5. L. J. Tranvik *et al.*, *Limnol. Oceanogr.* **54**, 2298–2314 (2009).
6. J. J. Elser *et al.*, *Ecol. Lett.* **10**, 1135–1142 (2007).
7. J. R. Webster *et al.*, *Freshw. Biol.* **41**, 687–705 (1999).
8. J. B. Wallace, S. L. Eggert, J. L. Meyer, J. R. Webster, *Science* **277**, 102–104 (1997).
9. D. A. Walther, M. R. Whiles, *J. N. Am. Benthol. Soc.* **30**, 357–373 (2011).
10. J. R. Webster *et al.*, *Verh. Int. Ver. Theor. Angew. Limnol.* **27**, 1337–1340 (2000).
11. K. Suberkropp, V. Gulis, A. D. Rosemond, J. P. Benstead, *Limnol. Oceanogr.* **55**, 149–160 (2010).
12. Materials and methods are available as supplementary materials on *Science* Online.
13. S. G. Fisher, G. E. Likens, *Ecol. Monogr.* **43**, 421–439 (1973).
14. M. O. Gessner, E. Chauvet, *Ecol. Appl.* **12**, 498–510 (2002).
15. J. P. Benstead *et al.*, *Ecology* **90**, 2556–2566 (2009).
16. J. L. Greenwood, A. D. Rosemond, J. B. Wallace, W. F. Cross, H. S. Weyers, *Oecologia* **151**, 637–649 (2007).
17. V. Gulis, K. Suberkropp, *Freshw. Biol.* **48**, 123–134 (2003).
18. C. J. Tant, A. D. Rosemond, M. R. First, *Freshw. Sci.* **32**, 1111–1121 (2013).
19. S. A. Thomas *et al.*, *Limnol. Oceanogr.* **46**, 1415–1424 (2001).
20. N. A. Griffiths *et al.*, *Ecol. Appl.* **19**, 133–142 (2009).
21. L. Boyero *et al.*, *Ecol. Lett.* **14**, 289–294 (2011).
22. J. B. Wallace, J. R. Webster, T. F. Cuffney, *Oecologia* **53**, 197–200 (1982).
23. J. B. Wallace, T. F. Cuffney, B. S. Goldowitz, K. Chung, G. J. Lugthart, *Verh. Int. Ver. Theor. Angew. Limnol.* **24**, 1676–1680 (1991).
24. V. Ferreira *et al.*, *Biol. Rev.* 10.1111/brv.12125 (2015).
25. J. S. Kominoski *et al.* (2015); available at www.esajournals.org/doi/abs/10.1890/14-1113.1.
26. D. J. Conley *et al.*, *Science* **323**, 1014–1015 (2009).
27. J. E. Allgeier, A. D. Rosemond, C. A. Layman, *J. Appl. Ecol.* **48**, 96–101 (2011).
28. J. R. Webster, *J. N. Am. Benthol. Soc.* **26**, 375–389 (2007).
29. R. B. Alexander, R. A. Smith, *Limnol. Oceanogr.* **51**, 639–654 (2006).
30. T. J. Battin *et al.*, *Nat. Geosci.* **1**, 95–100 (2008).
31. W. K. Dodds, *Trends Ecol. Evol.* **22**, 669–676 (2007).

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SUPPLEMENTARY MATERIALS

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Materials and Methods
Supplementary Text
Tables S1 to S7
References (*32*–*50*)

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POLITICAL ECONOMY

On the endogeneity of political preferences: Evidence from individual experience with democracy

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Democracies depend on the support of the general population, but little is known about the determinants of this support. We investigated whether support for democracy increases with the length of time spent under the system and whether preferences are thus affected by the political system. Relying on 380,000 individual-level observations from 104 countries over the years 1994 to 2013, and exploiting individual-level variation within a country and a given year in the length of time spent under democracy, we find evidence that political preferences are endogenous. For new democracies, our findings imply that popular support needs time to develop. For example, the effect of around 8.5 more years of democratic experience corresponds to the difference in support for democracy between primary and secondary education.

Popular support for democracy is critical to the success of a democracy, especially an emerging democracy (*1*, *2*). Will support increase over time when a democracy emerges and the population gains experience with democracy? If so, how quickly? Or are democratic attitudes deeply ingrained in individuals, such that they are hard to change? The latest wave of democratizations in the world, which started in December 2010 in a movement often collectively referred to as the "Arab Spring," and the subsequent struggles of these countries provide a recent illustration of the importance of these questions. However, a study that uses a clean identification strategy based on an experimental or quasi-experimental setup to identify the causal effect of accumulating experience with democracy on support for democracy in a broad set of countries—or more generally, a study that identifies endogenous preferences for political systems—is missing from the literature.

