Economic Shocks and Democratization in Africa

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Abstract: The literature on the determinants of democratization was long 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. An article in a leading economics journal by Bruckner and Ciccone (2011) appears to offer strong support for this latter view; it claims that lagged adverse GDP shocks generated by poor rainfall generate “windows of opportunity” for democratization in contemporary Sub-Saharan Africa. In this paper, we present evidence that this provocative finding does not survive several sensible robustness checks, leading us to doubt if the paper offers new insights into the process of democratization.

Keywords: Democratization, economic shocks

* Acknowledgements: We thank Michael Aklín and Thomas Zeitzoff for excellent research assistance, and Marshall Burke for sharing precipitation data. All errors remain our own.
1. Introduction

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). Recently Acemoglu, Johnson, Robinson, and Yared (2008, 2009) have demonstrated that empirical support for the modernization hypothesis is not robust to the addition of country fixed effects. As an alternative they have argued for the importance of “critical junctures” in influencing democratization. As they put it:

“[I]n our theory, democratizations occur because of the transitory nature of \textit{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 \textit{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, 31-32).

A recent paper in a leading journal in Economics (\textit{Econometrica}) by Bruckner and Ciccone (2011) (henceforth BC) appears to offer strong support for the view that economic crises significantly influence democratization. Controlling for country fixed effects, BC 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. BC examine the reduced-form relationship between lagged rainfall levels and subsequent changes in democracy, and also examine the link between GDP levels and subsequent changes in democracy using rainfall levels as instruments for GDP.

In our paper’s main contribution, we show that the Bruckner and Ciccone (2011) result does not survive several basic robustness checks. We conclude that BC 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 BC’s own econometric strategy. The basis for all analysis is the replication data set and computer statistical program (namely, a STATA do-file) provided by BC on the *Econometrica* website.

We then extend their analysis in three natural ways.¹

First, we simply check the robustness of the BC results (which are based on Polity data) to different measures of democracy. The first of these is the one 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 an exclusive reliance on subjective measures of democracy may leave one capturing perceptions of democracy and not the phenomenon itself. The Przeworkski et al. measure is based on behavior and is thus less subjective; a country is coded as a democracy only if there has been actual turnover in government following an election. Since BC’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).

Even aside from the subjectivity issue, it is important to check if 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 right to vote freely, run for office, join political parties and organizations, and elect representatives (Freedom House 2010).

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 et al. 2003). This leads to slight changes in standard errors (not shown). However, this change does not lead to substantive changes in the results and we do not emphasize it in this article.
A third reason to subject Polity to a robustness check relates to recently expressed concerns about whether it is correctly capturing the length of spells of authoritarian rule (Geddes et al 2012, 19). The most systematic examination of autocratic government is offered by the noted democracy scholar Barbara Geddes and her colleagues (Geddes et al. 2012). Her procedures for data collection – which are arguably more objective than Polity – 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 et al. 2012, 19). Our third democracy robustness check thus employs the Geddes et al. 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.

In addition to robustness checks with alternative democracy measures, we correct an omission in BC’s analysis, namely, their failure to include contemporaneous economic and rainfall shocks as explanatory variables. The structure of BC’s IV regressions, in the notation of their paper, 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 the BC paper 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 $t-1$. 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.

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2 See Geddes et al. (2013) for their coding procedures.
3 We first combine the various types of autocracies identified by Geddes et al. to create an indicator variable that distinguishes a democracy from an autocracy. We then use the change in this variable in our regressions.
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 $t$ ($\Delta D_t$) although $\Delta D_{t+1}$ 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.
other words, both GDP in period $t$ as well as in $t-1$ are omitted variables, even though influential recent theory, including Acemoglu and Robinson (2001, 2006) and Chassang and Padro-i-Miquel (2009), would imply 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 lagged GDP from period $t-1$.

As a final set of robustness checks, we use the updated versions of BC’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 leads the main findings in Bruckner 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 inter-disciplinary literature on the causes of democratization in the conclusion.

