-Wright p-values (in bolded text) are robust to weak instruments.

The rationale for reporting both tests is that there is no consensus in the econometrics literature about which of these two tests is most appropriate (Andrews and Stock 2005). In large samples the choice should not matter, because the tests are asymptotically equivalent. A complete picture of the robustness of the results thus requires reporting the results of both tests. For comprehensiveness we also report the traditional p-values (that is, p-values that do not account for weak instruments). In the following pages we will show that these tests coincide in that the null hypothesis of no effect cannot be rejected at conventional levels of confidence⁷.

Column 1 shows that with Polity2, the 5 percent level of significance is achieved with the Anderson-Rubin chi-squared test, while a 10 percent level of significance is achieved with Stock-Wright. The reduced-form estimate in Panel B is also significant at 10 percent. The change in significance from Brückner and Ciccone's reduced-form result—which they report to be statistically significant at 5 percent—is a result of our use of the correct *reg* command in STATA for a standard ordinary least square (OLS) regression, as opposed to their use of *ivreg2*; we discuss this issue further below. We now subject these results to changes in the measure of democracy.

In Column 2, we show the results using the Przeworski *et al.* measure of democracy (Cheibub, Gandhi and Vreeland 2010). Unlike with the Polity data, the main instrumental variables estimates are no longer statistically significant. The same pattern is apparent in Column 3, where we present the results using the political rights index developed by Freedom House.⁸ The same is true with the Geddes, Wright and Frantz measure (Column 4). It is apparent that Brückner and Ciccone's central result is not robust to alternative definitions of democracy. The marginal statistical significance (at the 10 percent level) of the reduced-form estimate also vanishes when using alternative definitions of democracy. We examine the results with these other measures in greater detail in subsequent tables.

As described above, an important implication of recent theoretical work is that contemporaneous shocks are key drivers of democratic change (Acemoglu and Robinson 2006, 2008; Chassang and Padro-i-Miquel 2009), so including them is necessary for valid inference. In Table 2 we add contemporaneous shocks as explanatory variables to the specifications displayed in Table 1, which are omitted variables in Brückner and Ciccone's main specification. The table displays the effects of adding rainfall and GDP in $t - 1$. The results here, as elsewhere, are no better if GDP and rainfall in period t are also added (not shown). As may be observed in Table 2, none of the main coefficient estimates is negative and statistically significant at 95 percent confidence for any of the democracy measures. Brückner and Ciccone's Table 3, Column 1 reports a regression that seems to be equivalent to our Table 2 Panel B, Column 1. The point estimates of the coefficients are the same, but the p-values differ (0.043 in Brückner and Ciccone, 0.067 in this article). According to their online replication materials (the STATA do-file and dataset from the *Econometrica* website), the result reported in Brückner and Ciccone's article is obtained using the *ivreg2* command with no excluded instruments. In Panel B of Table 2 we present

⁷ Hahn and Hausman (2002, 2003) have shown that weak instruments exacerbate the bias in the IV estimator.

⁸ The 956 observations for Freedom House are also used by BC in their Freedom House robustness check in a supplementary appendix. They report a significant result while we do not because they have erroneously used the third lag of GDP (and excluded the second lag). Their core specification uses the second lag, and so is the appropriate one for a robustness check. We discuss this issue in more detail below.

TABLE 2 *Sensitivity of Brückner and Ciccone Results to the Inclusion of Contemporaneous Shocks*