Indeed, recent research suggests that economic preferences are shaped by individual experiences with markets (*3*). In particular, preferences regarding fairness, preferences for redistribution, and other types of preferences related to economic behavior vary across societies in a way that correlates with market characteristics (*4*, *5*). A causal interpretation of these correlations and the view that economic preferences are endogenous is founded in theoretical arguments (*6*–*8*) and is empirically supported by research based on experimental or quasi-experimental settings, such as the end of communism in Eastern Europe or the stock market return experiences accumulated over a lifetime (*9*–*11*).

Regarding the endogeneity of political preferences, research has so far shown a positive correlation between experience with political systems and political preferences at the country level (*12*), a positive correlation between attitudes toward democracy and currently living under a democratic system (*13*), and that a longer democratic experience lowers the probability of exit from democracy and increases the probability of exit from autocracy (*12*). However, a causal influence of experience with democracy on the support for democracy, which would imply endogeneity of preferences, cannot be established from these correlations. The correlations could (partly) be due to reverse causality (i.e., countries have a democratic history precisely because the electorate supports democratic values); or a third, possibly unobserved, variable, such as historic events or economic conditions, could determine both individuals' support for democracy and the political system in place.

Here, we exploited within-country variation at the individual level in experience with a democratic regime to establish a plausibly causal impact of experience with democracy on preferences for democracy, and thereby contribute to a better understanding of the endogeneity of political preferences. Because we control for country-year fixed effects, the observed differences in attitudes toward democracy do not simply reflect a reaction to differences in the current quality of institutions or political environments, but, under the minimal and plausible identifying assumption that we state below, constitute a change in intrinsic preferences due to differences in the length of exposure to democracy. For example, if democratic institutions or economic conditions improve with the length of time spent under democracy, this might increase the support for democracy directly and not through intrinsic preferences, but it would be captured in our specification by the country-year fixed effects, which control for all country-level unobservables that are specific to a country in a given year. Any remaining correlation between experience with democracy and support for democracy can therefore confidently be attributed to a change in preferences.

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We base the analysis on two different data sets: (i) the World Values Surveys, which cover both developed and less-developed countries across the world, and (ii) the Afrobarometer Surveys, which allow us to specifically study African countries, many of which are still in the early stages of the transition from autocratic to democratic rule. Our empirical work is based on more than 380,000 individual-level observations, coming from 104 countries over the years 1994 to 2013.

We find that preferences for democracy increase as individuals experience more time living under democratic rule. This result is robust to different ways of measuring support for democracy and democracy itself, and across the different data sets. Our baseline estimates imply that 8.5 more years of continuously living under democratic rule increase support for democracy by as much as going from primary to secondary education (as the highest level of education attained). For new democracies, our findings thus imply that popular support needs time to develop.

Both the World Values Surveys (WVS) and the Afrobarometer Surveys are repeated cross-sectional surveys at the individual level that cover a set of questions that is consistent across countries and over time (details, including a list of countries and years covered, are in the supplementary text and tables S1 and S2). For our purposes, the main differences between the two surveys are in the questions related to support for democracy. For the analysis based on the WVS, we mainly used the Inglehart and Welzel (IW) index introduced in (*14*), which is based on four different questions, where higher index numbers indicate more prodemocratic attitudes; the index ranges from –6 to 6. The index and the four questions on which it is based are described in the supplementary materials. To demonstrate robustness, we also used all four questions individually. For the analysis based on the Afrobarometer Surveys, we created a binary variable, "support for democracy," which is coded as 1 if the individual chooses the statement "Democracy is preferable to any other kind of government" over the statements "a nondemocratic government can be preferable," "it doesn't matter," or "don't know" (*15*).

Our identification strategy relies on exploiting within-country variation in the length of time that individuals have experienced democracy. To this end, we first identified periods of democratic rule using the widely used Polity 2 index from the Polity IV project (*16*). We followed the categorization of the Polity IV

Table 1. Determinants of support for democracy. Question E117 asks whether "having a democratic political system" is "a very good, fairly good, fairly bad, or very bad way of governing this country." Question E123 asks whether the respondent agrees strongly, agrees, disagrees, or disagrees strongly with the statement "Democracy may have problems but it's better than any other form of government." Robust standard errors (in parentheses) are clustered at the country-year level. The omitted age category is older than 60 years; the omitted education category is no education. Columns 1 to 5 show coefficients from ordered probit estimations, column 6 from a probit estimation.

