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# Short and long run democracy diffusion

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ABSTRACT

Does democracy diffuse across borders? If so, how long does it take? Can diffusion cause path dependence, such that if a region is initially democratic (or autocratic), it becomes increasingly so? In this paper I estimate short and long run regional democratic diffusion and account for feedback to and from other countries within the region. Although it is difficult to establish causality, I estimate that when regional democracy in year (t-1) increases, domestic democracy receives or "catches" 40–42% of the increase in the next 5 years, 55–61% in 10 years, and 68–85% in the long run prior to accounting for feedback. When I account for feedback, the average region converges to a unique long-run democracy level regardless of how democratic it is initially. I also provide region-specific and contiguous neighbor estimates, use the model to explain democratization waves, and estimate the alternative V-DEM dataset. In the V-DEM data, democracy diffuses much faster, although the long-run diffusion effects are comparable.

## 1. Introduction

Democracy has been related to poverty reductions, human rights, happiness, and other beneficial outcomes (Frey and Stutzer, 2000; Davenport and Armstrong, 2004; McGann, 2004; Ross, 2006; Inglehart et al., 2008; Bjørnskov et al., 2010) and democratic transitions have often occurred in regional waves (Huntington, 1991; Wejnert, 2005; Gleditsch, 2009; Hale, 2013). For example, Fig. 1 depicts the average polity2 democracy score in the Polity 5 dataset from 1962 to 2018 in six regions of the world. Although common unobserved factors might explain these regional trends, democratic diffusion could also play a role. For example, democratization in other countries within the region might increase the salience of democracy, coordinate the citizens on protesting, teach them protest techniques, or signal that the return to protesting is higher than expected, thus, increasing the "demand" for democracy or advancing democracy from below (Bamert et al., 2015; Arezki et al., 2020; González, 2020; Manacorda and Tesei, 2020; Marino et al., 2020). Alternatively, democratization elsewhere might increase internal divisions or decrease external support for the autocratic elite, thus, increasing the "supply" of democracy or advancing democracy from above (Teorell, 2010; Escribà-Folch et al., 2015; Hyde, 2020).

In this paper, although I do not advance the study of the causal mechanisms behind democratic diffusion, I propose two methodological contributions to understanding the spread of democracy within different regions of the world. First, I estimate short and long run democratic diffusion within regions in a unified empirical framework (an error-correction model). The short and long run diffusion effects could intuitively differ due to several reasons. For example, the short-run effects might be transitory as ousted elites conduct counterrevolutions or countries revert to their long-run democracy levels, which might be determined by domestic or non-diffusion international factors (Lipset, 1959; Nunn, 2009; Kalyvitis and Vlachaki, 2012; Hicks, 2013; Bjørnskov and Rode, 2020; Dorsch and Maarek, 2020; Pittaluga et al., 2020). Alternatively, the short-run effects might increase over time because autocratic regimes can temporarily resist democratization pressure, but they cannot permanently do so. Second, I allow for dynamic feedback

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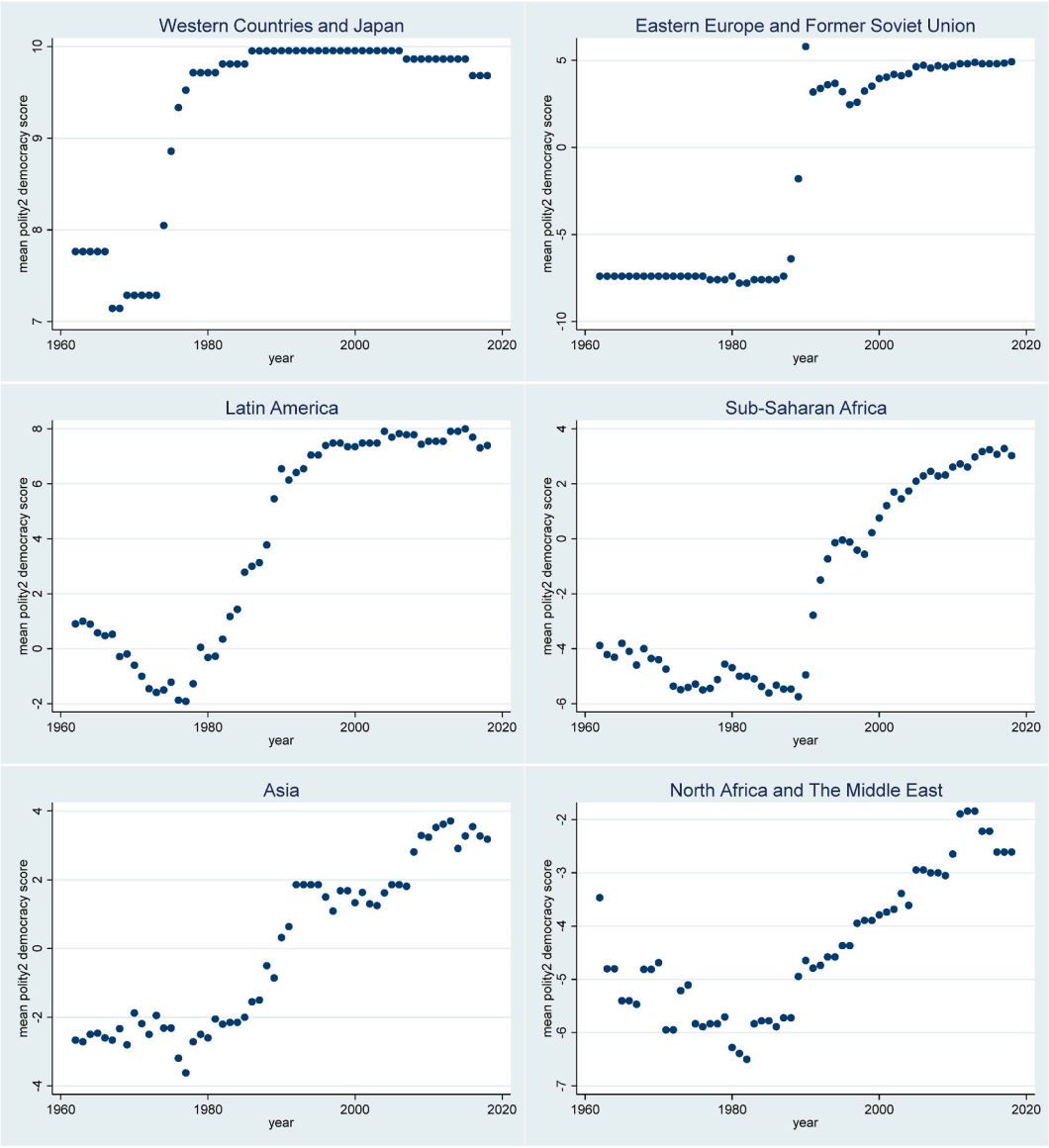



**Fig. 1.** Average democracy levels over time. **Note**: Average polity2 democracy scores from the Polity V dataset (v. 2018).

from domestic democracy changes to future regional changes, then back to the domestic country in the following period, etc. This allows me to test whether democratic diffusion can create path dependence in the sense that, if a region is initially democratic, the remaining autocracies will eventually democratize and the region will then remain democratic all else constant. Conversely, if the

region is initially autocratic, it eventually becomes trapped in autocracy (all else constant). If democracy exhibits path dependence at the region level, temporary political interventions, such as colonization or Cold War interventions, can have permanent effects (Leeson and Dean, 2009).[1]

To address these questions, I estimate short and long-run regional democratic diffusion in an error-correction model. The error-correction model relates the change in the polity2 democracy score from the Polity 5 dataset and the Freedom Rating from Freedom House to the lagged democracy level as well as the lagged level and recent changes in other countries in the region. The coefficients on the regional change terms can be interpreted as the short-run effects while the level coefficients are proportional to the long-term effects. I estimate that when regional democracy increases, in the language of Leeson and Dean (2009), domestic democracy "catches" 40–42% of the increase in the next 5 years, 55–61% in the next 10 years, and 68–85% in the long run without accounting for feedback. However, even accounting for feedback, the average region still converges to a unique long-run democracy level (which is inconsistent with path dependence).

