

Rain and the Democratic Window of Opportunity

by

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Abstract. According to the economic approach to political transitions, negative transitory economic shocks can open a window of opportunity for democratic change. Testing the theory requires a source of transitory shocks to the aggregate economy. We rely on rainfall shocks in Sub-Saharan African countries. Our analysis yields that negative transitory shocks lead to significant democratic change. A transitory 10 percent drop in income is followed by an improvement in democracy scores of 9 percentage points, and by an increase in the probability of a transition to democracy of 13 percentage points.

Key words: democratization, transitory economic shocks

JEL codes: O0, P0

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1. Introduction

What triggers democratic change? At least since Lipset (1959), it has been argued that democratic change tends to be sparked off by economic recessions (see also Huntington, 1991; Haggard and Kaufmann, 1995). Acemoglu and Robinson's (2001, 2006) theory of political transition provides an explanation. Transitory, negative economic shocks give rise to a window of opportunity for citizens to contest power, as the cost of fighting ruling autocratic regimes is relatively low. When citizens reject policy changes that are easy to renege upon once the window closes, autocratic regimes must make democratic concessions to avoid costly repression. Hence, democratic change is seen as a concession of ruling autocratic regimes when citizens' opportunity cost of contesting power is temporarily low.¹

Testing the window-of-opportunity effect of transitory economic shocks on political institutions is difficult. The key issue is singling out aggregate economic shocks that are transitory. Another concern is that aggregate income may respond to changing expectations about future democratization; for example, income levels may rise when countries are more likely to be freed from expropriatory autocratic regimes. It is also necessary to ensure that any correlation between economic downturns and democratic change is not due to both being driven by a third factor.

Empirical analysis of the window-of-opportunity theory of democratic change requires observing transitory, exogenous shocks to aggregate economic activity. We argue that yearly rainfall shocks in Sub-Saharan African countries satisfy these requirements. This results in a probably unique chance to test the theory by examining whether democratic change tends to follow rainfall-driven negative income shocks.

¹ Lipset and Huntington argue that recessions lead to autocratic regimes losing legitimacy which ends up increasing the probability of democratic change.

Our main measure of democratic institutions is the revised combined Polity IV project score, which is based on the competitiveness of political participation, openness and competitiveness of executive recruitment, and constraints on the executive (Marshall and Jaggers, 2005). Polity attempts to capture not only outcomes but also procedural rules. The extent to which this goal is achieved is still debated, but even Polity critics argue that it is probably the best of the democracy measures used in the literature (e.g. Glaeser et al., 2004).

Our empirical analysis yields that negative rainfall shocks lead to significant improvements in the Polity score, and that this continues to hold when we consider improvements in the Polity sub-scores for the competitiveness of political participation, openness and competitiveness of executive recruitment, and constraints on the executive.² When we examine transitions from autocracy to (partial and full) democracy as defined by Persson and Tabellini (2003) and Epstein et al. (2006), we also find that they are more likely following negative rainfall shocks. We do not find a statistically significant effect of rainfall on transitions away from democracy or coups d'état in democracies.

It is known that rainfall levels affect income per capita in Sub-Saharan African countries (e.g. Benson and Clay 1998; Miguel et al. 2004; Barrios and Bertinelli, 2008). In our sample, a fall of 100 log points in rainfall reduces GDP per capita by around 7.5 percentage points. As this effect is transitory, we can estimate the window-of-opportunity effect of transitory economic shocks on democratic institutions using an instrumental variables approach. Our estimates indicate that a transitory 10 percent drop in $t-1$ income is followed by an improvement in the Polity score of around 9 percentage points between t and $t+1$. The executive constraints score improves by 10 percentage points; the political competition score by 8 percentage points; and the openness and competitiveness of executive recruitment score

² Our results are similar when we measure democratic institutions using the Freedom House (2007) political rights indicator, but with a somewhat different timing compared to the Polity findings.

by 9 percentage points. When we consider transitions from autocracy to democracy, we find that a transitory 10 percent drop in income increases the probability of a transition to democracy by around 13 percentage points.

Our work fits into the literature on the economic determinants of democratic change. One of the most thoroughly investigated issues is the modernization hypothesis, which posits a positive link between income per capita and democratic change (Lipset, 1959). For empirical work see, for example, Przeworski and Limongi (1997); Barro (1999); Przeworski et al. (2000); and Epstein et al. (2006). This literature has found evidence of a positive link between income and democracy, but recent work by Acemoglu et al. (2007a,b) indicates that this relationship is absent when one focuses on within-country variation using fixed effects specifications (as we do). Our work differs from the modernization literature in that we are interested in democratic change following transitory changes in income. It is for this reason that we rely on rainfall shocks as a source of income variation. Our finding of a positive effect of transitory, negative income shocks on democratic institutions is in line with case-study evidence indicating that democratic change follows economic recessions (e.g. Haggard and Kaufman, 1995; Geddes, 1999). Methodologically, our work is related to Paxson (1992), who uses rainfall variation in Thailand to isolate the effect of transitory income shocks on consumption.³

The remainder of this paper is organized as follows. Section 2 discusses data and measurement, Section 3 presents the estimation framework, and Section 4 our results. Section 5 concludes.

³ Miguel et al. (2004) look at the link between rainfall growth, income growth, and civil conflict. In contrast to Paxson's and our work, they do not exploit the transitory nature of rainfall shocks and do not use rainfall shocks to isolate transitory income changes, see Ciccone (2008).