Determinant	Basis of support for democracy					
	World Values Survey					Afrobarometer
	IW index (2003) (1)	IW index (2003) (2)	IW index (2003) (3)	Question E117 (4)	Question E123 (5)	Bratton (2004) (6)
Country democratic at time of survey	0.339**	0.335**				
	(0.141)	(0.142)				
Country's democratic capital	0.063**	0.040				
	(0.030)	(0.030)				
Individual's democratic capital		0.021***	0.021***	0.018***	0.021***	0.021***
		(0.005)	(0.005)	(0.003)	(0.004)	(0.006)
Age 11–20	–0.162***	–0.066*	–0.053	–0.057**	–0.080**	–0.095***
	(0.044)	(0.036)	(0.035)	(0.024)	(0.040)	(0.029)
Age 21–30	–0.101***	–0.023	–0.011	–0.090***	–0.063*	–0.044*
	(0.039)	(0.032)	(0.032)	(0.020)	(0.035)	(0.024)
Age 31–40	–0.041	0.007	0.014	–0.069***	–0.047	0.049**
	(0.031)	(0.026)	(0.026)	(0.017)	(0.030)	(0.022)
Age 41–50	0.001	0.023	0.031	–0.039***	–0.022	0.078***
	(0.025)	(0.023)	(0.023)	(0.015)	(0.027)	(0.021)
Age 51–60	0.038**	0.048***	0.051***	–0.026**	–0.001	0.089***
	(0.019)	(0.018)	(0.018)	(0.012)	(0.021)	(0.020)
Male	0.049***	0.050***	0.050***	0.063***	0.042***	0.194***
	(0.011)	(0.011)	(0.011)	(0.008)	(0.012)	(0.015)
Primary education	0.073**	0.067**	0.067**	0.029*	0.011	0.215***
	(0.033)	(0.033)	(0.034)	(0.017)	(0.031)	(0.022)
Secondary education	0.250***	0.244***	0.233***	0.162***	0.098**	0.448***
	(0.043)	(0.043)	(0.043)	(0.022)	(0.042)	(0.036)
Postsecondary education	0.529***	0.523***	0.518***	0.374***	0.275***	0.562***
	(0.053)	(0.052)	(0.051)	(0.029)	(0.051)	(0.045)
Country fixed effects	Yes	Yes				
Year fixed effects	Yes	Yes				
Country-year fixed effects			Yes	Yes	Yes	Yes
Observations	82,990	82,990	82,990	228,901	92,565	149,035
Number of countries	56	56	56	79	57	31
Survey waves (WVS)	3–5	3–5	3–5	3–6	3–5	
Rounds (Afrobarometer)						1–5
Years covered	1994–2006	1994–2006	1994–2006	1994–2013	1994–2006	1999–2013

*$P < 0.1$, **$P < 0.05$, ***$P < 0.01$.

project and defined democratic countries as those with a Polity 2 index of 6 or higher (see table S4 for alternative categorizations). We then used the concept of democratic capital (*12*), defining democratic capital at the country level as

$$democ\_cap_{jt} = democratic_{jt} + \delta democ\_cap_{jt-1} = \sum_{\tau=t_0}^{t} \delta^{t-\tau} democratic_{j\tau} \quad (1)$$

where j and t represent the country and the year, respectively, and $democratic_{jt}$ is an indicator variable that takes on a value of 1 if a country is democratic in year t. We set $\delta = 0.98$, which is the midpoint of the range found in (*12*)—that is, democratic capital depreciates at a rate of 2%. Period t_0, at which accumulation of democratic capital starts, is defined as the year 1946, or the earliest available date after 1946 (*17*). Finally, to quantify experiences with political regimes at the individual level, we analogously calculated individual-specific measures of democratic capital; that is, for an individual i of age age_i, democratic capital is calculated as

$$democ\_cap_{ijt} = democratic_{jt} + \delta democ\_cap_{ijt-1} = \sum_{\tau=\max(t_0,\ t-age_i)}^{t} \delta^{t-\tau} democratic_{j\tau} \quad (2)$$

Our main specification is as follows:

$$support\_for\_democracy_{ijt} = \alpha_0 + \alpha_1 democ\_cap_{ijt} + \alpha'_2 X_{ijt} + country\text{-}year\_dummies_{jt} + \varepsilon_{ijt} \quad (3)$$

where X_{ijt} is a vector of individual characteristics (*18*). This specification recognizes that there are unobserved country-year–specific variables that change over time, so that country-specific fixed effects alone cannot fully account for possible reverse causality and/or omitted variables. The country-year–specific fixed effects will capture all country-level unobservables that are specific to a country in a given year, such as current democratic institutions, currently ruling parties, or current economic conditions. We are interested in α_1, the effect of experience with democracy at the individual level. Variation in individual experience is plausibly exogenous, as it is driven by age differences.