When I apply the error-correction framework to individual regions, I find that the evidence for regional diffusion is clearest in Latin America, sub-Saharan Africa, and Asia. However, the lack of evidence for some other regions (including Western countries and Eastern Europe and the Former Soviet Union) might reflect data limitations. When I estimate diffusion from contiguous neighbors as opposed to intra-regional diffusion, I find that the effects are significantly smaller, which suggests that contiguous neighbors do not play am outsized role (O'loughlin et al., 1998). Finally, I also estimate the Varieties of Democracy (V-DEM) dataset. This data reflects a broader range of possible definitions of democracy and democratic practices than the Polity 5 and Freedom House datasets (Coppedge et al., 2017). In the V-DEM dataset, I estimate that democracy diffuses much faster: When regional democracy increases, countries catch most of the increase in only two years. However, the long-run effects are slightly smaller. Altogether, although these results can only establish Granger causality, they are consistent with regional democratic diffusion.

The paper contributes to the literature on democratic diffusion. First, I estimate short and long-run democratic diffusion in a unified framework that allows for gradual democratic diffusion. In the existing literature, Wejnert (2005), Brinks and Coppedge (2006), Leeson and Dean (2009), and Houle et al. (2016) estimate short-run diffusion, which leaves the long-run effects unclear. For example, the short-run effects might be temporary as ousted elites conduct counter-revolutions, permanent, as new democracies become consolidated, or increase over time because autocracies can temporarily, but only temporarily, resist democratization pressure. Kelejian et al. (2013) study long-run institutional spillovers and Rahman (2017) links domestic democracy to contemporary neighbor democracy. However, both econometric frameworks assume that the diffusion process is instantaneous as opposed to gradual. Thus, they cannot explain democratization *waves* unless the exogenous determinants of democracy change appropriately to produce the wave. In this paper, I allow the average country's as well as the average regional democracy level to gradually adjust toward the long run level and allow the data to determine how long the diffusion process takes.

Second, the paper allows for dynamic feedback from domestic changes in democracy to and from changes in democracy in other countries within the region. I characterize the evolution of the average regional democracy level as a function of time, initial democracy, diffusion and convergence effects, and long-run democracy determinants. Third, I use the dynamic nature of the model to explain democratization waves. Although the error-correction model can only explain either upward *or* downward waves unless the parameters or exogenous democracy determinants change, I discuss how changing either the parameters or the exogenous determinants of democracy could, potentially, produce "complete" democratization waves (i.e., upward followed by downward waves or vice versa). Finally, the paper estimates short and long run democracy diffusion in the V-DEM dataset and presents region-specific estimates.

In the remainder of this paper, Section 2 presents the materials and methods. Section 3 presents the baseline results. Section 4 discusses robustness. Section 5 presents regional estimates. Section 6 presents contiguous neighbor estimates. Section 7 applies the model to democratization waves (Huntington, 1991). Section 8 estimates the V-DEM democracy dataset (Coppedge et al., 2022; Pemstein et al., 2022). Section 9 concludes the paper.

[1] The paper's focus on regional diffusion follows Huntington (1991), O'loughlin et al. (1998), Wejnert (2005), Mainwaring and Pérez-Liñán (2007), Gleditsch (2009), Bamert et al. (2015), Acemoglu et al. (2019), and Hyde's (2020) assessment based on a literature review. Alternatively, contiguous neighbors might have stronger diffusion effects. However, O'loughlin et al. (1998, p. 563) finds that: "Geographic distance [as indicated by spatial contiguity lags] does not have much effect on the overall distribution of democracy scores, with the values of polities strongly correlated to the values of all neighboring states in the region and stretching to [spatial lag] distances up to 9 lags." Bamert et al. (2015, p. 2) finds that "the imitation of protests [within the Middle East and North Africa region during the Arab Spring] did not depend on geographic proximity". Leeson and Dean (2009), find that countries only catch 8–11% of the average change in democracy in neighbors over 4 years. In this paper, I estimate that countries catch 40–42% of the average regional change in a five-year period. More generally, both citizens and governments might "look" not only to neighbors, but to countries with similar GDP per capita, autocratic or democratic regime types, religion, language, etc. I do not attempt to identify the optimal spatial weighting matrix (Plümper and Neumayer, 2010a).

## 2. Materials and methods

### 2.1. Data and specification

In the main analysis, I use democracy data from the Polity 5 Project and Freedom House.[2] The Polity 5 data spans 1962–2018 and the Freedom House data spans 1972–2018. In the Polity 5 data, I focus on the polity2 democracy score, which ranges from −10 to 10. The score is calculated by adding the scores for constraints on the chief executive, competitiveness of political participation, and openness and competitiveness of executive recruitment. Positive and negative scores indicate, respectively, democratic and autocratic regimes. Higher positive scores and lower negative scores indicate more democratic and more autocratic regimes. Given that zero scores indicate interregnum periods, including periods of conflict without a functioning government, I omit these observations (Plümper and Neumayer, 2010b). Freedom House scores political rights and civil liberties on a 1 to 7 scale. The average score is the Freedom Rating. In the regressions, I use the polity2 score and the Freedom Rating. I distinguish six regions - Western countries and Japan, Eastern Europe and the Former Soviet Union, Latin America, North Africa and the Middle East, Sub-Saharan Africa, and Asia – and calculate the average polity2 scores and Freedom Ratings among the remaining countries each year. Table 1 displays the summary statistics.

I estimate the following empirical model:

$$\Delta d_{it} = \alpha + \lambda d_{i(t-1)} + \theta \overline{d}^{N}_{i(t-1)} + \gamma_1 \Delta \overline{d}^{N}_{i(t-1)} + \gamma_2 \Delta \overline{d}^{N}_{i(t-2)} + \mu_i + \rho_t + \varepsilon_{it}, \tag{1}$$

where $d_{it}$ is the polity2 or Freedom House democracy score of country $i$ in year $t$ and $\Delta$ denotes the first-difference operator. $d_{i(t-1)}$ is the country's lagged democracy score. $\overline{d}^{N}_{i(t-1)} = \frac{\sum_{\substack{j \neq i, \\ r_j = r_i}} d_{jt-1}}{N_r - 1}$ is the average lagged democracy score in the remaining $N_r - 1$ countries in the region ($j \neq i$; $r_j = r_i$). $\Delta \overline{d}^{N}_{i(t-1)}$ and $\Delta \overline{d}^{N}_{i(t-2)}$ represent the first and second lagged average changes in these other countries' democracy scores. $\mu_i$ is a country-level fixed effect. $\rho_t$ are year effects for 1962 to 2018. I estimate the models with Driscoll and Kraay (1998) standard errors, which allows the error terms to be spatially correlated, heteroskedastic, and autocorrelated up to two lags (Vogelsang 2012).

The short-run effect of a change in regional democracy is $\gamma_s, s = 1, 2$. Additionally, if we assume that $\lambda < 0$ (which is consistently the case in the empirical estimation), the long-run effect of the level of regional democracy is $\theta/-\lambda$. This can be seen by replacing $\Delta d_{it} = d_{it} - d_{it-1}$ in equation (1) and rewriting the equation as:

$$d_{it} = \alpha + (1+\lambda) d_{i(t-1)} + \theta \overline{d}^{N}_{i(t-1)} + \gamma_1 \Delta \overline{d}^{N}_{i(t-1)} + \gamma_2 \Delta \overline{d}^{N}_{i(t-2)} + \mu_i + \rho_t + \varepsilon_{it}, \tag{2}$$

While the effect of regional democracy in period (t-1) on democracy in period (t) is only $\theta$, due to the lagged dependent variable, the effect in period (t+1) will be $(1 + \lambda)\theta$. The effect in period (t+2) is $(1+\lambda)^2\theta$ , etc. This geometric series converges to $\theta(1 + (1+\lambda) + (1+\lambda)^2 \ldots) = \theta/(1 - (1+\lambda)) = \theta/-\lambda$. We can also find the time it takes for $\alpha$ percent of the long-run effect to materialize by solving $\theta(1 + (1 + \lambda) + (1+\lambda)^2 \ldots (1+\lambda)^t) = \alpha(\theta/-\lambda)$ or

$$t = \frac{ln(1-\alpha)}{\ln(1+\lambda)} - 1 \tag{3}$$

Thus, when $\lambda$ is small in absolute value, the speed of convergence is slow. Equation (1) can, furthermore, be written as the following error-correction model:

$$\Delta d_{it} = \alpha + \underbrace{\lambda\left(d_{i(t-1)} - (\theta/-\lambda)\overline{d}^{N}_{i(t-1)} - (1/-\lambda)(\mu_i + \rho_t)\right)}_{Error\ correction} + \gamma_1 \Delta \overline{d}^{N}_{i(t-1)} + \gamma_2 \Delta \overline{d}^{N}_{i(t-2)} + \varepsilon_{it} \tag{4}$$

If $\lambda < 0$, countries should gradually close or "error-correct" the gap between the actual democracy level and the long-run level predicted by the other countries in the region, $\overline{d}^{N}_{i(t-1)}$, and the other long-run democracy determinants of democracy – which in this case only include the country fixed effect $\mu_i$ and global factors $\rho_t$. For example, if $d_{i(t-1)} - (\theta/-\lambda)\overline{d}^{N}_{i(t-1)} - (1/-\lambda)(\mu_i + \rho_t) > 0$, then the actual democracy exceeds the long-run level predicted by the current values of regional democracy, the fixed effect, and the global effect. Since $\lambda < 0$, the change in democracy in the next period, $\Delta d_{it}$, will tend to be negative. However, both positive shocks to regional democracy ($\Delta \overline{d}^{N}_{i(s-1)}, > 0, s = 1, 2$) and other shocks ($\varepsilon_{it} > 0$) can temporarily increase the gap.