2. Data and Measurement⁴

Our main measure of democratic institutions is the revised combined Polity score (Polity2) of the Polity IV database (Marshall and Jaggers, 2005). This variable combines scores for constraints on the chief executive, competitiveness of political participation, and the openness and competitiveness of executive recruitment. It ranges from -10 to +10, with higher values indicating more democratic institutions. Polity2 is based on the combined Polity score but modified for time series analysis. In particular, changes in the combined Polity score during so-called transitions periods are prorated across the span of the transition. Transitions refer to periods where new institutions are planned, legally constituted, and put into effect. Democratic and quasi-democratic polities are particularly likely to be preceded by such transition periods (Marshall and Jaggers, 2005). Moreover, Polity2 also assigns a score of zero (which Polity IV refers to as neutral) to so-called interregnum periods, which are periods where polities cannot exercise effective authority over at least half their established territory.

We perform a separate empirical analysis of the so-called Polity IV concept variables for constraints on the chief executive, political competition, and openness and competitiveness of executive recruitment. Constraints on the executive is a measure of the extent of institutionalized constraints on the decision making powers of chief executives and ranges from 1 to 7, with greater values indicating tighter constraints. Political competition measures the extent to which alternative preferences for policy and leadership can be pursued in the political arena. This indicator ranges from 1 to 10, with greater values denoting more competition. Finally, openness and competitiveness of executive recruitment measures the extent to which the politically active population has an opportunity to attain the position of chief executive through a regularized process and the degree to which prevailing modes of

⁴ A STATA file with the data and estimation programs used is available at www.antonioiciccone.eu.

advancement give subordinates equal opportunities to become superordinates. It ranges from 1 to 8, with greater values indicating more open and competitive executive recruitment. In using these variables we follow the revised combined Polity score in prorating changes during a transition across its span. We treat interregnum periods as missing values, as it is unclear what score they should be assigned (in contrast to the combined Polity variable, the Polity concept variables do not have a score that Polity IV considers as neutral). To facilitate the comparison of results for Polity2 with those for the Polity concept variables, we present results for a modified version of Polity2 where we drop interregnum periods.

We also consider the effect of rainfall and income shocks on transitions to democracy. Persson and Tabellini (2003, 2006, 2007) as well as the Polity IV manual consider countries to be democracies if their Polity2 score is strictly positive; other Polity2 scores correspond to non-democracies. We define a democratic transition indicator that is unity if the Polity2 score is strictly positive at time $t+1$ but smaller or equal to zero at t ; otherwise the indicator takes the value of zero. Transitions away from democracy are defined analogously. The Polity IV manual and Epstein et al. (2006) further separate democracies into partial democracies, with Polity2 scores 1 to 6, and full democracies, with Polity2 scores 7 to 10. In this case we analyze the effects of rainfall and income shocks on a democratization step indicator that takes the value of unity when democratic improvements between t and $t+1$ lead to countries being classified as partial or full democracies, and is zero otherwise. In addition, we examine the effect of rainfall shocks on coups d'état in democracies. Polity IV defines coups d'état as a forceful seizure of executive authority and office by a dissident/opposition faction within the country's ruling or political elites that results in a substantial change in the executive leadership and the policies of the prior regime (although not necessarily in the nature of regime authority or mode of governance).

An alternative measure of democratic institutions is the Freedom House (2007) political rights indicator, which ranges from 1 to 7, with higher scores reflecting fewer political rights. In assigning these scores, Freedom House evaluates the electoral process, political pluralism and participation, and the functioning of the government. FH puts greater emphasis on outcomes than Polity IV, which also aims at capturing procedural rules.

The country-year rainfall data come from the NASA Global Precipitation Climatology Project.⁵ This data is available from 1979 onwards. Real income per capita data are taken from the Penn World Tables 6.2 (Heston et al., 2006), which is available up to 2004.⁶ See Table 1 for summary statistics.

3. Estimation Framework

Our first stage equation relates log income per capita ($\log y_{c,t}$) to a country-specific time trend ($\alpha_c + \beta_c t$), time-varying shocks that affect all Sub-Saharan African countries (ϕ_t), and country-specific rainfall levels ($\log Rain_{c,t}$),

$$(1) \quad \log y_{c,t} = \alpha_c + \beta_c t + \phi_t + \gamma \log Rain_{c,t} + v_{c,t},$$

where $v_{c,t}$ is a disturbance term. This equation allows us to see the extent to which country-specific income fluctuations are driven by country-specific rainfall shocks.

To examine the effect of transitory income shocks on democratic change, we then estimate,

$$(2) \quad \Delta D_{c,t} = c_1 \log y_{c,t} + c_2 \log y_{c,t-1} + a_c + b_c t + f_t + e_{c,t},$$

⁵ See Adler et al. (2003). The data are available at <http://precip.gsfc.nasa.gov>.

⁶ The dataset is available at <http://pwt.econ.upenn.edu>.

where $D_{c,t}$ refers to the year t Polity2 score of country c and $\Delta D_{c,t} = D_{c,t+1} - D_{c,t}$; $e_{c,t}$ is a disturbance term. Our main estimation method is two-stage least squares (2SLS) with log rainfall levels in t and $t-1$ as excluded instruments. The coefficients c_1, c_2 are the effect of country-specific, transitory income shocks on democratic change, as we are controlling for country-specific income trends ($a_c + b_c t$) and global income shocks (f_t).⁷

To analyze democratic change in response to country-specific recessions, we construct a recession indicator that is unity if, and only if, income is below the country-specific trend for reasons other than shocks affecting all Sub-Saharan African countries. Formally, we estimate

$$(3) \quad \log y_{c,t} = \alpha_c + \beta_c t + \phi_t + \eta_{c,t}$$

and define a recession dummy that is unity if the estimated residual is negative, $\hat{\eta}_{c,t} < 0$, and zero otherwise. We then use this dummy to estimate democratic change in response to country-specific recessions.