To separate the effect of experience with democracy from the effect of age, we exploit the variation across the large number of countries whose democratic histories differ substantially in both WVS and Afrobarometer. The underlying identifying assumption of our approach is that there are no unobserved factors at the country-year-age level that are correlated with the individual democratic capital stock and support for democracy. Under this assumption, α_1 cleanly identifies the effect of the individual experience with democracy on the support for democracy. "Living under a democracy" is the basic treatment, and the individual's democratic capital (i.e., the "length of experience with democracy") can be interpreted as the treatment intensity. A positive estimate for α_1 arises if the relationship between age and support for democracy is more positive in long-standing democracies than in newly formed democracies, because in the former case, older individuals have accumulated a larger democratic capital stock than younger ones, whereas in the latter case, democratic capital does not vary by age (fig. S1). For the same reason, a positive estimate for α_1 arises if the relationship between age and support for democracy is more positive in newly formed autocracies than in long-standing autocracies.

Table 1 shows the main results. The first five columns report results based on WVS. Here, the dependent variables are ordinal, and we use the ordered probit estimator. In column 6, the dependent variable is a binary index and we estimate a probit model. All standard errors are corrected for correlation within country-year observations.

Columns 1 to 3 use the IW index as the dependent variable. As a reference point, column 1 includes country and year fixed effects separately, which allows us to include a dummy for the country's current democratic status ($democratic_{jt}$) and the country-level measure of democratic capital ($democ\_cap_{jt}$). Column 2 adds individual-level democratic capital ($democ\_cap_{ijt}$). All three variables are positively correlated with stated support for democracy. However, as noted above, the country-level variables are likely endogenous. Therefore, our main specification in column 3 includes country-year fixed effects. Because in this way we can control for country-year–specific unobservables, and under the above stated identifying assumption, we can interpret a significant coefficient on an individual's democratic capital as the causal effect that an individual's experience with democracy has on that individual's support for democracy. We find a statistically highly significant positive coefficient on the democratic capital that an individual has accumulated, indicating that individual experience with democracy positively affects support for democracy. Columns 4 and 5 use as dependent variables the two individual components from the IW index that measure prodemocratic attitudes (results using the two individual components that measure antidemocratic attitudes are shown in table S5). Unlike the other questions constituting the IW index, question E117 (column 4) is also available in the latest wave of the WVS (2010–2014) and thus leads to a much larger number of observations. The results confirm the main finding. Column 6 focuses on Africa, using Afrobarometer data. We continue to find that a higher individual-level democratic capital stock increases support for democracy.

Several robustness checks (tables S3 to S5) confirm that our main results are robust to (i) adding more individual-level controls, (ii) omitting the potentially endogenous controls for education, (iii) different assumptions about the error structure in the regression model, (iv) controlling for a full set of age dummies, (v) controlling for interactions between age and country fixed effects and age and year fixed effects, (vi) alternative ways to use the Polity 2 index to build the democratic capital stock, (vii) using alternative depreciation parameters to calculate democratic capital, (viii) restricting the sample to current democracies, current autocracies, or countries that never experienced a regime switch, and (ix) using the two remaining subcomponents of the IW index, which measure autocratic preferences, separately. Finally, in table S6 we show that our results are robust to using the Freedom House index [see, e.g., (*19*)] as an alternative way of identifying democratic periods.

In sum, across data sets and across a large number of specifications, we find a statistically highly significant positive impact of individual experience with democracy on support for democracy. How big is the effect? To get some idea about this, rather than using ordered probit estimates, it is more transparent to use ordinary least-squares (OLS) estimates (table S3, column 3) for the main specification, based on the WVS. The OLS estimate for the coefficient on individual democratic capital is 0.04. Thus, to move an individual one step up in the IW index in a more prodemocratic direction would take 25 additional democratic capital units (e.g., around 35 years of continuously living under democracy). Alternatively, one can compare the coefficient on individual democratic capital to the education coefficients. For example, the difference between primary and secondary education is about 0.32 in the OLS estimates. This implies that, for an individual to achieve the same increase in support for democracy as switching from primary to secondary education, individual democratic capital needs to go up by around 8 units (for example, roughly 8.5 years of continuously living under democracy).