Following Collier and Goderis (2012), I test the existence of a long relationship between domestic and regional democracy using the bounds test in Pesaran et al. (2001). The bounds test allows the variables to be integrated of orders I(0) or I(1). The variables can be integrated of different orders. Sufficient conditions for rejecting the null hypothesis that there does not exist a long-run relationship are

[2] The Polity 5 dataset can be found at https://www.systemicpeace.org/polityproject.html. Marshall and Gurr (2020) explains the methodology. The Freedom House dataset can be found at https://freedomhouse.org/report/freedom-world. Freedom House (2020) explains the methodology.

**Table 1**
Summary statistics.

| Variable | Obs | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|---|
| Polity2 | 7759 | 1.34 | 7.46 | −10 | 10 |
| ΔPolity2 | 7546 | 0.07 | 1.54 | −18 | 16 |
| Regional Polity2 | 7759 | 1.34 | 5.24 | −8 | 10 |
| Regional ΔPolity2 | 7546 | 0.07 | 0.43 | −1.5 | 9.5 |
| Freedom Rating | 6809 | 4.15 | 2.01 | 1 | 7 |
| ΔFreedom Rating | 6505 | 0.02 | 0.42 | −4.5 | 4 |
| Regional FR | 6809 | 4.15 | 1.43 | 1.4 | 7 |
| Regional ΔFR | 6505 | 0.02 | 0.11 | −0.4 | 2 |

that the F statistic for $H_0 : \lambda = \theta = 0$ and the t-statistic for $H_0 : \lambda = 0$ exceed the maximum of the critical values for I(0) and I(1) variables in Pesaran et al. (2001) Table CI(v) (for the F-statistic) and Table CII(v) (for the t-statistic) for k = 1. To ensure that the variables are not integrated or order 2 or higher, Appendix A presents results from panel unit root tests (Choi, 2001). The test statistics confirm that democracy levels have unit roots but that the first-differences can be treated as stationary.

### 2.2. Accounting for feedback

If democracy diffuses from other countries in the region, such that $\theta > 0$ and/or $\gamma_s > 0, s = 1, 2$ in equation (1), as domestic democracy increases, regional democracy in other countries increases in the next period, which then increases domestic democracy further, etc., in a positive feedback loop. Therefore, countries in initially-democratic regions might become increasingly democratic while countries in initially-autocratic regions become increasingly autocratic. The fact that subsequent evolution depends on initial conditions indicates there is path dependence. At the same time, the error-correction term $\lambda < 0$ in (1) implies that higher initial democracy levels decrease the future change in democracy and that countries convergence toward the long-run democracy levels implied by the current values of the right-hand-side variables. In this section, I derive an equation that characterizes the evolution of average regional democracy as a function of time, initial democracy, the balance between the diffusion and convergence effects, and other long-run democracy determinants.

In Appendix B, I show that if we average equation (1) across the $N_r$ countries in a particular region, we get a difference equation that relates the change in the region's average democracy level to the lagged level, the one and two year lagged changes, and the other democracy determinants. In this simple specification, the other democracy determinants only include the regional average of the country fixed effects, the global year effect, and the average error term across the countries:

$$\overline{d}_t - \overline{d}_{t-1} = \lambda \overline{d}_{t-1} + \theta \overline{d}_{t-1} + \gamma_1(\overline{d}_{t-1} - \overline{d}_{t-2}) + \gamma_2(\overline{d}_{t-2} - \overline{d}_{t-3}) + \widetilde{\mu}_t \tag{5}$$

where $\overline{z}_t$ denotes the regional average of variable $z$ in period $t$ and $\widetilde{\mu}_t \equiv (\alpha + \overline{\mu} + \rho_t + \overline{\varepsilon}_t)$.

Equation (5) is a third-order linear stochastic inhomogenous difference equation. Nonetheless, if we simplify the equation, we can derive an analytical solution for $\overline{d}_t$, that is, we can get an analytical expression for democracy as a function of time. Specifically, I assume that

(1) The influence of global $(\rho_t)$ and country-specific factors $(\overline{\varepsilon}_t)$ remains constant: $\widetilde{\mu}_t = \widetilde{\mu}$.
(2) $\gamma_1 \in (0, 1)$. This is consistently true in the estimation.
(3) $\gamma_2 \approx 0$. $\gamma_2$ is never significant and usually small in the estimated regressions.

Under these assumptions, Appendix B shows that average regional democracy at time $t$ is

$$\overline{d}_t = \left(\overline{d}_0 + \frac{\widetilde{\mu}}{\lambda + \theta}\right) w^t - \frac{\widetilde{\mu}}{\lambda + \theta}, ; \widetilde{\mu}_t \equiv (\alpha + \overline{\mu} + \rho_t + \overline{\varepsilon}_t) \tag{6}$$

$$w \equiv \frac{(1 + \lambda + \theta + \gamma_1) \pm \sqrt{(1 + \lambda + \theta + \gamma_1)^2 - 4\gamma_1}}{2} > 0 \tag{7}$$

In Appendix C, I show that $w \in (0, 1)$ if and only if $-\lambda > \theta$, such that the convergence effect exceeds the diffusion effect. Equivalently, the long-run effect of regional democracy, $\theta/-\lambda$ is less than one. There are thus two cases.

**CASE 1:** $w < 1$ or $\theta/-\lambda < 1$, such that the convergence effect exceeds the diffusion effect. Equation (6) then implies that the region's average democracy level converges to $\overline{d}_\infty = -\frac{\widetilde{\mu}}{\lambda+\theta} \equiv \overline{d}^L$, where $\overline{d}^L$ is the region's long-run democracy level. This long-run democracy level is independent of the region's initial average democracy level, $\overline{d}_0$. Equation (6) also implies that the region closes $\beta$ percent of the gap between the initial and the long-run level in the following number of years:

$$\frac{(\overline{d}_t - \overline{d}^L)}{(\overline{d}_0 - \overline{d}^L)} = w^t \Leftrightarrow 1 - \beta = w^t \Leftrightarrow t = \frac{\ln(1 - \beta)}{\ln(w)} \tag{8}$$

For example, the region closes half the gap in $t = \frac{\ln(1-0.5)}{\ln(w)}$ years.

CASE 2: $w > 1$ or $\theta/-\lambda > 1$, such that the diffusion effect exceeds the convergence effect. Equation (6) then implies that the average democracy level increases indefinitely if the initial democracy level is $\overline{d}_0 > -\frac{\widetilde{\mu}}{\lambda+\theta}$. Otherwise, democracy decreases indefinitely. For example, in an initially highly democratic region, the remaining autocracies eventually democratize. Conversely, in autocratic regions, the remaining democracies eventually autocratize. The regions then continue to increase their democracy or autocracy scores.

## 3. Results

Table 2 presents the estimates of equation (1). The F statistic for $H_0 : \lambda = \theta = 0$ and t-statistic for $H_0 : \lambda = 0$ reject the null hypothesis that there is no long-run relationship between domestic and regional democracy (Pesaran et al., 2001). An initial 1-point increase in regional democracy is associated with 0.68–0.85 points increase in long-run domestic democracy. In the polity2 data, half of the long-run diffusion effect arrives in $t = \frac{ln(1-0.50)}{\ln(1-0.11)} - 1 \approx 5$ years. Thus, domestic democracy "catches" 42% of the regional change (0.50 times 85%) over 5 years. In 10 years, solving $10 = \frac{ln(1-\alpha)}{\ln(1-0.11)} - 1$ for $\alpha$ and multiplying by 85%, domestic democracy catches 61% of the regional change. In the long run, it catches 85%. In the Freedom House data, in the same 5-year period, solving $5 = \frac{ln(1-\alpha)}{\ln(1-0.14)} - 1$ for $\alpha$ and multiplying by 68% shows that domestic democracy "catches" 40% of the regional change. In 10 years, it catches 55%. In the long run, it catches 68%.