We also estimate the effect of rainfall levels and income shocks on transitions to democracy, transitions away from democracy, and coups d'état in democracies. In this case the left-hand side variable in (2) and (3) will be a transition indicator that takes the value of unity if a transition or coup takes place, and zero otherwise. We use linear specifications as non-linear (e.g. Probit, Logit) specifications are computationally difficult in the presence of fixed effects and also inconsistent due to the incidental parameter problem (e.g. Angrist and Krueger, 2001; Wooldridge, 2002).

⁷ To see this from a different perspective, note that (2) can be obtained by relating democratic change to income shocks, $\Delta D_{c,t} = c_1 (\log y_{c,t} - \alpha_c - \beta_c t - \phi_t) + c_2 (\log y_{c,t-1} - \alpha_c - \beta_c (t-1) - \phi_{t-1}) + e_{c,t}$, and collecting terms that only depend on the country, terms that only depend on time, and terms that capture country-specific time trends.

4. Empirical Results

Table 2, column (1) estimates the reduced form equation corresponding to (2). t-statistics are based on heteroskedasticity and autocorrelation consistent standard errors. All our results refer to the 1980-2004 period.⁸ The results show that negative rainfall shocks at $t-1$ are followed by statistically significant democratic change. According to the estimate, a drop of 100 log points in rainfall levels leads to an improvement of 1.467 points in the Polity2 score (absolute t-statistic of 2.52). Given the [-10,10] range of Polity2, this corresponds to an improvement of 7.3 percentage points.⁹

Table 2, column (2) estimates the same specification as column (1) but codes interregnum years as missing observations (which is why the number of observations drops to 902) to make the results more readily comparable with our analysis for Polity sub-cores in columns (3)-(5). This strengthens our main result somewhat, as the effect of negative rainfall shocks is now stronger both quantitatively and statistically.

Table 2, columns (3)-(5) estimate the effect of rainfall shocks on the change in Polity scores for constraints on the executive, political competition, and the openness and competitiveness of executive recruitment using (2). The results show that negative $t-1$ rainfall shocks lead to significant democratic improvement in all three dimensions. A drop of 100 log points in rainfall levels at $t-1$ results in an improvement of 0.470 points in the executive constraints score (absolute t-statistic of 2.25). As this score has a [1,7] range, this amounts to a tightening of executive constraints by 7.8 percentage points. The political competition and executive recruitment scores increase by 0.573 (absolute t-statistic of 2.24)

⁸ The first Polity observation used corresponds to 1980 but the first rainfall observation to 1979 (the starting date of the rainfall data), as our specifications include rainfall levels at t and $t-1$.

⁹ It is interesting to note that linking changes in the Polity score to rainfall growth between $t-1$ and t yields that democratic change is more likely following high rainfall growth. This is easily reconciled with our finding that democratic change is most likely after negative rainfall shocks. As rainfall shocks are transitory, it is following negative rainfall shocks that rainfall growth is highest.

and 0.483 (absolute t-statistic of 2.09) respectively, which amount to 6.4 and 6.9 percentage points respectively (political competition has a [1,10] range and executive recruitment a [1,8] range).

Table 3 contains the effect of rainfall on GDP per capita and the probability of a country-specific recession. Column (1) shows the effect of contemporaneous rainfall on GDP per capita controlling for country fixed effects, country-specific time trends, and shocks common to Sub-Saharan African countries. t-statistics are based on heteroskedasticity and autocorrelation consistent standard errors. A drop in rainfall of 100 log points leads to a fall in income per capita of 7.9 percent (t-statistic of 3.34). Columns (2) and (3) augment the specification in column (1) by lagged rainfall levels. In column (2) we find that rainfall in the past year has a statistically significant but quantitatively smaller effect on GDP than contemporaneous rainfall. Column (3) includes rainfall levels at $t-2$ and finds that the effect is small and statistically insignificant. Columns (4)-(6) consider the effect of rainfall levels on our country-specific recession indicator. This indicator is unity if income falls below trend for reasons other than shocks common to all Sub-Saharan African countries, and zero otherwise. The interpretation of the coefficient on log rainfall levels at t in column (4) is that a drop of 100 log points in rainfall levels raises the probability of a recession by 39.2 percentage points (absolute t-statistic of 3.54). Columns (5) and (6) show that the effect of $t-1$ rainfall is smaller than the effect of rainfall at t , and that the effect of rainfall at $t-2$ is small and statistically insignificant.