2. Empirical Results

In Table 1, column 1 we replicate Bruckner 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, BC 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 account of the extent to which the instruments are weak. BC 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 BC)$^5$. Both procedures test the joint significance of the endogenous variables (for details on the tests, see Andrews and Stock (2005, section 7.1).

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 robustness of the results thus requires reporting the results of both tests. For comprehensiveness we also report the traditional $p$-values (i.e. $p$-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 confidence$^6$.

Column 1 shows that with Polity2 the 5% level of significance is achieved with the Anderson Rubin chi square test, while a 10% level of significance is achieved with Stock-Wright. The reduced form estimate in Panel B is also significant at 10%. (The change in significance from BC’s reduced form result, which they report to be statistically significant at 5%, is a result of our use of the correct `reg` command in STATA for a standard OLS regression,

$^5$ There is a third test for weak instruments, namely 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.

$^6$ It has been shown (e.g. Hahn and Hausman 2002, 2003) that weak instruments exacerbate the bias in the IV estimator.
as opposed to their use of \textit{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 et al. 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.\footnote{The 956 observations for Freedom House are also used by BC in their Freedom House robustness check in a supplementary appendix. The reason why they report a significant result while we do not is that they have erroneously used the third lag of GDP (while excluding 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.} The same is true with the Geddes et al. measure (column 4). It is apparent that BC’s central result is not robust to alternative definitions of democracy. The marginal statistical significance (at the 10\% 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 2001, 2006, 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 BC’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 are negative and statistically significant at 95\% confidence for any of the democracy measures. BC’s Table 3, column 1, reports a regression that seems to be equivalent to our Table 2 panel B. The point estimates of the coefficients are the same but the \textit{p}-values
differ (0.043 in BC, 0.067 in this paper). According to their online replication materials (the
STATA do-file and dataset from the Econometrica website), the result reported in BC’s paper is
obtained using the *ivreg2* command with no excluded instruments. In panel B of Table 2 we
present 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 BC’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 paper.

We now conduct various additional robustness checks involving the use of updated
measures of the Penn World Tables GDP (PWT 7.0), 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 BC,
while the last two columns show results when the sample is extended to 2009. In column 1 we
begin with BC’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, the 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% 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 are statistically significant when the data is extended to 2009.8

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. As shown in the table, none of the coefficient estimates are negative and significant at 95% confidence, either according to the traditional _p_-values or the weak instrument tests. The BC 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, BC appear to show a successful robustness check for their main IV specification using this data. Note that in the notation of BC’s paper, 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 with Polity2, BC use only GDP in t-1 (in the notation of their paper) as their independent variable. However in the robustness check that they report with Freedom House (in the supplementary appendix) they

8 As Appendix Table 1 shows, the first stage relationships are relatively weak over the entire 1981-2009 period, but note that the reduced form relationships also remain weak.
unaccountably switch to only using GDP in period t-2 (in the notation in their paper). In the equivalent language of the do file and our paper (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 and we conduct such a test here.

When GDP in t-2 (in the notation of the do file and our paper) is the independent variable, to be consistent with the core BC Polity2 specification, the coefficient estimate is no longer statistically significant at 95% confidence. In column 3 of Tables 1 and 2 we already saw the non-robustness of BC’s core results for GDP in t-2 to Freedom House data using the sample in BC’s supplementary appendix (n=956). Columns 1-8 of Table 5 show results dropping the 6 observations that are offered by Freedom House, but not by the core Polity2 measure. 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 are statistically significant.

Finally, we address the results with the Geddes et al. (2012) dataset. Since this dataset is missing 35 country-year observations which 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 the missing observations in with scores from the Przeworski et al. measure. This is justified by the fact that the specific problem of potentially inaccurate length of autocratic spells, which motivated this robustness check in the first place, does not appear to be an issue for the

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

10 For the version of the Freedom House measure used by BC there is no data to extend the Freedom House dataset beyond 2004.
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 et al. data (in Appendix Table 2). In both 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 BC’s core empirical result: in neither Table 6 nor Appendix Table 2 are any main coefficient estimates statistically significant at 95% confidence. We draw special attention to columns 5 and 6 of Appendix Table 2, which use the latest versions of all datasets.