In the polity2 data, the coefficient on the 1-year lagged regional change in democracy – the short-run diffusion effect – is also large. However, neither of the short-run effects are significant in the Freedom House data (although the estimates are positive). A possible explanation is that it is easier to announce elections or otherwise increase the polity2 score in the short run, while it is more difficult to guarantee political freedoms and civil liberties in the short run to increase the Freedom Rating. The latter might depend on state capacity, the bureaucracy, local power brokers, and social norms that cannot be controlled by politicians in the short term. However, it is often difficult to compare democracy measures (and regression coefficients) using different democracy datasets because the different measures measure different phenomena and aggregate underlying heterogenous, qualitative, or ordinal data to get the overall democracy index (Gründler and Krieger, 2021; Paldam 2021a).[3]

When I account for feedback to other countries in the region, substituting the estimates in Table 2 into Equation (7) implies that $w \approx 0.97$ in the polity2 data and $w \approx 0.95$ in the Freedom House data. Although I cannot always reject the null hypothesis that $w > 1$, the evidence best supports that $w < 1$, such that the regions converge to unique democracy levels. Equivalently, the region's initial democracy level does not affect the long-run level. Equation (8) implies that the region closes 50% of the gap to the long-run level in 24 years using the polity2 data and 14 years using the Freedom House data. Fig. 2 simulates the trajectory of regional democracy implied by Equation (6). In the polity2 simulation, I set $w = 0.97$ and assume that the initial average polity2 score is $-5$ while the long-run score is 5. In the Freedom House simulation, $w = 0.95$, the initial Freedom Rating is 2, and the long-run Freedom Rating is 6. Since the polity2 score ranges from $-10$ to 10 and the Freedom Rating ranges from 1 to 7, I assume that the fictive country is initially weakly autocratic or unfree, but weakly democratic and mostly free in the long run.

## 4. Robustness

Equation (1) is not the only possible specification for democratic change and could potentially fail to identify the causal effect of regional democracy due to several reasons. First, the dynamic-fixed-effects estimate of $\lambda$ is biased in finite samples (Nickell, 1981). Although the bias is of order 1/T and the paper uses a long time dimension (T = 57), if $\lambda$ is close to zero, even a small proportional bias can significantly bias the estimated long-run effect of regional democracy, which is $\theta/-\lambda$ (Reed and Zhu, 2017). In Table 2, the $\lambda$ estimates range from $-0.11$ to $-0.14$, so the bias should not zbe extremely problematic. Additionally, Reed and Zhu (2017, T1able 8G) find that the bias in the calculation of the long-run effect decreases when the coefficient of autocorrelation in the independent variable is close to one. The correlation between current and lagged regional democracy in this paper is 0.98 using either democracy measure.

Second, although I lag the right-hand side of regression (1), anticipated future democracy changes and other omitted variables could bias the estimates. For example, if the government is expected to manipulate the election in period *t*, the military might launch a pre-emptive coup or pro-democracy movements might form in period *t-1*. In Appendix D, Table D.1, Columns (1)–(2) seek to control for omitted variables by controlling for country-specific linear time trends (which might control for modernization effects on democracy), lagged PPP-adjusted GDP per capita, and the lagged growth rate (log-change) of 3-year moving average GDP per capita (Haggard and Kaufman, 1995; Geddes, 1999; Krishnarajan, 2019). I also note that the fixed effects should also help to control for time-invariant and slow-moving factors, such as historical determinants of democracy, latitude, oil and other natural resource endowments, and ethnic and religious composition. The lagged dependent variable controls for initial democracy status. The results remain similar.

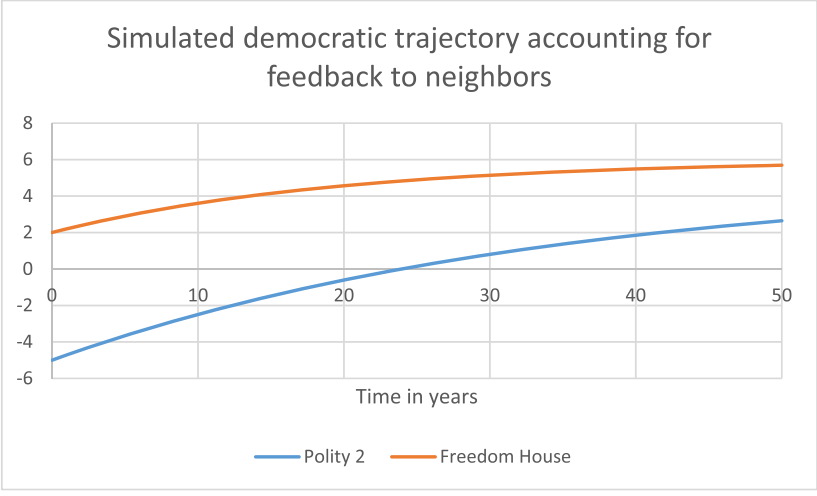
Third, countries might be influenced more by specific countries within the region. Following Acemoglu et al. (2019), I assume that countries are only affected by other countries that had the same democracy status in the first sample year or, in this paper, 1972, which is the first sample year with Freedom House data. Table D.1, Columns (3)–(4) show that this alternative spatial weighting matrix

[3] Paldam (2021a,b) contains additional discussion and references to different democracy measures and studies.

**Table 2**
Error-correction estimates.

| Dependent Variable: | (1) | (2) |
|---|---|---|
| | ΔPolity2 | ΔFreedom Rating |
| *Long Run Coefficient* | | |
| Regional democracy | 0.85*** | 0.68*** |
| | (0.17) | (0.22) |
| *Error Correction Term* | | |
| Own democracy (t-1) | −0.11*** | −0.14*** |
| | [0.01] | [0.02] |
| *Short Run Coefficients* | | |
| Lag of regional democracy | 0.09*** | 0.10*** |
| | [0.02] | [0.02] |
| Lagged regional change | 0.29*** | 0.12 |
| | [0.10] | [0.13] |
| Twice-lagged regional change | 0.01 | 0.06 |
| | [0.08] | [0.05] |
| F-statistic ($H_0 : \lambda = \theta = 0$) | 39.54 | 46.79 |
| t-statistic ($H_0 : \lambda = 0$) | −7.57 | −6.60 |
| F-statistic critical value (10, 5, 1% sign.) 6.26, 7.30, 9.63 | | |
| t-statistic critical value (10, 5, 1% sign.) −3.40, −3.69, −4.26 | | |
| Observations | 7130 | 5901 |
| Within R-squared | 0.08 | 0.1 |
| #Countries | 159 | 164 |
| Country fixed effects | Y | Y |
| Year fixed effects | Y | Y |

**Note:** Driscoll and Kraay (1998) standard errors in brackets. *,**,*** significant at 10%, 5%, 1%. The error structure is assumed to be heteroskedastic, autocorrelated up to two lags, and correlated across countries.




**Note:** The simulation is based on Table 2 and equation (6). In the polity2 simulation, $w = 0.97$, the initial polity2 score is -5, and the long-run score is 5. In the Freedom House simulation, $w = 0.95$, the initial Freedom Rating is 2, and the long-run Freedom Rating is 6.

**Fig. 2.** Simulated regional trajectory of democracy. **Note:** The simulation is based on Table 2 and equation (6). In the polity2 simulation, $w = 0.97$, the initial polity2 score is −5, and the long-run score is 5. In the Freedom House simulation, $w = 0.95$, the initial Freedom Rating is 2, and the long-run Freedom Rating is 6.

produces similar results.

Fourth, region-specific economic, political, and other shocks might affect democracy (Houle et al., 2016). Unfortunately, regressing the regional average democracy score outside the sample country on the region-specific year effects causes multicollinearity (R-squared>0.99). Instead, I substitute the Acemoglu et al. (2019) spatial weighting matrix to calculate the regional democracy averages. The region × year effects now "only" explain 73–80% of the average regional democracy scores. Table D.1, Columns (5)–(6) shows that the result are robust to using region × year effects, although the long-run effects are smaller in the Freedom House data.