Table 4, Panel A, columns (1)-(4) contain our estimates of the effect of $t-1$ income shocks on changes in Polity2 scores using (2). t-statistics are based on heteroskedasticity and autocorrelation consistent standard errors.. We start with income in $t-1$ as this is the timing suggested by the reduced form regressions and the first stage regressions in Tables 2 and 3 respectively. The two-stage least squares (2SLS) estimates in column (1) indicate that a 10

percent income drop leads to an improvement of the Polity2 score of 1.83 points, which amounts to 9.2 percentage points. The 2SLS effect becomes larger when we drop observations corresponding to interregnum periods in column (3). For comparison, we show the results using least squares for the world sample (the largest possible sample for 1980-2004) and Sub-Saharan Africa in columns (3) and (4) respectively. The effects go in the same direction as the 2SLS estimates, but are small and statistically insignificant. For example, in the world sample, a 10 percent drop in income leads to an improvement of Polity2 scores of less than one-tenth of a percentage point. For Sub-Saharan Africa, the least squares effect is less than one-half of a percentage point.¹⁰ Hence, the 2SLS effect in column (1) is more than 20 times the least squares effect.¹¹ What explains this large difference? It is most likely a combination of three factors. First, the window-of-opportunity theory of democratic change stresses transitory shocks; permanent economic shocks change the balance of power permanently and will therefore allow citizens to demand and obtain future policy concessions in the absence of democratic reforms. When we instrument using rainfall, we isolate transitory shocks and hence the stronger effect in column (1) is consistent with theory. Second, income is measured quite unreliably (e.g. Heston, 1994; Deaton, 2005) and the estimates in column (3) could therefore be attenuated due to classical measurement error bias. Third, it is possible that least squares estimates are upwardly biased as democratic reforms (non-democratic lapses) are partly anticipated and have positive (negative) effects on income.

Table 4, Panel A, columns (5)-(7) estimate the effect of transitory income shocks on changes in the Polity scores for executive constraints, political competition, and openness and

¹⁰ Formal tests yield that there are no statistically significant differences between the results for the world sample and for Sub-Saharan Africa.

¹¹ A Hausman test rejects the equality of the least squares effect in column (4) and the two-stage least squares effect in column (1) at the 99 percent confidence level.

competitiveness of executive recruitment. We find that a 10 percent drop in income levels at $t-1$ raises the score for executive constraints by 9.6 percentage points (absolute t-statistic of 1.89); raises the score for political competition by 8.2 percentage points (absolute t-statistic of 1.91); and raises the score for executive recruitment by 8.5 percentage points (absolute t-statistic of 1.78).

Table 4, Panel B considers the effect of income at t on Polity2 as well as Polity sub-scores. It can be seen that all estimates are statistically insignificant. 2SLS estimates switch sign depending on the score considered. For example, the effect of income is positive for Polity2 but negative for Polity2 without the interregnum periods. Regarding the sub-scores, the effect is positive for executive constraints and recruitment and negative for political competition.

Table 4, Panel C includes income at $t-1$ and t simultaneously into the estimating equation. Our 2SLS results indicate that it is $t-1$ income shocks that are significant, just as suggested in Panels A and B. The exception is the sub-score for political competition. There we find that political competition increases after negative income shocks, but cannot determine the exact timing. Least squares estimation for the world sample yields a small, but statistically significant, negative effect of income at time t .¹² All other least squares effects are statistically insignificant.

Table 4, Panel D examines democratic change in response to income growth, which is measured in log points. The 2SLS effects indicate that Polity2 improvements are most likely following high income growth. As rainfall-driven income shocks are transitory, this result is easily reconciled with Panel C. Income growth tends to be higher following low-rainfall years than following high-rainfall years. Hence, the income growth results simply reflect that

¹² The estimate implies that a 10 percent drop in income improves the Polity2 score by less than one-half of a percentage point. The effect in the Sub-Saharan African sample is of the same sign but insignificant.

democratic change is more likely following years where income is low because there was little rain. The 2SLS results for the sub-scores have the same explanation.

Table 5 considers democratic change in response to country-specific recessions at $t-1$. To do so, we use our recession dummy as the variable quantifying the income shock. Columns (1) and (2) contain 2SLS effects for the Polity2 score. In column (1) we find that a recession leads to an increase in the score of 18 percentage points (absolute t-statistic of 2.17). The effect is somewhat larger when we exclude interregnum periods in column (2). Columns (3) and (4) contain least squares results for the world sample and Sub-Saharan Africa. Both samples yield statistically insignificant and small effects. Columns (5)-(7) contain 2SLS results for the sub-scores. We obtain that following recessions, the score for executive constraints improves by 19 percentage points (absolute t-statistic of 2.03); the score for political competition by 16 percentage points (absolute t-statistic of 2.01); and the score for the openness and competitiveness of executive recruitment by 17 percentage points (absolute t-statistic of 1.90).

Table 6 examines how results change when we include the lagged Polity2 score into the analysis. Columns (1) and (2) consider the reduced form effect of rainfall shocks on the change in the Polity2 score. Column (1) gives least squares results, while column (2) contains system-GMM (Blundell-Bond, 1998) estimates. Both estimators yield an effect of $t-1$ rainfall shocks that is very similar to our baseline result in Table 2, column (1). Columns (3)-(5) contain our two-stage least squares estimates of the effect of income shocks on changes in the Polity2 score. Results are again very similar to our earlier estimates.

Table 7, column (1) shows our reduced form estimates of the effect of rainfall shocks on the probability of democratization based on the definition of Persson and Tabellini (2003, 2006, 2007) and the Polity IV project. t-statistics continue to be based on heteroskedasticity and autocorrelation consistent standard errors. The results indicate that negative rainfall

shocks lead to a significant increase in the probability of a political transition to democracy between t and $t+1$ (absolute t-statistic of 2.32). The point estimate implies that a drop in rainfall of 100 log points increases the probability of democratization by 12.3 percentage points. Column (2) repeats the analysis using the democratization step indicator based on the Epstein et al. (2006) and Polity IV trichotomous classification of polities. Now a drop in rainfall of 100 log points increases the probability of a step towards democracy by 13.8 percentage points (absolute t-statistic of 2.48).