	[1]	[2]	[3]	[4]
	Polity IV: p4v2004 GDP: PWT 6.2 Precip: GCPC 2.0 1981–2004	Przeworski (Cheibub, Gandhi and Vreeland 2010) GDP: PWT 6.2 Precip: GCPC 2.0 1981–2004	Political Rights (Freedom House) GDP: PWT 6.2 Precip: GCPC 2.0 1981–2004	Geddes, Wright and Frantz (2012) GDP: PWT 6.2 Precip: GCPC 2.0 1981–2004
Panel A: Second-stage (IV) regressions				
Log GDP, $t - 2$	-22.482* [11.746]	-1.233 [0.903]	-3.556 [2.954]	0.178 [0.582]
Log GDP, $t - 1$	5.389 [7.878]	1.038 [0.675]	0.669 [2.420]	0.399 [0.626]
Panel B: Reduced-form regressions				
Log rainfall, $t - 2$	-1.461* [0.776]	-0.037 [0.038]	-0.218 [0.150]	0.038 [0.033]
Log rainfall, $t - 1$	0.261 [0.372]	0.059* [0.035]	0.057 [0.142]	0.024 [0.036]
Observations	955	955	956	955
Significance tests in Panel A:				
Anderson-Rubin Chi2 p-value	0.079	0.164	0.294	0.370
Stock-Wright LM Chi2 p-value	0.134	0.217	0.347	0.413
Joint significance Chi2-statistic	3.670	2.402	1.966	1.517
Joint significance p-value	0.160	0.301	0.374	0.468

- (1) The dependent variable in Column 1 is the change in Polity IV index.
- (2) The dependent variable in Column 2 is the change in Przeworski's democracy indicator from Cheibub, Gandhi and Vreeland (2010). In levels, a value of 1 indicates a democratic regime and 0 otherwise.
- (3) The dependent variable in Column 3 is the change in the Political Rights index from Freedom House, taken from the dataset published online by Brückner and Ciccone.
- (4) The dependent variable in Column 4 is the change in the Geddes, Wright and Franz (2012) democracy indicator. In levels, a value of 1 indicates a democratic regime, and a value of 0 an autocracy.
- (5) All regressions include country fixed effects, country time trends and common time effects.
- (6) Robust standard errors (clustered at the country level) in brackets.
- (7) The joint significance p-value and Chi2-statistic refer to tests that do not account for weak instruments.
- (8) *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$, based on p-values that do not account for weak instruments.
- (9) Anderson-Rubin and Stock-Wright p-values (in bolded text) are robust to weak instruments.

TABLE 3 *Dependent Variable: Change in Polity2 Index*

	[1] <i>Polity IV: p4v2004</i> <i>GDP: PWT 6.2</i> <i>Precip: GCPC 2.0</i> 1981–2004	[2] <i>Polity IV: p4v2004</i> <i>GDP: PWT 7.0</i> <i>Precip: GCPC 2.0</i> 1981–2004	[3] <i>Polity IV: p4v2010</i> <i>GDP: PWT 7.0</i> <i>Precip: GCPC 2.2</i> 1981–2004	[4] <i>Polity IV: p4v2010</i> <i>GDP: PWT 7.0</i> <i>Precip: GCPC 2.2</i> 1981–2004	[5] <i>Polity IV: p4v2004</i> <i>GDP: PWT 6.2</i> <i>Precip: GCPC 2.0</i> 1981–2004	[6] <i>Polity IV: p4v2004</i> <i>GDP: PWT 6.2</i> <i>Precip: GCPC 2.0</i> 1981–2004	[7] <i>Polity IV: p4v2010</i> <i>GDP: PWT 6.2</i> <i>Precip: GCPC 2.0</i> 1981–2004	[8] <i>Polity IV: p4v2010</i> <i>GDP: PWT 6.2</i> <i>Precip: GCPC 2.0</i> 1981–2004	[9] <i>Polity IV: p4v2004</i> <i>GDP: PWT 7.0</i> <i>Precip: GCPC 2.2</i> 1981–2009	[10] <i>Polity IV: p4v2004</i> <i>GDP: PWT 7.0</i> <i>Precip: GCPC 2.2</i> 1981–2009	[11] <i>Polity IV: p4v2010</i> <i>GDP: PWT 7.0</i> <i>Precip: GCPC 2.2</i> 1981–2009	[12] <i>Polity IV: p4v2010</i> <i>GDP: PWT 7.0</i> <i>Precip: GCPC 2.2</i> 1981–2009
Panel A: Second-stage (IV) regressions												
Log GDP, $t - 2$	-18.021 [11.347]	-22.482* [11.746]	-20.244 [14.148]	-27.493** [12.458]	-38.122 [24.494]	-23.272 [18.047]	-45.525 [37.449]	-27.519 [19.864]	-16.965 [11.031]	-20.964* [11.768]	-131.394 [568.579]	1.211 [56.675]
Log GDP, $t - 1$		5.389 [7.878]		6.912 [11.054]		-13.427 [20.628]		-28.282 [54.746]		4.832 [7.721]		-70.663 [185.831]
Panel B: Reduced-form regressions												
Log rainfall, $t - 2$	-1.431* [0.779]	-1.461* [0.776]	-1.431* [0.779]	-1.461* [0.776]	-1.514* [0.816]	-1.514* [0.817]	-1.622* [0.820]	-1.622* [0.820]	-1.347* [0.765]	-1.374* [0.765]	-0.940 [0.714]	-0.940 [0.715]
Log rainfall, $t - 1$		0.261 [0.372]		0.261 [0.372]		-0.020 [0.503]		0.012 [0.489]		0.232 [0.374]		-0.002 [0.444]
Observations	955	955	955	955	955	955	955	955	955	955	1,179	1,179
Significance tests in Panel A:												
Anderson-Rubin Chi2 p-value	0.049	0.079	0.049	0.079	0.047	0.133	0.034	0.104	0.059	0.118	0.162	0.375
Stock-Wright LM Chi2 p-value	0.075	0.134	0.075	0.134	0.078	0.208	0.064	0.179	0.086	0.177	0.186	0.416
Joint significance Chi2-statistic	2.522	3.670	2.048	4.871	2.422	3.004	1.478	2.168	2.365	3.174	0.053	0.315
Joint significance p-value	0.112	0.160	0.152	0.088	0.120	0.223	0.224	0.338	0.124	0.204	0.817	0.854