## 5. Region-specific estimates

In Tables 3, I report the results from region-specific Polity2 regressions using Acemoglu et al.'s (2019) spatial weighting matrix to reduce multicollinearity. The long-run relationship between regional and domestic democracy is clearest in Latin America, Sub-Saharan Africa, and Asia. Western countries show signs of a long-run relationship but fail the cointegration tests based on the F-and t-statistics (Pesaran et al., 2001), i.e., the null hypothesis that there is no long-run relationship between domestic and regional democracy cannot be rejected. This is also the case in Eastern Europe and the Former Soviet Union as well as North Africa and the Middle East. However, the large positive short-run effects in Western countries and Eastern Europe and the Former Soviet Union (0.41 and 0.75) suggest that the diffusion effects could, potentially, be immediate. Among the Western countries, for example, the only remaining autocracies (Greece, Portugal, and Spain) democratized in 1974, 1975, and 1976. The model may then be unable to distinguish between the short and the long run diffusion effects. In contrast, there is no evidence of either short or long run effects in the North Africa and the Middle East.

## 6. Contiguous neighbor effects

Given their geographical closeness, contiguous neighbors could potentially exert larger effects on the domestic democratization process than non-contiguous countries (Brinks and Coppedge, 2006; Leeson and Dean, 2009). In Tables 4, I report results for contiguous neighbors. The contiguity data comes from the CEPII Gravity Database (Conte et al., 2022). While the estimated effects in Table 4 are significant, they are also significantly smaller than the regional diffusion effects in Table 2. They are also not robust to controlling for region-specific year effects. This suggests that consistent with O'loughlin et al. (1998) and Bamert et al. (2015), contiguity does not necessarily play a special role in democratic diffusion processes.

## 7. Application to regional democratization waves

Fig. 1 shows the approximately S-shaped patterns of regional democratization waves. If we assume that $< 1$ , as implied by Table 2, and that each region started below its long-run average democracy level ($\overline{d}_0 < -\frac{\widetilde{\mu}}{\lambda+\theta}$), Equation (6) can explain the upward-sloping part of the S-shape in Fig. 1. First, first, the annual change is positive:

$$\overline{d}_{t+1} - \overline{d}_t = \left(\overline{d}_0 + \frac{\widetilde{\mu}}{\lambda+\theta}\right) w^t (w-1) > 0.$$

Second, the change slows down over time:

**Table 3**
Region-specific estimates.

| Dependent Variable: | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| | ΔPolity2 | ΔPolity2 | ΔPolity2 | ΔPolity2 | ΔPolity2 | ΔPolity2 |
| Region | Western | EEur&FSU | Lat Am | SSA | Asia | NAfr&ME |
| *Long Run Coefficient* | | | | | | |
| Regional democracy | 0.78*** | 0.35 | 0.86*** | 0.74*** | 0.48** | 0.12 |
| | (0.27) | (1.39) | (0.24) | (0.11) | (0.25) | (0.30) |
| *Error Correction Term* | | | | | | |
| Own democracy (t-1) | −0.18** | −0.17*** | −0.14*** | −0.15*** | −0.11*** | −0.09** |
| | [0.07] | [0.06] | [0.03] | [0.02] | [0.03] | [0.04] |
| *Short Run Coefficients* | | | | | | |
| Lag of regional democracy | 0.14 | 0.06 | 0.12** | 0.11*** | 0.05 | 0.01 |
| | [0.09] | [0.23] | [0.05] | [0.02] | [0.03] | [0.03] |
| Lagged regional change | 0.41** | 0.75* | 0.13 | 0.07 | −0.17* | −0.17 |
| | [0.17] | [0.39] | [0.12] | [0.09] | [0.09] | [0.15] |
| Twice-lagged regional change | 0.06 | −0.11 | −0.27 | −0.06 | −0.07 | 0.16 |
| | [0.09] | [0.10] | [0.18] | [0.07] | [0.07] | [0.22] |
| F-statistic ($H_0 : \lambda = \theta = 0$) | 4.48 | 3.65 | 9.40 | 21.02 | 11.69 | 2.52 |
| t-statistic ($H_0 : \lambda = 0$) | −2.43 | −2.70 | −4.22 | −6.47 | −4.51 | −2.20 |
| F-statistic critical value (10, 5, 1% sign.) | 6.26, 7.30, 9.63 | | | | | |
| t-statistic critical value (10, 5, 1% sign.) | −3.40, −3.69, −4.26 | | | | | |
| Observations | 1134 | 765 | 1125 | 2033 | 1047 | 933 |
| Within R-squared | 0.31 | 0.45 | 0.13 | 0.14 | 0.11 | 0.15 |
| #Countries | 21 | 26 | 22 | 45 | 23 | 19 |
| Country fixed effects | Y | Y | Y | Y | Y | Y |
| Year fixed effects | Y | Y | Y | Y | Y | Y |

**Note:** Driscoll and Kraay (1998) standard errors in brackets. *,**,*** significant at 10%, 5%, 1%. The error structure is assumed to be heteroskedastic, autocorrelated up to two lags, and correlated across countries.

**Table 4**
Contiguous-neighbor estimates.

| Dependent Variable: | (1) | (2) |
|---|---|---|
| | ΔPolity2 | ΔFreedom Rating |
| *Long Run Coefficient* | | |
| Neighbor democracy | 0.27** | 0.14** |
| | (0.11) | (0.06) |
| *Error Correction Term* | | |
| Own democracy (t-1) | −0.10*** | −0.14*** |
| | [0.01] | [0.03] |
| *Short Run Coefficients* | | |
| Lag of neighbor democracy | 0.03** | 0.02** |
| | [0.01] | [0.01] |
| Lagged neighbor change | 0.04 | 0.04 |
| | [0.03] | [0.03] |
| Twice-lagged neighbor change | 0.01 | 0 |
| | [0.03] | [0.02] |
| F-statistic ($H_0 : \lambda = \theta = 0$) | 28.95 | 15.05 |
| t-statistic ($H_0 : \lambda = 0$) | −7.52 | −5.44 |
| F-statistic critical value (10, 5, 1% sign.) 6.26, 7.30, 9.63 | | |
| t-statistic critical value (10, 5, 1% sign.) −3.40, −3.69, −4.26 | | |
| Observations | 6283 | 5097 |
| Within R-squared | 0.07 | 0.1 |
| #Countries | 140 | 143 |
| Country fixed effects | Y | Y |
| Year fixed effects | Y | Y |

**Note:** Driscoll and Kraay (1998) standard errors in brackets. *,**,*** significant at 10%, 5%, 1%. The error structure is assumed to be heteroskedastic, autocorrelated up to two lags, and correlated across countries.

$$(\overline{d}_{t+2} - \overline{d}_{t+1}) - (\overline{d}_{t+1} - \overline{d}_t) = \left(\overline{d}_0 + \frac{\widetilde{\mu}}{\lambda + \theta}\right) w^t (w-1)(w-1) < 0,$$

which can explain why the S-shapes flattens out.

Unfortunately, Equation (6) predicts either persistent democratic progress *or* (if the region starts above the long-run democracy level) persistent democratic deterioration. Therefore, it can only explain the upward part of the S-shape from the 1970s in Fig. 1 *or* the

**Table 5**
Results for initially undemocratic and initially democratic subsamples.

| Dependent Variable: | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| | ΔPolity2 | ΔPolity2 | ΔFreedom Rating | ΔFreedom Rating |
| Initial (t-1) | Autocracy | Democracy | Unfree | Free |
| *Long Run Coefficient* | | | | |
| Regional democracy | 2.29*** | 0.44* | 0.75*** | −0.27 |
| | [0.61[ | [0.25] | [0.16] | [0.33] |
| *Error Correction Term* | | | | |
| Own democracy (t-1) | −0.11*** | −0.15*** | −0.17*** | −0.20*** |
| | [0.03] | [0.05] | [0.03] | [0.03] |
| *Short Run Coefficients* | | | | |
| Lag of regional democracy | 0.25*** | 0.06** | 0.13*** | −0.05 |
| | [0.07] | [0.03] | [0.03] | [0.07] |
| Lagged regional change | 0.41* | 0.13** | 0.2 | 0 |
| | [0.23] | [0.06] | [0.21] | [0.08] |
| Twice-lagged regional change | −0.06 | 0.01 | 0.11 | 0.03 |
| | [0.11] | [0.07] | [0.10] | [0.07] |
| F-statistic ($H_0 : \lambda = \theta = 0$) | 10.48 | 9.32 | 22.80 | 33.01 |
| t-statistic ($H_0 : \lambda = 0$) | −4.13 | −2.87 | −6.31 | −7.18 |
| F-statistic critical value (10, 5, 1% sign.) 6.26, 7.30, 9.63 | | | | |
| t-statistic critical value (10, 5, 1% sign.) −3.40, −3.69, −4.26 | | | | |
| Observations | 3207 | 3923 | 3006 | 2895 |
| Within R-squared | 0.10 | 0.05 | 0.09 | 0.08 |
| #Countries | 111 | 129 | 124 | 121 |
| Country fixed effects | Y | Y | Y | Y |
| Year fixed effects | Y | Y | Y | Y |