Columns (3) and (4) estimate the effects of rainfall shocks on the probability of transitions away from democracy (democratic lapses) and coups d'état in democracies. The point estimates in column (3) indicate that democratic lapses are more likely following positive $t-1$ rainfall shocks. The estimate is actually larger in absolute terms than for democratic transitions in column (1), but the effect is very imprecisely estimated and therefore statistically insignificant (note the smaller number of observations compared to column (1)). For coups d'état in democracies, the effect of rainfall shocks is small and statistically insignificant.

Table 8 summarizes our findings on the effect of income shocks on transitions to democracy. Column (1) contains least squares estimates for the Persson and Tabellini and Polity IV based democratization indicator. The effects are very small and statistically insignificant. Moreover, the sign of the effect goes against the democratic window-of-opportunity effect as income levels enter positively. Column (2) contains our two-stage least squares estimates. Now there is a statistically significant, negative effect of $t-1$ income on the probability of a democratic transition between t and $t+1$ (absolute t-statistic of 1.77). The point estimate implies that a drop in income of 10 percent increases the probability of democratization by 17.5 percentage points. The effect is somewhat smaller but more precisely estimated in column (3) where we include $t-1$ income only in the specification.

Column (4) shows that following recessions, the probability of a democratic transition increases by 23.6 percentage points (absolute t-statistic of 1.99).¹³

The results using the Epstein et al. and Polity IV based democratization step indicator in columns (5)-(8) are similar. The least squares results in column (5) yield very small and statistically insignificant effects. But our two-stage least squares approaches in columns (6)-(8) all yield that negative income shocks at $t-1$ trigger movements towards democracy. For example, according to column (6), a drop in income of 10 percent increases the probability of a democratization step by 17.5 percentage points (absolute t-statistic of 1.86). The effect is 14.7 percentage points (absolute t-statistic of 2.11) in column (7) where we include $t-1$ income only. Column (8) indicates that a step towards democracy is 28.1 percent more likely following a recession (absolute t-statistic of 2.33).

Table 9 uses the Freedom House (FH) political rights indicator to measure democratic change. This indicator seems less appropriate for testing the window-of-opportunity effect than Polity scores. Most importantly, the FH political rights indicator does not consider the extent to which there is an independent judiciary (which FH codes in its civil liberties indicator), although an independent judiciary is often regarded as part of an effective system of executive constraints. Two additional drawbacks compared to Polity are that FH puts less emphasis on procedural rules and greater emphasis on outcomes, and that FH does not revise past indicator values when introducing methodological changes.

Table 9, column (1) examines the link between rainfall shocks and changes in the FH political rights score.¹⁴ We continue to find that movements towards democracy are more

¹³ Bratton and van de Walle (1997) discuss democratic transitions in Africa over the 1988-1994 period and argue that transitions are largely explained by domestic political forces rather than by domestic economic conditions. Our results indicate that country-specific economic factors did play a role over the 1980-2004 period (there are too few transitions for the 1988-1994 period for a statistical analysis).

¹⁴ FH does not provide calendar year scores for the 1980s. The reporting period varies over time (but is the same across countries). It can be January-August of the following year; August-November of

likely following negative rainfall shocks, but now the significant effect is at $t-2$, while the effect was on $t-1$ rainfall shocks when we used Polity scores (in interpreting the table it is important to bear in mind that higher scores denote fewer political rights according to the FH convention). The most likely explanation is that FH's emphasis on outcomes implies that democratic change is registered somewhat later than in Polity. In columns (2) and (3), we present two-stage least squares estimates of the effect of $t-2$ income shocks and our recession indicator. Column (2) indicates that a 10 percent drop in income lowers the FH political rights indicator by 0.46 points (t-statistic of 1.95), which amounts to an improvement in political rights of 8 percentage points (political rights vary on a scale from 1 to 7).¹⁵ Column (3) considers the effect of recessions. Our two-stage least squares results imply that recessions lower the FH political rights indicator by 0.87 points (absolute t-statistic of 1.95), which is equivalent to a 15 percentage point improvement in political rights. Columns (5)-(9) repeat the analysis of the previous columns taking into account lagged values of the FH political rights indicator. It can be seen that the findings of the previous columns prevail.

5. Conclusions

It has long been argued that democratic change is often sparked off by economic recessions. The economic approach to political change (Acemoglu and Robinson, 2001, 2006) provides a rationale. Political change is more likely following negative, transitory economic shocks because opportunity costs of contesting power are temporarily lower during such episodes. Empirical tests of economic theories of political change are difficult—we rarely have clean

the following year; November-November of the following year; and November-December of the following year. To allow for comparisons, we map the FH scores into calendar years by assigning to each calendar year the Freedom House score that covers the greatest part of the year. The correlation between annual changes of FH political rights and combined Polity scores is -0.53 (greater FH scores denote fewer political rights).