- (1) Column 1 is the original Brückner and Ciccone specification.
- (2) All regressions include country fixed effects, country time trends and common time effects.
- (3) Robust standard errors (clustered at the country level) in brackets.
- (4) The joint significance p-value and Chi2-statistic refer to tests that do not account for weak instruments.
- (5) ***p < 0.01, **p < 0.05, *p < 0.1, based on p-values that do not account for weak instruments.
- (6) Anderson-Rubin and Stock-Wright p-values (in bolded text) are robust to weak instruments.

the reduced-form output generated by STATA (which can also be obtained by running OLS regressions with the standard *reg* command). The documentation materials on the *ivreg2* command state that Brückner and Ciccone’s procedure should render the same results as OLS, but this does not appear to hold in practice. We consider the reduced-form results from a standard OLS regression to be more reliable than the results from an IV regression (*ivreg2*) run with no instruments, and thus report the OLS results throughout this article.

We now conduct various additional robustness checks involving the use of updated measures of the Penn World Tables GDP (PWT 7.0)⁹, Rainfall GPCP (version 2.2) and Polity (version p4v2010) datasets. In Table 3, we focus exclusively on robustness checks without bringing in the non-Polity democracy measures. Columns 1–10 use the same time period as Brückner and Ciccone, while the last two columns show results when the sample is extended to 2009. In Column 1 we begin with Brückner and Ciccone’s original specification and then add GDP and rainfall in $t - 1$ in Column 2. (These are the same specifications as Table 1 Column 1, and Table 2 Column 1). In Columns 3 and 4 we present results with the latest GDP dataset, keeping the Polity and rainfall datasets unchanged. In Columns 5 and 6 we use the latest the versions of the Polity, GDP and rainfall datasets. In Columns 7 and 8 we use the latest version of the rainfall dataset with the old versions of the other datasets. In Columns 9 and 10 we use the latest version of the Polity dataset with old versions of the other two datasets. Finally, in Columns 11 and 12 we extend the data to 2009 while using the latest versions of all the datasets.