**Note:** Driscoll and Kraay (1998) standard errors in brackets. *,**,*** significant at 10%, 5%, 1%. The error structure is assumed to be heteroskedastic, autocorrelated up to two lags, and correlated across countries. Democracy (autocracy) status is measured with a strictly positive (negative) polity2 score or a Freedom Rating above (below) 4.

downward sloping part in the 1960s–70s and possibly again from the 2010s. Although developing a theoretical or empirical model that can explain both downward and upward waves is beyond the scope of this paper, in the following, I nonetheless use equation (6) to informally discuss two possible explanations for why we might observe both upward and downward democratization waves. First, I note that for Equation (6) to explain both upward and downward waves, either the parameters ($\lambda, \theta,$ and/or $\gamma_1$) must change or the "shocks" contained in $\widetilde{\mu} \equiv (\alpha + \overline{\mu} + \rho_t + \overline{\varepsilon}_t)$ must change. In Tables 5, I present some evidence for the first possibility by dividing the sample into relatively autocratic and democratic countries according to whether the country has a strictly negative or a strictly positive polity2 score or a Freedom Rating below or above 4 in year (t-1). The result suggests that regional democracy mainly affects long-run democracy in initial autocracies or unfree countries.

If regional democracy stops affecting domestic democracy once a country becomes sufficiently democratic, the S-shapes should flatten out or even reverse. For example, consider a democratic region that starts in its long-run equilibrium, such that $\overline{d}_0 = -\frac{\widetilde{\mu}}{\lambda+\theta}$. Assume that, sooner or later during the region's democratic spell, $\theta$ decreases to $\widehat{\theta} < \theta$. Then suddenly $\overline{d}_0 > -\frac{\widetilde{\mu}}{\lambda+\widehat{\theta}}$: The region's average democracy level exceeds its new and lower long-run level. Equation (6) then implies that the region will begin a downward (or reverse) democratization wave and converge to the new long-run level. As the region slips into autocracy, however, the regional effect ($\theta$) increases (Table 5, Columns (1) and (3)). The downward democratization wave then switches to an upward wave as countries are suddenly below their long-run levels. Thus, decreases in $\theta$ as democratic countries become less sensitive to other countries within the region could generate downward waves. Increases in $\theta$ at the countries autocratize could then explain upward waves.

The second possible way that the model could generate both upward and downward waves is if the "shocks" contained in $\widetilde{\mu} \equiv (\alpha + \overline{\mu} + \rho_t + \overline{\varepsilon}_t)$ change. For convenience, I reproduce Equation (6) below:

$$\overline{d}_t = \left(\overline{d}_0 + \frac{\widetilde{\mu}}{\lambda+\theta}\right) w^t - \frac{\widetilde{\mu}}{\lambda+\theta} \tag{6}$$

Assume that $w < 1$ and that the region starts in its long-run equilibrium in period 0, such that $\overline{d}_0 = -\frac{\widetilde{\mu}}{\lambda+\theta}$. Consider now a positive democracy shock that, starting from period 0, temporarily increases $\rho_t$ and therefore $\widetilde{\mu}$. For example, the two parameters might increase for a decade or two because the end of the Cold War encouraged democratization around the world (Mainwaring and Bizzarro, 2019). The marginal effect on $\overline{d}_1$ in Equation (6) is $\frac{\partial \overline{d}_1}{\partial \widetilde{\mu}} = -\frac{1-w}{\lambda+\theta}$, which is greater than the long-run response, $\frac{\partial \overline{d}^L}{\partial \widetilde{\mu}} = -\frac{1}{\lambda+\theta}$ since $w > 0$. In fact, the initial (or short-run) response is less than 5 percent of the long-run response since Table 2 implies that $0.95 \lesssim w < 1$. Thus, instead of adjusting quickly, the region's average democracy level, $\overline{d}_t$, will only gradually increase toward the new long-run level implied by the new $\widetilde{\mu}$ value. This adjustment process, if uninterrupted, then produces an upward democratization wave. However, if and when $\widetilde{\mu}$ decreases back down to its original value - perhaps a decade or two later due to due to the War on Terror, which empowered autocracies around the world, or due to backlash against globalization - the region will suddenly be above its new long-run democracy level, such that $\overline{d}_0 > -\frac{\widetilde{\mu}}{\lambda+\theta}$. The wave then reverses as the region converges toward the previous long-run level. Processes like this - sequences of upward and downward jumps in the long-run democracy determinants combined with gradual adjustment toward the current long-run democracy level - could also explain upward and downward democratization waves.

## 8. V-DEM estimates

In Tables 6, I present results for the five high-level democracy measures in the V-DEM dataset (Coppedge et al., 2022; Pemstein et al., 2022). The V-DEM dataset reflects a broader range of possible definitions of democracy and democratic practices than the Polity 5 and Freedom House datasets (Coppedge et al., 2017). According to Coppedge et al. (2017, p. 19) and Paldam (2021a, p. 2):

> "… V-Dem is focused on the construction of a wide-ranging database consisting of a series of measures of varying ideas of what democracy is or ought to be … As such, its goal is orthogonal to Polity, Freedom House et al."

> "The [Freedom House] and the *Polity* indices see democracy as a concrete set of rules that can be implemented (also de facto). Hence, they score many countries as full democracies. The V-Dem indices see democracy as a utopian ideal that can only be approached."

The V-DEM data contains five high level measures of democracy between zero and one, although the correlations between them exceeds 0.95. I refer to the V-DEM project for detailed definitions, methodologies, and comparison to the other datasets (Coppedge et al., 2017, 2022; Pemstein et al., 2022). Table 6 indicates that regional and domestic democracy are cointegrated. In the V-DEM data, the short-run diffusion effects are larger and more robust than in the Polity 5 and Freedom House data, although the long-run effects are slightly smaller. Comparing the sum of the short-run effects to the long-run effects implies that democracy largely diffuses within the first 2 years. I leave an analysis of this contrast to the Polity and Freedom House data to future research.[4]

[4] Another democracy dataset is Bjørnskov and Rode (2020), who extend and update the Cheibub et al. (2010) binary democracy dataset. However, since the bounds tests for cointegration in Pesaran et al. (2001) has not been extended to binary dependent variables, I leave a study of this data to future research.

**Table 6**
V-DEM estimates.

| Dependent Variable: | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| | ΔElectoral Democracy | ΔLiberal Democracy | ΔParticipatory. Democracy | ΔEgalitarian Democracy | ΔDeliberative Democracy |
| *Long Run Coefficient* | | | | | |
| Regional democracy | 0.65*** | 0.51*** | 0.54*** | 0.50*** | 0.47** |
| | (0.16) | (0.19) | (0.19) | (0.17) | (0.21) |
| *Error Correction Term* | | | | | |
| Own democracy (t-1) | −0.07*** | −0.06*** | −0.06*** | −0.06*** | −0.06*** |
| | [0.01] | [0.01] | [0.01] | [0.01] | [0.01] |
| *Short Run Coefficients* | | | | | |
| Lag of regional democracy | 0.05*** | 0.03*** | 0.03*** | 0.03** | 0.03** |
| | [0.01] | [0.01] | [0.01] | [0.01] | [0.01] |
| Lagged regional change | 0.31*** | 0.34*** | 0.34*** | 0.34*** | 0.34*** |
| | [0.11] | [0.11] | [0.08] | [0.10] | [0.10] |
| Twice-lagged regional change | 0.14*** | 0.18*** | 0.17*** | 0.17*** | 0.13** |
| | [0.05] | [0.05] | [0.04] | [0.05] | [0.05] |
| F-statistic ($H_0 : \lambda = \theta = 0$) | 23.52 | 16.16 | 15.74 | 12.37 | 17.02 |
| t-statistic ($H_0 : \lambda = 0$) | −6.27 | −5.30 | −5.06 | −4.92 | −5.55 |
| F-statistic critical value (10, 5, 1% sign.) 6.26, 7.30, 9.63 | | | | | |
| t-statistic critical value (10, 5, 1% sign.) −3.40, −3.69, −4.26 | | | | | |
| Observations | 8007 | 7958 | 8007 | 8007 | 8007 |
| Within R-squared | 0.08 | 0.07 | 0.08 | 0.07 | 0.08 |
| #Countries | 163 | 163 | 163 | 163 | 163 |
| Country fixed effects | Y | Y | Y | Y | Y |
| Year fixed effects | Y | Y | Y | Y | Y |

**Note:** Driscoll and Kraay (1998) standard errors in brackets. *,**,*** significant at 10%, 5%, 1%. The error structure is assumed to be heteroskedastic, autocorrelated up to two lags, and correlated across countries.