Our results provide evidence for the hypothesis that political preferences are shaped by the political system. Based on individual-level variation, our approach rules out potential effects of unobserved variables at the country-year level, such as the political environment or economic conditions. Of course, there are variables other than experience with the political system that affect support for democracy, many of which have been analyzed in the political science literature [e.g., (*20*)]. Yet the endogeneity of preferences to the actual political system is by itself an important phenomenon from both a policy and a theoretical point of view. For public policy, it means that implementing major political reforms might be a difficult task, while on the other hand individuals will increase their support for new systems over time. For the countries involved in the fresh waves of democratization movements in the Arab Spring, this gives some hope that broad support for democracy will increase over time, albeit slowly, making the new regimes more sustainable. For theoretical work, endogenous preferences pose challenges for both welfare theory and political economy.

REFERENCES AND NOTES

1. J. J. Linz, A. Stepan, *Problems of Democratic Transition and Consolidation: Southern Europe, South America, and Post-Communist Europe* (Johns Hopkins Univ. Press, Baltimore, 1996).
2. L. Diamond, *Developing Democracy: Toward Consolidation* (Johns Hopkins Univ. Press, Baltimore, 1999).
3. E. Fehr, K. Hoff, *Econ. J.* **121**, F396–F412 (2011).
4. A. Alesina, E. L. Glaeser, *Fighting Poverty in the US and Europe: A World of Difference* (Oxford Univ. Press, Oxford, 2004).
5. J. Henrich *et al*., *Science* **327**, 1480–1484 (2010).
6. A. Alesina, G.-M. Angeletos, *Am. Econ. Rev.* **95**, 960–980 (2005).
7. R. Bénabou, J. Tirole, *Q. J. Econ.* **121**, 699–746 (2006).
8. T. Piketty, *Q. J. Econ.* **110**, 551–584 (1995).
9. A. Alesina, N. Fuchs-Schündeln, *Am. Econ. Rev.* **97**, 1507–1528 (2007).
10. E. F. P. Luttmer, M. Singhal, *Am. Econ. J. Econ. Policy* **3**, 157–179 (2011).
11. U. Malmendier, S. Nagel, *Q. J. Econ.* **126**, 373–416 (2011).
12. T. Persson, G. Tabellini, *Am. Econ. J. Macroecon.* **1**, 88–126 (2009).
13. R. Inglehart, *Polit. Sci. Politics* **36**, 51–57 (2003).
14. R. Inglehart, C. Welzel, *Comp. Polit.* **36**, 61–79 (2003).
15. M. Bratton, *J. Democracy* **15**, 147–158 (2004).
16. M. G. Marshall, K. Jaggers, *Polity IV Project: Dataset Users' Manual* (Center for Global Policy, George Mason University, Fairfax, VA, 2005).
17. A small number of deviating cases, because of data constraints, are described in the supplementary materials. Note that because we include country or even country-year fixed effects in all specifications and thus identify the coefficients only through changes within a country (or a country-year), the choice of the start year is in fact innocuous.
18. We follow standard specifications in the literature and include some basic demographic characteristics of the respondents as controls, namely variables related to age, gender, and education. Because our focus lies on establishing a causal relationship, we omit likely endogenous attitudinal variables [as analyzed in, e.g., (*20*)].
19. A. Karatnycky, *J. Democracy* **14**, 100–113 (2003).
20. R. Mattes, M. Bratton, *Am. J. Polit. Sci.* **51**, 192–217 (2007).

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SUPPLEMENTARY MATERIALS

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NUCLEAR PORES

Architecture of the nuclear pore complex coat

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The nuclear pore complex (NPC) constitutes the sole gateway for bidirectional nucleocytoplasmic transport. Despite half a century of structural characterization, the architecture of the NPC remains unknown. Here we present the crystal structure of a reconstituted ~400-kilodalton coat nucleoporin complex (CNC) from *Saccharomyces cerevisiae* at a 7.4 angstrom resolution. The crystal structure revealed a curved Y-shaped architecture and the molecular details of the coat nucleoporin interactions forming the central "triskelion" of the Y. A structural comparison of the yeast CNC with an electron microscopy reconstruction of its human counterpart suggested the evolutionary conservation of the elucidated architecture. Moreover, 32 copies of the CNC crystal structure docked readily into a cryoelectron tomographic reconstruction of the fully assembled human NPC, thereby accounting for ~16 megadalton of its mass.