While with the use of the Polity data the main coefficient estimates are occasionally statistically significant at traditional levels and the reduced form is significant at the 10 percent level in Columns 1 through 10, the most noteworthy findings are contained in Columns 6, 11 and 12. Column 6 shows that even with the Polity data, use of the latest versions of all the datasets means that none of the IV measures are statistically significant when GDP at $t - 1$ is included as an explanatory variable. Columns 11 and 12 show that neither the main coefficient estimates nor the reduced form coefficients is statistically significant when the data is extended to 2009.¹⁰

We now apply the same robustness checks with respect to updated GDP and rainfall datasets while using other democracy measures. Table 4 uses the Przeworski *et al.* measure; none of the coefficient estimates is negative and significant at 95 percent confidence, either according to the traditional p-values or the weak instrument tests. The Brückner and Ciccone results are also not robust with the previous version of the Przeworski *et al.* data (not shown).

Table 5 reports the results using the change in political rights index developed by Freedom House as the dependent variable. This table is of particular interest because in their online appendix Table IX Column 2, Brückner and Ciccone appear to show a successful robustness check for their main IV specification using this data. Note that in the notation of Brückner and Ciccone’s article, the dependent variable is the change in democracy between t and $t + 1$, while the core explanatory variable in the instrumental variables regression is GDP in period $t - 1$. (This is equivalent to our notation as per their do-file, in which we examine democracy change between $t - 1$ and t and use rainfall in $t - 2$ as the main explanatory variable). In their core instrumental variables regression

⁹ Obtained from Heston, Summers, and Aten (2009).

¹⁰ As Appendix Table 1 shows, the first-stage relationships are relatively weak for the entire 1981–2009 period, but note that the reduced-form relationships also remain weak.

TABLE 4 *Dependent Variable: Change between Democracy and Dictatorship (Przeworski et al. Measure, from Cheibub et al. 2010)*

	[1] <i>GDP: PWT 6.2</i> <i>Precip: GCPC 2.0</i> 1981–2004	[2] <i>GDP: PWT 6.2</i> <i>Precip: GCPC 2.0</i> 1981–2004	[3] <i>GDP: PWT 7.0</i> <i>Precip: GCPC 2.0</i> 1981–2004	[4] <i>GDP: PWT 7.0</i> <i>Precip: GCPC 2.0</i> 1981–2004	[5] <i>GDP: PWT 7.0</i> <i>Precip: GCPC 2.2</i> 1981–2004	[6] <i>GDP: PWT 7.0</i> <i>Precip: GCPC 2.2</i> 1981–2004	[7] <i>GDP: PWT 6.2</i> <i>Precip: GCPC 2.2</i> 1981–2004	[8] <i>GDP: PWT 6.2</i> <i>Precip: GCPC 2.2</i> 1981–2004	[9] <i>GDP: PWT 7.0</i> <i>Precip: GCPC 2.2</i> 1981–2008	[10] <i>GDP: PWT 7.0</i> <i>Precip: GCPC 2.2</i> 1981–2008
Panel A: Second-stage regressions										
Log GDP, $t - 2$	-0.374 [0.453]	-1.233 [0.903]	-0.420 [0.534]	-1.678 [1.167]	-1.118 [1.039]	-2.715* [1.592]	-1.246 [1.189]	-2.476 [1.579]	-7.943 [102.994]	-1.898 [2.659]
Log GDP, $t - 1$		1.038 [0.675]		1.199 [0.797]		1.444 [1.020]		1.931 [1.443]		-1.636 [12.397]
Panel B: Reduced-form regressions										
Log rainfall, $t - 2$	-0.030 [0.036]	-0.037 [0.038]	-0.030 [0.036]	-0.037 [0.038]	-0.044 [0.032]	-0.045 [0.032]	-0.044 [0.032]	-0.045 [0.032]	-0.019 [0.037]	-0.016 [0.036]
Log rainfall, $t - 1$		0.059* [0.035]		0.059* [0.035]		0.090* [0.050]		0.090* [0.050]		0.092** [0.045]
Observations	955	955	955	955	955	955	955	955	1,138	1,138
Significance tests in Panel A:										
Anderson-Rubin Chi2 p-value	0.380	0.164	0.380	0.164	0.137	0.104	0.137	0.104	0.588	0.092
Stock-Wright LM Chi2 p-value	0.388	0.217	0.388	0.217	0.152	0.150	0.152	0.150	0.586	0.129
Joint significance Chi2-statistic	0.684	2.402	0.621	2.426	1.157	3.661	1.100	2.937	0.006	3.000
Joint significance p-value	0.408	0.301	0.431	0.297	0.282	0.160	0.294	0.230	0.939	0.223