## 9. Conclusion

This paper estimated short and long run regional democratic diffusion and accounted for dynamic feedback in a panel error correction framework. Although it is difficult to infer causality, the paper found that in the widely used Polity 5 and Freedom House datasets, when regional democracy in year (t-1) increases, domestic democracy "catches" 40–42%% of the increase in the next 5 years, 55–61% in 10 years, and 68–85% in the long run. Accounting for dynamic feedback to and from other countries in the region suggests that the average region converges to a unique long-run democracy level independently of how democratic or autocratic it is initially.[5] When I applied the error-correction framework to individual regions, the evidence for regional diffusion was clearest in Latin America, sub-Saharan Africa, and Asia. However, the lack of evidence for some other regions - particularly Western countries and Eastern Europe and the Former Soviet Union - might reflect data limitations. When I estimated diffusion from contiguous neighbors, the effects were significantly smaller, which suggests that contiguous neighbors do not play an outsized role in democratic diffusion (O'loughlin et al., 1998). Finally, I also estimated the alternative V-DEM democracy dataset (Coppedge et al., 2022; Pemstein et al., 2022), I found that regional democracy diffuses much more rapidly. The diffusion process only takes about 2 years. I leave a study of these different diffusion speeds compared to the Polity 5 and Freedom House data to future research.

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## Declaration of competing interest

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## Data availability

Data will be made available on request.

[5] Nonetheless, initially-autocratic regions may be worse off due to two reasons. First, the region will remain more autocratic in every year along the transition path to the long-run democracy level. Second, autocratic regions might adversely affect other determinants of democracy, such as domestic and regional poverty, conflict, state capacity and/or the country's relative average propensity for democracy (the fixed effect in the panel estimation). I have not considered these effects.

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## Appendix A. Panel Unit Root Tests

To ensure that the variables are not integrated or order 2 or higher, Table A1 presents results from panel unit root tests (Choi, 2001). Choi (2001) considers four different panel unit root tests based on combining the p-values from unit root tests in the individual panels. and recommends an inverse-normal test based on the trade-off between size and power. The test statistic is $Z = \sum_1^N \Phi^{-1}(p_i)/\sqrt{N}$, where $p_i$ is the asymptotic p-value for the Augmented Dickey-Fuller statistic in panel $i$ and $\Phi^{-1}(.)$ is the inverse function of the standard normal distribution. The unit root tests that are summarized in Table A1 suggests that democracy levels have unit roots. However, the first-differenced levels can be treated as stationary.[6]

**Table A.1**
Panel Unit Root Tests

| | p-values for panel unit root tests |
|---|---|
| Polity2 | 0.81 |
| ΔPolity2 | 0.00 |
| Freedom Rating | 0.28 |
| ΔFreedom Rating | 0.00 |
| Regional Polity2 | 0.83 |
| ΔRegional Polity2 | 0.00 |
| Regional FR | 1.00 |
| ΔRegional FR | 0.00 |

**Note:** The p-values apply to the Fisher-type inverse normal Z statistic for the combined p-values from ADF unit root tests in individual panels (Choi, 2001). The ADF regressions subtract the cross-sectional means in each yar and include time trends and two lags of the first-differenced variable.

## Appendix B. Derivation of Equation (5)

The error-correction specification (1) can be rewritten as follows:

$$d_{it} - d_{it-1} = \alpha + \lambda d_{i(t-1)} + \theta \frac{\sum\limits_{\substack{j\neq i,\\ r_j=r_i}} d_{jrt-1}}{N_r - 1} + \gamma_1 \left( \frac{\sum\limits_{\substack{j\neq i,\\ r_j=r_i}} d_{jrt-1}}{N_r - 1} - \frac{\sum\limits_{\substack{j\neq i,\\ r_j=r_i}} d_{jrt-2}}{N_r - 1} \right) + \gamma_2 \left( \frac{\sum\limits_{\substack{j\neq i,\\ r_j=r_i}} d_{jrt-2}}{N_r - 1} - \frac{\sum\limits_{\substack{j\neq i,\\ r_j=r_i}} d_{jrt-3}}{N_r - 1} \right) + \mu_i + \rho_t + \varepsilon_{it} \tag{a1}$$

which relates the change in democracy to past own and regional democracy levels. If we wrote the equations up for all $N_r$ countries in a particular region, we would get a system of $N_r$ difference equations. If we sum the $N_r$ equations and divide by $N_r$, we get that average evolution of democracy within the region:

$$\frac{\sum_i d_{it}}{N_r} - \frac{\sum_i d_{it-1}}{N_r} = \alpha + \lambda \frac{\sum_i d_{it-1}}{N_r} + \theta \frac{\sum_i \sum_{j\neq i} d_{jt-1}}{N_r(N_r-1)}$$

$$+\gamma_1 \left( \frac{\sum_i \sum_{j\neq i} d_{jt-1}}{N_r(N_r-1)} - \frac{\sum_i \sum_{j\neq i} d_{jt-2}}{N_r(N_r-1)} \right) + \gamma_2 \left( \frac{\sum_i \sum_{j\neq i} d_{jt-2}}{N_r(N_r-1)} - \frac{\sum_i \sum_{j\neq i} d_{jt-3}}{N_r(N_r-1)} \right) + \frac{\sum_i \mu_i}{N_r} + \frac{\sum_i \varepsilon_{it}}{N_r} + \rho_t \Leftrightarrow$$

[6] Unit root tests can be misleading when variables are bounded (Cavaliere and Xu, 2014) or exhibit structural breaks (Im et al., 2005). However, the democracy measures used in this paper are unlikely to be bounded. For example, if democratic practices in a country warranted a poltiy2 score of 11, which is currently infeasible since the maximum score is 10, presumably the Polity 5 Project would have allowed the polity2 score to be as high as 11 rather than restricting it needlessly. Therefore, it seems unlikely that the true democracy scores in the dataset would ever "hit" and be restricted by the bounds. Regarding the structural break concern, structural breaks decrease the power of unit root tests, making it harder to reject the null hypothesis that there exists a unit root (Perron, 1989; Im et al., 2005). However, the unit-root tests for the first-differenced variables in Table A1 easily reject the null hypothesis (with p = 0.00). This suggests that the tests are not underpowered.

$$\overline{d}_t - \overline{d}_{t-1} = \lambda\overline{d}_{t-1} + \theta\overline{d}_{t-1} + \gamma_1(\overline{d}_{t-1} - \overline{d}_{t-2}) + \gamma_2(\overline{d}_{t-2} - \overline{d}_{t-3}) + (\alpha + \overline{\mu} + \rho_t + \overline{\varepsilon}_t) \tag{a2}$$

where $\overline{z}_t$ denotes the regional average of variable $z$ in period $t$. To focus on the diffusion and convergence effects I treat the value of the other determinants of the change in democracy as a constant $\widetilde{\mu} \equiv (\alpha + \overline{\mu} + \rho_t + \overline{\varepsilon}_t)$. Equation (a2) is a third-order linear inhomogenous difference equation. However, the empirical results presented below show that the estimated effects of two-year-lagged democracy changes among other countries in the region ($\gamma_2$) are small and insignificant. Therefore, I set $\gamma_2 = 0$ and simplify equation (a2) to the second-order difference equation:

$$\overline{d}_t - (1 + \lambda + \theta + \gamma_1)\overline{d}_{t-1} + \gamma_1\overline{d}_{t-2} - \widetilde{\mu} = 0 \tag{a3}$$