The nuclear pore complex (NPC) is composed of ~34 different proteins, termed nucleoporins (Nups), that assemble in numerous copies to yield a ~120 MD transport channel embedded in the nuclear envelope (NE) (*1*). To facilitate the extensive membrane curvature generated in each NE pore, NPCs require a membrane-bending coat. The NPC coat is believed to be formed by an evolutionarily conserved coat Nup complex (CNC), the Nup107/160 complex in humans and the Nup84 complex in *Saccharomyces cerevisiae*, the latter of which is composed of Nup120, Sec13, Nup145C, Seh1, Nup85, Nup84, and Nup133 (*1*, *2*).

We reconstituted a heterohexameric CNC containing the yeast Nups Nup120, Sec13, Nup145C, Seh1, Nup85, and the Nup84 N-terminal domain (NTD) (Fig. 1, A and B). Our reconstituted CNC did not include Nup133 because this nup is conformationally flexible and loosely associated (*2*–*4*). Because the initial crystals of this reconstituted CNC diffracted poorly, we generated a series of conformation-specific, high-affinity synthetic antibodies (sABs) and tested them as crystallization chaperones (*5*). This approach yielded crystals of the CNC in complex with sAB-57, which allowed us to solve the structure to 7.4 Å by molecular replacement, using high-resolution crystal structures of CNC components and the sAB scaffold (figs. S1 and S2) (*6*–*10*). The inclusion of a second sAB (sAB-87) produced another crystal form, for which we collected anomalous x-ray diffraction data of Seleno-L-methionine and heavy metal–labeled crystals to confirm the placement of the CNC components (figs. S1 to S3). Because the coat Nups in both CNC•sAB complexes adopted the same arrangement, we focused our analysis on the better-ordered CNC•sAB-57 structure (figs. S4 to S6).

The CNC adopted a curved Y-shaped structure spanning ~250 Å in length and width, consistent with previous negative-stain electron microscopy (EM) analyses (Fig. 1C and movie S1) (*2*–*4*, *11*). The Seh1•Nup85 pair and Nup120 constituted the upper arms of the Y, which were connected to the rest of the CNC through a central triskelion. Sec13•Nup145C•Nup84^{NTD} formed the stalk at the bottom of the triskelion and would attach the tail formed by Nup84^{CTD} and Nup133, which were absent in the structure. Both arms curved out so that the Nup120 β-propeller domain was perpendicular to the plane of the Y. Nup145C organized the CNC through four distinct interaction surfaces contacting nearly every member of the complex. sAB-57 bound at the Nup145C-Nup85 interface and formed crystal packing contacts (Fig. 2 and fig. S4).

The C-terminal domains (CTDs) of Nup145C (residues 553 to 712), Nup85 (residues 545 to 744), and Nup120 (residues 729 to 1037) converged to form the CNC triskelion. Although we observed clear electron density that revealed the connectivity of the three CTDs and their interactions (Fig. 2 and fig. S2), the sequence register in the triskelion was only approximate because of the absence of side-chain density. Nup120^{CTD} was sandwiched between Nup85^{CTD} and Nup145C^{CTD}, and no direct contacts were observed between Nup85^{CTD} and Nup145C^{CTD} (Fig. 2, A and B). The interactions between Nup85^{CTD}, Nup145C^{CTD}, and Nup120^{CTD} were mediated predominantly by their most C-terminal helices. An additional interaction was made by an N-terminal Nup145C helix bound to a groove in the Nup85^{CTD} surface ~60 Å away from the triskelion center, an interaction that was recognized by sAB-57 (Fig. 2C).

Consistent with our structural data, we reconstituted a stoichiometric complex between Nup120 and Nup85^{CTD} as monitored by size-exclusion chromatography interaction experiments (fig. S7A). Furthermore, Nup120 failed to interact with Sec13•Nup145C in the absence of Nup145C^{CTD} (fig. S7, B and C). The interaction between Seh1•Nup85 and Sec13•Nup145C depended on the presence of an N-terminal Nup145C fragment

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On the endogeneity of political preferences: Evidence from individual experience with democracy

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Editor's Summary

Political preferences provide economic capital

Longer periods of democratic government favor economic growth, which in turn stabilizes democracy. But is this relationship a given? Fuchs-Schundeln and Schundeln collected individual-level data from more than 100 countries over two decades. Support for democracy did indeed increase as the length of time lived in a democratic system increased.

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