- (1) Change in Przeworski democracy indicator from Cheibub, Gandhi and Vreeland (2010). In levels, a value of 1 indicates a democratic regime and 0 otherwise.
- (2) All regressions include country fixed effects, country time trends and common time effects.
- (3) Robust standard errors (clustered at the country level) in brackets.
- (4) The joint significance p-value and Chi2-statistic refer to tests that do not account for weak instruments.
- (5) *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$, based on p-values that do not account for weak instruments.
- (6) Anderson-Rubin and Stock-Wright p-values (in bolded text) are robust to weak instruments.

TABLE 5 *Change in Political Rights Index (Freedom House 2007)*

	[1] <i>GDP: PWT 6.2</i> <i>Precip: GCPC 2.0</i> 1981–2004	[2] <i>GDP: PWT 6.2</i> <i>Precip: GCPC 2.0</i> 1981–2004	[3] <i>GDP: PWT 7.0</i> <i>Precip: GCPC 2.0</i> 1981–2004	[4] <i>GDP: PWT 7.0</i> <i>Precip: GCPC 2.0</i> 1981–2004	[5] <i>GDP: PWT 7.0</i> <i>Precip: GCPC 2.2</i> 1981–2004	[6] <i>GDP: PWT 7.0</i> <i>Precip: GCPC 2.2</i> 1981–2004	[7] <i>GDP: PWT 6.2</i> <i>Precip: GCPC 2.2</i> 1981–2004	[8] <i>GDP: PWT 6.2</i> <i>Precip: GCPC 2.2</i> 1981–2004	[9] <i>GDP: PWT 7.0</i> <i>Precip: GCPC 2.2</i> 1981–2004	[10] <i>GDP: PWT 7.0</i> <i>Precip: GCPC 2.2</i> 1981–2004
Panel A: Second-stage regressions										
Log GDP, $t - 2$	-2.862 [2.069]	-3.523 [2.944]	-3.088 [2.420]	-4.444 [3.542]	-3.536 [3.639]	-1.831 [4.944]	-4.122 [4.658]	-2.049 [4.789]	-3.633 [3.996]	-1.902 [4.858]
Log GDP, $t - 1$		0.801 [2.472]		1.282 [2.712]		-1.561 [3.478]		-3.376 [6.302]		-1.520 [3.396]
Panel B: Reduced-form regressions										
Log rainfall, $t - 2$	-0.216 [0.148]	-0.221 [0.151]	-0.216 [0.148]	-0.221 [0.151]	-0.140 [0.168]	-0.140 [0.169]	-0.140 [0.168]	-0.140 [0.169]	-0.130 [0.168]	-0.130 [0.169]
Log rainfall, $t - 1$		0.049 [0.143]		0.049 [0.143]		-0.018 [0.171]		-0.018 [0.171]		-0.006 [0.170]
Observations	950	950	950	950	950	950	950	950	956	956
Significance tests in Panel A:										
Anderson-Rubin Chi2 p-value	0.118	0.288	0.118	0.288	0.372	0.636	0.372	0.636	0.406	0.688
Stock-Wright LM Chi2 p-value	0.146	0.342	0.146	0.342	0.385	0.649	0.385	0.649	0.418	0.700
Joint significance Chi2-statistic	1.913	1.963	1.628	1.986	0.944	0.953	0.783	0.764	0.826	0.804
Joint significance p-value	0.167	0.375	0.202	0.370	0.331	0.621	0.376	0.682	0.363	0.669

(1) Change in Freedom House Political Rights Index (2007).

(2) All regressions include country fixed effects, country time trends and common time effects.