3. Conclusion

In light of the above findings, we argue that the claim in Bruckner and Ciccone’s (2011) well-known *Econometrica* article – namely, that adverse rainfall shocks provided a democratic “window of opportunity” in Africa – appears to be premature. The empirical results in BC do not stand up to several basic robustness checks that we view as essential for scientific credibility. With any 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 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 the analysis in BC does not offer convincing support for the claim.

We hope that the analysis that we offer in this short article will ultimately be constructive for 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 inter-disciplinary research area.

Moreover, given that there are multiple logical and potentially valid ways of capturing
democracy, this paper highlights the importance of not placing too much weight on empirical results that hinge exclusively on a single measure of democracy.

References


Hahn, Jinyong, and Jerry Hausman. 2002. “A New Specification Test for the Validity of


Table 1 – Rainfall, GDP, and Different Measures of Democracy

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<tr>
<td>Panel A: Second Stage (IV) Regressions</td>
<td>Log GDP, t-2 -18.021 [11.347]</td>
<td>-0.374 [0.453]</td>
<td>-2.969 [2.168]</td>
<td>0.508 [0.417]</td>
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<td>Panel B: Reduced Form Regressions</td>
<td>Log rainfall, t-2 -1.431* [0.779]</td>
<td>-0.030 [0.036]</td>
<td>-0.211 [0.147]</td>
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<td>Observations</td>
<td>955 955 956 955</td>
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Significance tests in Panel A:
- Anderson-Rubin Chi2 p-value
  - Column 1: 0.049
  - Column 2: 0.380
  - Column 3: 0.123
  - Column 4: 0.196
- Stock-Wright LM Chi2 p-value
  - Column 1: 0.075
  - Column 2: 0.388
  - Column 3: 0.152
  - Column 4: 0.210
- Joint significance Chi2-statistic
  - Column 1: 2.522
  - Column 2: 0.684
  - Column 3: 1.875
  - Column 4: 1.487
- Joint significance p-value
  - Column 1: 0.112
  - Column 2: 0.408
  - Column 3: 0.171
  - Column 4: 0.223

(1) Column [1] is the original BC 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 BC.
(4) The dependent variable in column [4] is the change in 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 trend, 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.
Table 2 - Sensitivity of BC Results to the Inclusion of Contemporaneous Shocks

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<td>Panel A: Second Stage (IV) Regressions</td>
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<tr>
<td>Log GDP, t-2</td>
<td>-22.482*</td>
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<td>-3.556</td>
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<td>[2.954]</td>
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<td>Log GDP, t-1</td>
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<td>Panel B: Reduced Form Regressions</td>
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<tr>
<td>Log rainfall, t-2</td>
<td>-1.461*</td>
<td>-0.037</td>
<td>-0.218</td>
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<td>[0.776]</td>
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<td>Log rainfall, t-1</td>
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<td>Significance tests in Panel A:</td>
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<tr>
<td>Anderson-Rubin Chi2 p-value</td>
<td>0.079</td>
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<td>0.294</td>
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<td>Stock-Wright LM Chi2 p-value</td>
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<td>0.217</td>
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<td>Joint significance Chi2-statistic</td>
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<td>0.468</td>
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(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 BC.
(4) The dependent variable in column [4] is the change in 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 trend, and common time effects.
(6) Robust standard errors (clustered at the country level, adjusted for finite samples) 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.
Table 3 - Dependent variable: Change in Polity2 index

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Panel A: Second Stage (IV) Regressions