¹⁵ Including incomes at t , $t-1$, and $t-2$ yields individually and jointly insignificant income effects.

measures of the theoretical driving forces—and the window-of-opportunity hypothesis of democratic change is not an exception. Testing the theory requires a source of transitory shocks to the aggregate economy. Our approach relies on country-specific rainfall shocks in Sub-Saharan Africa, where such shocks have a significant but transitory impact on GDP. Our reduced form analysis yields that negative rainfall shocks lead to significant democratic change and, in particular, a tightening of executive constraints, greater political competition, and a more open and competitive executive recruitment. Our instrumental variables results indicate that improvements in democratic institutions triggered by transitory negative income shocks can be substantial. For example, rainfall-driven recessions are followed by an improvement in the score for executive constraints of 19 percentage points; the score for political competition of 16 percentage points; and the score for the openness and competitiveness of executive recruitment of 17 percentage points.

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Table 1. Descriptive Statistics

<u>A. Measures of Democracy</u>			
	Mean	Std. Dev.	Observations
Revised Combined Polity IV Democracy Score (Polity2)	-2.458	5.668	955
Executive Constraints (EXCONST)	2.911	1.768	910
Political Competition (POLCOMP)	3.842	3.110	910
Executive Recruitment (EXREC)	4.802	1.915	910
Democracy Indicator	0.279	0.449	955
Democratic Transition Indicator	0.036	0.186	700
Democratization Step Indicator	0.035	0.183	867
Autocratic Transition Indicator	0.055	0.238	255
Freedom House Political Rights Score	5.181	1.647	956

<u>B. GDP and Rainfall</u>			
	Mean	Std. Dev.	Observations
Log Real Per Capita GDP	7.051	0.749	955
Log Rainfall (mm per year)	6.713	0.641	955

Table 2. Rainfall and Polity Change

	<u>ΔPOLITY2</u>		<u>ΔEXCONST</u>	<u>ΔPOLCOMP</u>	<u>ΔEXREC</u>
	(1)	(2)	(3)	(4)	(5)
	LS	LS	LS	LS	LS
Log Rainfall, t	0.267 (0.70)	0.037 (0.09)	0.092 (0.68)	-0.142 (-0.77)	0.092 (0.59)
Log Rainfall, t-1	-1.467** (-2.52)	-1.667*** (-2.72)	-0.470** (-2.25)	-0.573** (-2.24)	-0.483** (-2.09)
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes
Country Time Trend	Yes	Yes	Yes	Yes	Yes
Common Time Effects	Yes	Yes	Yes	Yes	Yes
Observations	955	902	902	902	902

Note: The method of estimation is least squares; t-values (in brackets) are based on Huber robust and Newey-West autocorrelation consistent standard errors. The dependent variable in columns (1)-(2) is the t to $t+1$ change in the revised combined Polity score (*Polity2*), in column (2) excluding observations that correspond to interregnum periods. The dependent variable in columns (3)-(5) is the t to $t+1$ change in Polity IV sub-scores that reflect changes in a country's constraints on the executive (*EXCONST*), political competition (*POLCOMP*), and executive recruitment (*EXREC*). The range of the dependent variables is as follows: *Polity2* [-10,10], *EXCONST* [1,7], *POLCOMP* [1,10], and *EXREC* [1,8]. *Significantly different from zero at 90 percent confidence, ** 95 percent confidence, *** 99 percent confidence.

Table 3. Rainfall, Per Capita GDP, and Country Specific Recessions

	Log GDP			Country Specific Recession		
	(1)	(2)	(3)	(4)	(5)	(6)
	LS	LS	LS	LS	LS	LS
Log Rainfall, t	0.078*** (3.34)	0.074*** (3.24)	0.075*** (3.24)	-0.392*** (-3.54)	-0.374*** (-3.47)	-0.375*** (-3.47)
Log Rainfall, t-1		0.050** (2.17)	0.049** (2.20)		-0.201* (-1.73)	-0.199* (-1.77)
Log Rainfall, t-2			0.010 (0.41)			-0.017 (-0.14)
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Country Time Trend	Yes	Yes	Yes	Yes	Yes	Yes
Common Time Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	955	955	955	955	955	955

Note: The method of estimation is least squares; t-values (in brackets) are based on Huber robust and Newey-West autocorrelation consistent standard errors. The dependent variable in columns (1)-(3) is log real per capita GDP (PWT 6.2). The dependent variable in columns (4)-(6) is an indicator variable (*Country Specific Recession*) that is unity if and only if per capita GDP falls below the country specific time trend for reasons other than shocks affecting all Sub-Saharan countries (see equation (3) in the main text). *Significantly different from zero at 90 percent confidence, ** 95 percent confidence, *** 99 percent confidence.