(3) Columns 1 through 8 are restricted to observations from the original Brückner and Ciccone sample with valid data for the political rights index. Columns 9 and 10 include all observations with valid data.

(4) Robust standard errors (clustered at the country level) in brackets.

(5) The joint significance p-value and Chi2-statistic refer to tests that do not account for weak instruments.

(6) *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$, based on p-values that do not account for weak instruments.

(7) Anderson-Rubin and Stock-Wright p-values (in bolded text) are robust to weak instruments.

TABLE 6 *Change between Democracy and Autocracy (Geddes, Wright and Frantz 2012)*

	[1] <i>GDP: PWT 6.2</i> <i>Precip: GCPC 2.0</i> 1981–2004	[2]	[3] <i>GDP: PWT 7.0</i> <i>Precip: GCPC 2.0</i> 1981–2004	[4]	[5] <i>GDP: PWT 7.0</i> <i>Precip: GCPC 2.2</i> 1981–2004	[6]	[7] <i>GDP: PWT 6.2</i> <i>Precip: GCPC 2.2</i> 1981–2004	[8]	[9] <i>GDP: PWT 7.0</i> <i>Precip: GCPC 2.2</i> 1981–2009	[10]
Panel A: Second-stage regressions										
Log GDP, $t - 2$	0.508 [0.417]	0.178 [0.582]	0.571 [0.506]	0.117 [0.776]	1.053 [1.124]	-0.615 [1.449]	1.174 [1.426]	-0.383 [1.538]	1.445 [1.221]	-0.483 [1.150]
Log GDP, $t - 1$		0.399 [0.626]		0.433 [0.701]		1.508 [1.183]		2.445 [2.809]		1.647 [1.433]
Panel B: Reduced-form regressions										
Log rainfall, $t - 2$	0.040 [0.033]	0.038 [0.033]	0.040 [0.033]	0.038 [0.033]	0.042 [0.048]	0.041 [0.048]	0.042 [0.048]	0.041 [0.048]	0.045 [0.038]	0.047 [0.038]
Log rainfall, $t - 1$		0.024 [0.036]		0.024 [0.035]		0.057 [0.056]		0.056 [0.056]		0.043 [0.051]
Observations	955	955	955	955	955	955	955	955	1,154	1,154
Significance tests in Panel A:										
Anderson-Rubin Chi2 p-value	0.196	0.370	0.196	0.370	0.352	0.423	0.352	0.423	0.211	0.366
Stock-Wright LM Chi2 p-value	0.210	0.413	0.210	0.413	0.355	0.446	0.355	0.446	0.215	0.382
Joint significance Chi2-statistic	1.487	1.517	1.271	1.348	0.877	1.735	0.678	0.774	1.401	1.420
Joint significance p-value	0.223	0.468	0.260	0.510	0.349	0.420	0.410	0.679	0.237	0.492

(1) Change in democracy indicator from Geddes, Wright and Franz (2012). In levels, a value of 1 indicates a democratic regime and 0 otherwise.

(2) All regressions include country fixed effects, country time trends and common time effects.

(3) Columns 1 through 8 are restricted to observations from the original Brückner and Ciccone sample with valid democracy data. Columns 9 and 10 include all observations with valid data and expand the analysis to 2009.

(4) Robust standard errors (clustered at the country level) in brackets.

(5) The joint significance p-value and Chi2-statistic refer to tests that do not account for weak instruments.

(6) *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$, based on p-values that do not account for weak instruments.

(7) Anderson-Rubin and Stock-Wright p-values (in bolded text) are robust to weak instruments.

with Polity2, Brückner and Ciccone use only GDP in $t - 1$ (in the notation of their article) as their independent variable. However in the robustness check that they report with Freedom House (in their supplementary appendix), they unaccountably switch to only using GDP in period $t - 2$ (in the notation in their article). In the equivalent language of the do-file and our article (where the left-hand side is change in democracy from $t - 1$ to t), they switch from using only GDP in $t - 2$ for the core Polity IV regression to only using GDP in $t - 3$ for the Freedom House robustness check. This, of course, does not make for a true robustness check of the core specification; we conduct such a test here.