Log rainfall, t-2  | -1.431* | -1.461* | -1.431* | -1.461* | -1.514* | -1.514* | -1.622* | -1.622* | -1.347* | -1.374* | -0.940 | -0.940 |
|                 | [0.779]  | [0.776]  | [0.776]  | [0.816]  | [0.817]  | [0.820]  | [0.820]  | [0.765]  | [0.765]  | [0.714]  | [0.715]  |         |
Log rainfall, t-1 | 0.261   | 0.261    | 0.261    | 0.020    | 0.012    | 0.232    | -0.002   |          |          |          |         |         |
|                 | [0.372]  | [0.372]  | [0.503]  | [0.489]  | [0.374]  | [0.444]  |          |           |           |           |         |         |

Panel B: Reduced Form Regressions

Observations | 955 | 955 | 955 | 955 | 955 | 955 | 955 | 955 | 955 | 955 | 1179 | 1179 |

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 BC specification.
(2) All regressions include country fixed effects, country time trend, and common time effects.
(3) Robust standard errors (clustered at the country level, adjusted for finite samples) 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.
Table 4 - Dependent variable: Change between Democracy and Dictatorship (Przeworski et al. Measure)

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</tbody>
</table>
| Panel B: Reduced Form Regressions
| Log rainfall, t-2 | -0.030 | -0.037 | -0.030 | -0.037 | -0.044 | -0.045 | -0.044 | -0.045 | -0.019 | -0.016 |
|                  | [0.036] | [0.038] | [0.036] | [0.038] | [0.032] | [0.032] | [0.032] | [0.032] | [0.037] | [0.036] |
| Log rainfall, t-1 | 0.059* | 0.059* | 0.090* | 0.090* |        |        |        |        | 0.092** |        |
|                  | [0.035] | [0.035] | [0.050] | [0.050] |       |       |       |       | [0.045] |       |
| Observations     | 955 | 955 | 955 | 955 | 955 | 955 | 955 | 955 | 1138 | 1138 |

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
  - 0.388 | 0.217 | 0.388 | 0.217 | 0.152 | 0.150 | 0.152 | 0.150 | 0.586 | 0.129
- **Stock-Wright LM Chi2 p-value**
  - 0.684 | 2.402 | 0.621 | 2.426 | 1.157 | 3.661 | 1.100 | 2.937 | 0.006 | 3.000
  - 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 trend, and common time effects.
(3) Robust standard errors (clustered at the country level, adjusted for finite samples) 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.
Table 5 - Change in Political Rights Index (Freedom House)

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<td>1981-2004</td>
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</tbody>
</table>

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]  

-4.244 [3.639]  

-4.544 [4.944]  

-1.831 [4.658]  

-4.122 [4.789]  

-2.049 [4.396]  

-3.633 [4.858]  

Log GDP, t-1  

0.801 [2.472]  

1.282 [2.712]  

1.282 [3.478]  

1.561 [6.302]  

-3.376 [3.996]  

-1.520 [4.858]  

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

(2) All regressions include country fixed effects, country time trend, and common time effects.
(3) Columns [1] through [8] are restricted to observations from the original BC 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, adjusted for finite samples) 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.
Table 6 - Change between Democracy and Autocracy (Geddes, Wright and Frantz 2012)

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<td>GDP: PWT 6.2</td>
<td>0.508</td>
<td>0.178</td>
<td>0.571</td>
<td>0.117</td>
<td>1.053</td>
<td>-0.615</td>
<td>1.174</td>
<td>-0.383</td>
<td>1.445</td>
<td>-0.483</td>
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<td>[0.506]</td>
<td>[0.776]</td>
<td>[1.124]</td>
<td>[1.449]</td>
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<td>0.433</td>
<td>1.508</td>
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<td>1.647</td>
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<td>0.040</td>
<td>0.038</td>
<td>0.042</td>
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<td>0.024</td>
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<td>1981-2009</td>
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</tr>
</tbody>
</table>

Panel A: Second Stage Regressions

- Log GDP, t-2
  - 0.508 0.178 0.571 0.117 1.053 -0.615 1.174 -0.383 1.445 -0.483
  - [0.417] [0.582] [0.506] [0.776] [1.124] [1.449] [1.426] [1.538] [1.221] [1.150]
- Log GDP, t-1
  - 0.399 0.433 1.508 2.445 1.647
  - [0.626] [0.701] [1.183] [2.809] [1.433]