Table 4. Income Shocks and Polity Change

	<u>Δ POLITY2</u>				<u>ΔEXCONST</u>	<u>ΔPOLCOMP</u>	<u>ΔEXREC</u>
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	2SLS	2SLS	LS	LS	2SLS	2SLS	2SLS
Panel A: Per Capita GDP, t-1							
Log GDP, t-1	-18.306** (-1.99)	-20.849** (-2.13)	-0.045 (-0.13)	-0.836 (-1.38)	-5.775* (-1.89)	-7.378* (-1.91)	-5.933* (-1.78)
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country Time Trend	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Common Time Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	955	902	3191	955	902	902	902
Panel B: Per Capita GDP, t							
Log GDP, t	1.549 (0.26)	-1.904 (-0.32)	-0.511 (-1.48)	-0.851 (-1.31)	0.633 (0.33)	-2.888 (-1.05)	0.614 (0.27)
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country Time Trend	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Common Time Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	955	902	3209	955	902	902	902
Panel C: Per Capita GDP, t and t-1							
Log GDP, t	4.811 (0.55)	2.166 (0.23)	-0.821* (-1.66)	-0.533 (-0.63)	1.963 (0.62)	-1.838 (-0.51)	1.975 (0.64)
Log GDP, t-1	-22.283** (-2.03)	-22.639* (-1.88)	0.518 (1.15)	-0.485 (-0.61)	-7.340* (-1.80)	-5.855 (-1.25)	-7.567* (-1.86)
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country Time Trend	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Common Time Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	955	902	3187	955	902	902	902
Panel D: Per Capita GDP Growth, t							
GDP Growth, t	21.390** (1.96)	20.879* (1.85)	-0.592 (-1.40)	-0.030 (-0.04)	6.932* (1.72)	5.194 (1.24)	7.086* (1.75)
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country Time Trend	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Common Time Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	955	902	3187	955	902	902	902

Note: The method of estimation in columns (1)-(2) and (5)-(7) is two-stage least squares and columns (3)-(4) least squares; t-values (in brackets) are based on Huber robust and Newey-West autocorrelation consistent standard errors. The 2SLS regressions use rainfall as an instrument for income. The dependent variable in columns (1)-(4) is the t to $t+1$ change in the revised combined Polity score (*Polity2*), in column (2) excluding observations that correspond to interregnum periods. The dependent variable in columns (5)-(7) is the t to $t+1$ change in Polity IV sub-scores of constraints on the executive (*EXCONST*), political competition (*POLCOMP*), and executive recruitment (*EXREC*). The range of the dependent variables is as follows: *Polity2* [-10,10], *EXCONST* [1,7], *POLCOMP* [1,10], and *EXREC* [1,8]. Column (3) contains the regression for the world sample, with the other columns focusing exclusively on Sub-Saharan Africa. *Significantly different from zero at 90 percent confidence, ** 95 percent confidence, *** 99 percent confidence.

Table 5. Country Specific Recessions and Polity Change

	<u>Δ POLITY2</u>				<u>ΔEXCONST</u>	<u>ΔPOLCOMP</u>	<u>ΔEXREC</u>
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	2SLS	2SLS	LS	LS	2SLS	2SLS	2SLS
Country Specific Recession, t-1	3.662** (2.17)	4.182** (2.32)	-0.085 (-1.41)	0.199 (1.50)	1.158** (2.03)	1.480** (2.01)	1.190* (1.90)
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country Time Trend	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Common Time Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	955	902	3187	955	902	902	902

Note: The method of estimation in columns (1)-(2) and (5)-(7) is two-stage least squares and columns (3)-(4) least squares; t-values (in brackets) are based on Huber robust and Newey-West autocorrelation consistent standard errors. The two-stage least squares regressions use rainfall as an instrument for income. The dependent variable in columns (1)-(4) is the t to $t+1$ change in the revised combined Polity score (*Polity2*), in column (2) excluding observations that correspond to interregnum periods. The dependent variable in columns (5)-(7) is the t to $t+1$ change in Polity IV sub-scores of constraints on the executive (*EXCONST*), political competition (*POLCOMP*), and executive recruitment (*EXREC*). The range of the dependent variables is as follows: *Polity2* [-10,10], *EXCONST* [1,7], *POLCOMP* [1,10], and *EXREC* [1,8]. Column (1) contains the regression for the world sample, with the remaining columns focusing exclusively on Sub-Saharan Africa. *Country Specific Recession* is an indicator variable that is unity if and only if per capita GDP falls below the country specific time trend for reasons other than shocks affecting all Sub-Saharan countries (see equation (3) in the main text). *Significantly different from zero at 90 percent confidence, ** 95 percent confidence, *** 99 percent confidence.

Table 6. Income Shocks, Polity Change, and Democratic Convergence

	<u>Δ POLITY2</u>				
	(1)	(2)	(3)	(4)	(5)
	LS	SYS-GMM	2SLS	2SLS	2SLS
Polity2, t	-0.294*** (-6.61)	-0.359*** (-9.64)	-0.285*** (-5.56)	-0.282*** (-5.61)	-0.286*** (-5.71)
Log Rainfall, t	0.203 (0.57)	-0.024 (-0.06)			
Log Rainfall, t-1	-1.404** (-2.54)	-1.487** (-2.03)			
Log GDP, t			3.740 (0.46)		
Log GDP, t-1			-20.710** (-1.97)	-17.621** (-1.99)	
Country Specific Recession, t-1					3.524* (2.18)
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes
Country Time Trend	Yes	Yes	Yes	Yes	Yes
Common Time Effects	Yes	Yes	Yes	Yes	Yes
Observations	955	955	955	955	955

Note: The method of estimation in column (1) is least squares, in column (2) system-GMM (Blundell-Bond), and in columns (3)-(5) two-stage least squares; t-values (in brackets) are based on Huber robust and Newey-West autocorrelation consistent standard errors. The 2SLS regressions use rainfall as an instrument for income. The dependent variable is the t to $t+1$ change in the revised combined Polity score (*Polity2*). *Country Specific Recession* is an indicator variable that takes on the value of unity if and only if per capita GDP falls below the country specific time trend for reasons other than shocks affecting all Sub-Saharan countries (see equation (3) in the main text). *Significantly different from zero at 90 percent confidence, ** 95 percent confidence, *** 99 percent confidence.