When GDP in $t - 2$ (in the notation of the do-file and our article) is the independent variable, to be consistent with the core Brückner and Ciccone Polity2 specification, the coefficient estimate is no longer statistically significant at the 95 percent confidence level. In Column 3 of Tables 1 and 2, we already saw the non-robustness of Brückner and Ciccone's core results for GDP in $t - 2$ to Freedom House data using the sample in Brückner and Ciccone's supplementary appendix ($n = 956$). Columns 1–8 of Table 5 show results dropping the six observations that are offered by Freedom House, but not by the core Polity2 measure.¹¹ The structure of the first eight columns is the same as in the previous table, with different permutations of datasets. The last two columns present results with the latest versions of datasets with the full range of observations offered by Freedom House. As shown in the table, neither the main coefficients nor the reduced-form estimates is statistically significant.¹²

Finally, we address the results using the Geddes, Wright and Frantz (2012) dataset. Since this dataset is missing 35 country-year observations that we used in the previously presented regressions, we present these results in two ways. First, in Table 6 we present results in which we fill in the missing observations with scores from the Przeworski *et al.* measure. This is justified by the fact that the specific problem of the potentially inaccurate length of autocratic spells, which motivated this robustness check in the first place, does not appear to be an issue for the Przeworski *et al.* measure, as mentioned earlier. However, for assurance that the results are not driven by this imputation, we also present results using only the observations in the Geddes, Wright and Frantz data (in Appendix Table 2). In both of these tables, a score of 1 on the democratic change measure indicates a change from an autocratic to a democratic regime. Once again, there is no evidence in favor of Brückner and Ciccone's core empirical result: neither Table 6 nor Appendix Table 2 has any main coefficient estimates that are statistically significant at 95 percent confidence. We draw special attention to Columns 5 and 6 of Appendix Table 2, which use the latest versions of all datasets.

CONCLUSION

In light of the above findings, we argue that Brückner and Ciccone's well-known *claim*—that adverse rainfall shocks provided a democratic 'window of opportunity' in Africa—appears to be premature. Their empirical results do not stand up to several basic robustness checks that we view as essential for scientific credibility. With a slight change in the data used, or in the econometric specification—including the theoretically justified inclusion of contemporaneous income shocks—we can no longer reject the null

¹¹ We do this for completeness, not because it makes any difference.

¹² For the version of the Freedom House measure used by Brückner and Ciccone, there is no data to extend the Freedom House dataset beyond 2004.

hypothesis of no impact on democratic change. None of this is to say that economic, weather or other shocks have no effect on democratization (in Africa or elsewhere), but rather that Brückner and Ciccone's analysis does not offer convincing support for the claim.

We hope that our analysis will ultimately contribute to the emerging empirical literature that tests theories of democratization by clearly delineating what we do and do not know, and by clarifying the questions that need to be more rigorously answered to make progress in this important and growing interdisciplinary research area. Moreover, given that there are multiple logical and potentially valid ways of capturing democracy, this article highlights the importance of not placing too much weight on empirical results that hinge exclusively on a single measure of democracy.

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Appendix Table 1. Analysis that Illustrates the First Stage Results in Brückner and Ciccone (2011)

	[1] <i>Polity IV: p4v2004</i> <i>GDP: PWT 6.2</i> <i>Precip: GCPC 2.0</i> <i>1981–2004</i>	[2]	[3] <i>Polity IV: p4v2010</i> <i>GDP: PWT 7.0</i> <i>Precip: GCPC 2.2</i> <i>1981–2004</i>	[4]	[5] <i>Polity IV: p4v2010</i> <i>GDP: PWT 7.0</i> <i>Precip: GCPC 2.2</i> <i>1981–2009</i>	[6]
	Log GDP ($t-1$)	Log GDP ($t-2$)	Log GDP ($t-1$)	Log GDP ($t-2$)	Log GDP ($t-1$)	Log GDP ($t-2$)
Rainfall, $t-1$	0.060*** [0.022]	0.003 [0.021]	0.031 [0.024]	-0.017 [0.020]	-0.001 [0.032]	-0.042* [0.025]
Rainfall, $t-2$	0.059* [0.031]	0.079*** [0.030]	0.044* [0.026]	0.040 [0.026]	0.013 [0.032]	0.005 [0.035]
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Country time trend	Yes	Yes	Yes	Yes	Yes	Yes
Common time effect	Yes	Yes	Yes	Yes	Yes	Yes
Observations	955	955	955	955	1,179	1,179