Panel B: Reduced Form Regressions

- Log rainfall, t-2
  - 0.040 0.038 0.040 0.038 0.042 0.041 0.042 0.041 0.045 0.047
  - [0.033] [0.033] [0.033] [0.033] [0.048] [0.048] [0.048] [0.048] [0.038] [0.038]
- Log rainfall, t-1
  - 0.024 0.024 0.057 0.056 0.043
  - [0.036] [0.035] [0.056] [0.056] [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 trend, and common time effects.
(3) Columns [1] through [8] are restricted to observations from the original BC 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, adjusted for finite samples) 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.
## Appendix Table 1 – Analysis that Illustrates the First Stage Results in Bruckner and Ciccone (2011)

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<tr>
<td>(t-1)</td>
<td>0.060***</td>
<td>0.031</td>
<td>0.044*</td>
<td>0.013</td>
<td>-0.001</td>
<td>-0.042*</td>
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<td>Log GDP</td>
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<tr>
<td>(t-2)</td>
<td>0.003</td>
<td>-0.017</td>
<td>0.040</td>
<td>0.005</td>
<td>-0.042*</td>
<td>-0.050**</td>
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<td>0.003</td>
<td>0.044*</td>
<td>0.013</td>
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(1) cols [1]-[2] illustrate the first stage results of specification [2] in Table 3
(2) cols [3]-[4] illustrate the first stage results of specification [6] in Table 3
(3) cols [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 (Geddes, Wright and Franz 2012)

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<td>0.624</td>
<td>0.334</td>
<td>0.671</td>
<td>0.236</td>
<td>0.688</td>
<td>0.099</td>
<td>0.751</td>
<td>0.335</td>
<td>0.790</td>
<td>0.229</td>
</tr>
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<td>0.409</td>
<td>0.556</td>
<td>0.549</td>
<td>0.543</td>
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<td>1981-2004</td>
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<td>[0.724]</td>
<td>[0.909]</td>
<td>[0.840]</td>
<td>[0.992]</td>
<td>[0.703]</td>
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<tr>
<td>Log GDP, t-2</td>
<td>0.057</td>
<td>0.054</td>
<td>0.057</td>
<td>0.054</td>
<td>0.039</td>
<td>0.039</td>
<td>0.039</td>
<td>0.039</td>
<td>0.034</td>
<td>0.035</td>
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<tr>
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<td>[0.034]</td>
<td>[0.034]</td>
<td>[0.044]</td>
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<tr>
<td>1981-2004</td>
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<td>[0.741]</td>
<td>[0.997]</td>
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<tr>
<td>Log rainfall, t-2</td>
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<td>[0.047]</td>
<td>[0.043]</td>
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<td>Significance tests in Panel A:</td>
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<td>Anderson-Rubin Chi2 p-value</td>
<td>0.075</td>
<td>0.174</td>
<td>0.075</td>
<td>0.174</td>
<td>0.338</td>
<td>0.541</td>
<td>0.338</td>
<td>0.541</td>
<td>0.291</td>
<td>0.567</td>
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<td>Stock-Wright LM Chi2 p-value</td>
<td>0.087</td>
<td>0.212</td>
<td>0.087</td>
<td>0.212</td>
<td>0.338</td>
<td>0.548</td>
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<td>0.294</td>
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<td>Joint significance Chi2-statistic</td>
<td>2.628</td>
<td>2.754</td>
<td>2.206</td>
<td>2.338</td>
<td>0.917</td>
<td>1.216</td>
<td>0.799</td>
<td>0.945</td>
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<td>Joint significance p-value</td>
<td>0.105</td>
<td>0.252</td>
<td>0.138</td>
<td>0.311</td>
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<td>0.545</td>
<td>0.372</td>
<td>0.623</td>
<td>0.261</td>
<td>0.530</td>
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</table>

(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 trend, and common time effects.

(3) Robust standard errors (clustered at the country level, adjusted for finite samples) 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.