Table 7. Rainfall and Polity Transitions

	<u>Democratic Transition</u>	<u>Democratization Step</u>	<u>Autocratic Transition</u>	<u>Coup d'État</u>
	(1)	(2)	(3)	(4)
	LS	LS	LS	LS
Log Rainfall, t	0.027 (0.61)	0.016 (0.41)	-0.013 (-0.31)	0.003 (0.03)
Log Rainfall, t-1	-0.123** (-2.32)	-0.138** (-2.48)	0.159 (1.46)	-0.013 (-0.12)
Country Fixed Effects	Yes	Yes	Yes	Yes
Country Time Trend	Yes	Yes	Yes	Yes
Common Time Effects	Yes	Yes	Yes	Yes
Observations	700	867	255	255

Note: The method of estimation is least squares; t-values (in brackets) are based on Huber robust and Newey-West autocorrelation consistent standard errors. The dependent variable in column (1) is an indicator variable (*Democratic Transition Indicator*) that is unity if a country is classified as a democracy in period $t+1$ but as a non-democracy in t ; the indicator variable is zero if a country is classified as a non-democracy in both periods. The dependent variable in column (2) is an indicator variable (*Democratization Step Indicator*) that is unity if and only if the country is classified (i) as a full democracy in period $t+1$ but as an autocracy or partial democracy in period t ; (ii) as a partial democracy in period $t+1$ but as an autocracy in period t . The dependent variable in columns (3) is an *Autocratic Transition Indicator* that is unity if a country is classified as a non-democracy in period $t+1$ but as a democracy in t ; the indicator variable is zero if a country is classified as a democracy in both periods. The dependent variable in columns (4) is the incidence of a coup d'état in African countries that were democracies. For further detail on the coding of the dependent variables see the main text, pages 5 and 6. *Significantly different from zero at 90 percent confidence, ** 95 percent confidence, *** 99 percent confidence.

Table 8. Income Shocks and Transitions to Democracy

	<u>Democratic Transition</u>				<u>Democratization Step</u>			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	LS	2SLS	2SLS	2SLS	LS	2SLS	2SLS	2SLS
Log GDP, t	0.090 (1.03)	0.691 (0.91)			-0.014 (-0.17)	0.319 (0.44)		
Log GDP, t-1	0.001 (0.02)	-1.746* (-1.77)	-1.282* (-1.84)		-0.045 (-0.53)	-1.752* (-1.86)	-1.474** (-2.11)	
Country Specific Recession, t-1				0.236** (1.99)				0.281** (2.33)
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country Time Trend	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Common Time Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	700	700	700	700	871	871	871	871

Note: The method of estimation in columns (1) and (5) is least squares and columns (2)-(4) and (6)-(8) two-stage least squares; t-values (in brackets) are based on Huber robust and Newey-West autocorrelation consistent standard errors. The 2SLS regressions use rainfall as an instrument for income. The dependent variable in columns (1)-(4) is an indicator variable (*Democratic Transition Indicator*) that is unity if a country is classified as a democracy in period $t+1$ but as a non-democracy in t ; the indicator variable is zero if a country is classified as a non-democracy in both periods. The dependent variable in columns (5)-(8) is an indicator variable (*Democratization Step Indicator*) that is unity if and only if the country is classified (i) as a full democracy in period $t+1$ but as an autocracy or partial democracy in period t ; (ii) as a partial democracy in period $t+1$ but as an autocracy in period t . For further detail on the coding of the dependent variables see the main text, pages 5 and 6. *Country Specific Recession* is an indicator variable that is unity if and only if per capita GDP falls below the country specific time trend for reasons other than shocks affecting all Sub-Saharan countries (see equation (3) in the main text). *Significantly different from zero at 90 percent confidence, ** 95 percent confidence, *** 99 percent confidence.

Table 9. Rainfall, Income Shocks, and Political Rights

	<u>Δ Political Rights</u>						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	LS	2SLS	2SLS	LS	SYS-GMM	2SLS	2SLS
Log Rainfall, t	-0.057 (-0.41)			-0.053 (-0.42)	-0.125 (-0.88)		
Log Rainfall, t-1	0.174 (1.00)			0.116 (0.73)	0.075 (0.50)		
Log Rainfall, t-2	0.313** (2.11)			0.339** (2.47)	0.288** (1.96)		
Log GDP, t-2		4.612* (1.95)				4.868** (2.08)	
Country Specific Recession, t-2			-0.891* (-1.95)				-0.945** (-2.12)
Political rights, t				-0.355*** (-8.88)	-0.342*** (-7.96)	-0.333*** (-7.28)	-0.356*** (-8.65)
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country Time Trend	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Common Time Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	956	956	956	956	956	956	956

Note: The method of estimation in columns (1) and (4) is least squares, in column (5) system-GMM (Blundell-Bond), and in columns (2), (3), (6), and (7) two-stage least squares; t-values (in brackets) are based on Huber robust and Newey-West autocorrelation consistent standard errors. The two-stage least squares regressions use rainfall as an instrument for income. The dependent variable is the t to $t+1$ change in the Freedom House index of political rights, with scores ranging between 1 and 7 (higher values indicate less political rights). *Country Specific Recession* is an indicator variable that is unity if and only if per capita GDP falls below the country specific time trend for reasons other than shocks affecting all Sub-Saharan countries (see equation (3) in the main text). *Significantly different from zero at 90 percent confidence, ** 95 percent confidence, *** 99 percent confidence.