- (1) Columns 1–2 illustrate the first-stage results of specification 2 in Table 3.
(2) Columns 3–4 illustrate the first-stage results of specification 6 in Table 3.
(3) Columns 5–6 illustrate the first-stage results of specification 12 in Table 3.
(4) Robust standard errors (clustered at the country level) in brackets.
(5) *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Appendix Table 2. Change between Democracy and Autocracy without Imputation (Geddes, Wright and Frantz 2012)

	[1] GDP: PWT 6.2 Precip: GCPC 2.0 1981–2004	[2] GDP: PWT 6.2 Precip: GCPC 2.0 1981–2004	[3] GDP: PWT 7.0 Precip: GCPC 2.0 1981–2004	[4] GDP: PWT 7.0 Precip: GCPC 2.0 1981–2004	[5] GDP: PWT 7.0 Precip: GCPC 2.2 1981–2004	[6] GDP: PWT 7.0 Precip: GCPC 2.2 1981–2004	[7] GDP: PWT 6.2 Precip: GCPC 2.2 1981–2004	[8] GDP: PWT 6.2 Precip: GCPC 2.2 1981–2004	[9] GDP: PWT 7.0 Precip: GCPC 2.2 1981–2009	[10] GDP: PWT 7.0 Precip: GCPC 2.2 1981–2009
Panel A: Second-stage regressions										
Log GDP, $t - 2$	0.624 [0.385]	0.334 [0.587]	0.671 [0.452]	0.236 [0.724]	0.688 [0.718]	0.099 [0.909]	0.751 [0.840]	0.335 [0.992]	0.790 [0.703]	0.229 [0.745]
Log GDP, $t - 1$		0.324 [0.583]		0.409 [0.643]		0.556 [0.741]		0.549 [0.997]		0.543 [0.838]
Panel B: Reduced-form regressions										
Log rainfall, $t - 2$	0.057 [0.035]	0.054 [0.034]	0.057 [0.035]	0.054 [0.034]	0.039 [0.044]	0.039 [0.044]	0.039 [0.044]	0.039 [0.044]	0.034 [0.035]	0.035 [0.035]
Log rainfall, $t - 1$		0.028 [0.036]		0.028 [0.036]		0.027 [0.046]		0.027 [0.046]		0.009 [0.043]
Observations	920	920	920	920	920	920	920	920	1,119	1,119
Significance tests in Panel A:										
Anderson-Rubin Chi2 p-value	0.075	0.174	0.075	0.174	0.338	0.541	0.338	0.541	0.291	0.567
Stock-Wright LM Chi2 p-value	0.087	0.212	0.087	0.212	0.338	0.548	0.338	0.548	0.294	0.571
Joint significance Chi2-statistic	2.628	2.754	2.206	2.338	0.917	1.216	0.799	0.945	1.263	1.269
Joint significance p-value	0.105	0.252	0.138	0.311	0.338	0.545	0.372	0.623	0.261	0.530

(1) Change in democracy indicator from Geddes, Wright and Franz (2012). In levels, a value of 1 indicates a democratic regime and 0 otherwise.

(2) All regressions include country fixed effects, country time trends and common time effects.

(3) Robust standard errors (clustered at the country level) in brackets.

(4) The joint significance p-value and Chi2-statistic refer to tests that do not account for weak instruments.

(5) ***p < 0.01, **p < 0.05, *p < 0.1, based on p-values that do not account for weak instruments.

(6) Anderson-Rubin and Stock-Wright p-values (in bolded text) are robust to weak instruments.