Standard principles for solving difference equations imply that equation (a3) can be solved by guessing the general solution to the homogenous equation (which is the equation when $\widetilde{\mu} = 0$) and adding a particular solution to the inhomogenous equation (when $\widetilde{\mu} \neq 0$). The general solution to the homogenous equation is:

$$\overline{d}_t = aw^t,$$

where $a \neq 0$ is a constant and (substituting $\overline{d}_t = aw^t$ into (3)):

$$aw^t - (1 + \lambda + \theta + \gamma_1)aw^{t-1} + \gamma_1 aw^{t-2} = 0 \Leftrightarrow$$

$$w = \frac{(1 + \lambda + \theta + \gamma_1) \pm \sqrt{(1 + \lambda + \theta + \gamma_1)^2 - 4\gamma_1}}{2} \tag{a4}$$

Next, I guess the following particular solution to equation (3):

$$\overline{d}_t = k,$$

where $k \neq 0$ and (substituting into (3)):

$$k - (1 + \lambda + \theta + \gamma_1)k + \gamma_1 k - \widetilde{\mu} = 0$$

$$k = -\frac{\widetilde{\mu}}{\lambda + \theta}. \tag{a5}$$

*The sum of the general and particular solutions is*

$$\overline{d}_t = aw^t + k \tag{a6}$$

where $w$ and $k$ are defined in (a4)- (a5).

Finally, to identify the constant $a$, an initial condition is needed. I assume that the average democracy level in period zero is $\overline{d}_0$ . Then $\overline{d}_0 = a0^t + k \Leftrightarrow a = (\overline{d}_0 - k)$. Altogether,

$$\overline{d}_t = \left(\overline{d}_0 + \frac{\widetilde{\mu}}{\lambda + \theta}\right)w^t - \frac{\widetilde{\mu}}{\lambda + \theta}. \tag{a7}$$

## Appendix C. Proof that $w < 1$ if and only if $\lambda + \theta < 0$

From Equation (7),

$$w < 1$$

$$\frac{(1 + \lambda + \theta + \gamma_1) \pm \sqrt{(1 + \lambda + \theta + \gamma_1)^2 - 4\gamma_1}}{2} < 1$$

$$(1 + \lambda + \theta + \gamma_1) \pm \sqrt{(1 + \lambda + \theta + \gamma_1)^2 - 4\gamma_1} < 2$$

$$(\lambda + \theta + \gamma_1) + \sqrt{(1 + \lambda + \theta + \gamma_1)^2 - 4\gamma_1} < 1$$

$$\sqrt{(1+\lambda+\theta+\gamma_1)^2-4\gamma_1}<1-(\lambda+\theta+\gamma_1)$$

$$(1+\lambda+\theta+\gamma_1)^2-4\gamma_1<1+(\lambda+\theta+\gamma_1)^2-2(\lambda+\theta+\gamma_1)$$

$$1+(\lambda+\theta+\gamma_1)^2+2(\lambda+\theta+\gamma_1)-4\gamma_1<1+(\lambda+\theta+\gamma_1)^2-2(\lambda+\theta+\gamma_1)$$

$$2(\lambda+\theta+\gamma_1)-4\gamma_1<-2(\lambda+\theta+\gamma_1)$$

$$4(\lambda+\theta+\gamma_1)-4\gamma_1<0$$

$$\lambda+\theta<0\blacksquare$$

## Appendix D. Alternative specifications

In Table A4, Columns (1)–(2) control for country-specific linear time trends (which might control for modernization effects on democracy), lagged PPP-adjusted GDP per capita, and the lagged growth rate (log-change) of 3-year moving average GDP per capita (Haggard and Kaufman, 1995; Geddes, 1999; Krishnarajan, 2019). In Columns (3)–(4), following Acemoglu et al. (2019), I assume that countries are only affected by other countries within the region that had the same democracy status in the first sample year or, in this paper, 1972, which is the first sample year with Freedom House data (although the Polity data extends back to 1962). In Columns (5)–(6), I continue to use the Acemoglu et al. (2019) spatial weighting matrix but control for region × year effects. As explained in the paper, the original weighting matrix produces collinearity problems.

Finally, Table A5 tests whether regional democratic diffusion works through contiguous neighbors. If only democracy changes in contiguous (or adjacent) neighbors affect domestic democracy, the estimates should increase if we replace regional democracy in the regressions with neighbor democracy. I collect contiguity data from the CEPII gravity database (Conte et al., 2022).

Table A5 shows that this is not the case.

**Table D.1**
Alternative Specifications

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| Dependent Variable: | ΔPolity2 | ΔFR | ΔPolity2 | Δ FR | ΔPolity2 | Δ FR |
| Specification: | Additional Controls | | Other countries in region w/same democracy status in 1972 | | Other countries in region w/same democracy status in 1972+region × year effects | |
| *Long Run Coefficient* | | | | | | |
| Regional democracy | 0.61*** | 0.52** | 0.73*** | 0.47*** | 0.68*** | 0.28** |
| | (0.18) | (0.22) | (0.09) | (0.15) | (0.16) | (0.13) |
| *Error Correction Term* | | | | | | |
| Own democracy (t-1) | −0.20*** | −0.23*** | −0.13*** | −0.14*** | −0.13*** | −0.15*** |
| | [0.02] | [0.02] | [0.02] | [0.02] | [0.02] | [0.02] |
| *Short Run Coefficients* | | | | | | |
| Lag of regional democracy | 0.12*** | 0.12*** | 0.09*** | 0.07*** | 0.09*** | 0.04** |
| | [0.04] | [0.04] | [0.02] | [0.02] | [0.03] | [0.02] |
| Lagged regional change | 0.30*** | 0.14 | 0.21*** | 0.05 | 0.1 | −0.01 |
| | [0.11] | [0.15] | [0.07] | [0.06] | [0.07] | [0.05] |
| Twice-lagged regional change | 0.02 | 0.1 | −0.01 | 0.04 | −0.03 | 0.01 |
| | [0.07] | [0.06] | [0.05] | [0.04] | [0.07] | [0.06] |
| Lagged GDP per capita | −0.09 | 0.05 | | | | |
| | [0.13] | [0.05] | | | | |
| Lagged 3-yr econ growth | −0.55 | −0.16 | | | | |
| | [0.43] | [0.15] | | | | |
| F-statistic ($H_0: \lambda = \theta = 0$) | 44.33 | 79.78 | 26.28 | 44.07 | 33.16 | 23.83 |
| t-statistic ($H_0: \lambda = 0$) | −9.36 | −9.72 | −7.21 | −6.58 | −7.39 | −6.57 |
| F-statistic critical value (10, 5, 1% sign.) | 6.26, 7.30, 9.63 | | | | | |
| t-statistic critical value (10, 5, 1% sign.) | −3.40, −3.69, −4.26 | | | | | |
| Observations | 6550 | 5530 | 7037 | 5846 | 7037 | 5846 |
| Within R-squared | 0.14 | 0.16 | 0.09 | 0.10 | 0.14 | 0.15 |
| #Countries | 150 | 156 | 156 | 162 | 156 | 162 |
| Country fixed effects | Y | Y | Y | Y | Y | Y |
| Year fixed effects | Y | Y | Y | Y | Y | Y |
| Country-specific time trends | Y | Y | N | N | N | N |
| Region × year effects | N | N | N | N | Y | Y |

**Note:** Driscoll and Kraay (1998) standard errors in brackets. *,**,*** significant at 10%, 5%, 1%. The error structure is assumed to be heteroskedastic, autocorrelated up to two lags, and correlated across countries. Compared to Table 2 in the paper, Columns (1) and (2) control for country-specific

linear time trends, lagged PPP-adjusted GDP per capita, and the lagged growth rate (log-change) of 3-year moving average PPP-adjusted GDP per capita. GDP and population data are from the Penn Tables Version 9.1 (Feenstra et al., 2015). The regressions omit the highest and lowest 0.5th percentiles of the growth rate of 3-year moving average GDP per capita to prevent outlier effects. The regressions in Columns (3) and (4) relate the democracy change to democracy in democratically-similar (as opposed to all) other countries in the region. Democratically similar countries are defined as countries that have the same democracy status in 1972. Democracy (autocracy) status is measured with a strictly positive (negative) polity2 score or a Freedom Rating above (below) 4. Columns (5)–(6) use democratically-similar countries but control for region-specific year effects.

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