Intrinsic honesty and the prevalence of rule violations across societies

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Deception is common in nature and humans are no exception[1]. Modern societies have created institutions to control cheating, but many situations remain where only intrinsic honesty keeps people from cheating and violating rules. Psychological[2], sociological[3] and economic theories[4] suggest causal pathways to explain how the prevalence of rule violations in people's social environment, such as corruption, tax evasion or political fraud, can compromise individual intrinsic honesty. Here we present cross-societal experiments from 23 countries around the world that demonstrate a robust link between the prevalence of rule violations and intrinsic honesty. We developed an index of the 'prevalence of rule violations' (PRV) based on country-level data from the year 2003 of corruption, tax evasion and fraudulent politics. We measured intrinsic honesty in an anonymous die-rolling experiment[5]. We conducted the experiments with 2,568 young participants (students) who, due to their young age in 2003, could not have influenced PRV in 2003. We find individual intrinsic honesty is stronger in the subject pools of low PRV countries than those of high PRV countries. The details of lying patterns support psychological theories of honesty[6,7]. The results are consistent with theories of the cultural co-evolution of institutions and values[8], and show that weak institutions and cultural legacies[9–11] that generate rule violations not only have direct adverse economic consequences, but might also impair individual intrinsic honesty that is crucial for the smooth functioning of society.

Good institutions that limit cheating and rule violations, such as corruption, tax evasion and political fraud are crucial for prosperity and development[12,13]. Yet, even very strong institutions cannot control all situations that may allow for cheating. Well-functioning societies also require the intrinsic honesty of citizens. Cultural characteristics, such as whether people see themselves as independent or part of a larger collective, that is, how individualist or collectivist[9] a society is, might also influence the prevalence of rule violations due to differences in the perceived scope of moral responsibilities, which is larger in more individualist cultures[10,14]. Here, we investigate how the prevalence of rule violations in a society and individual intrinsic honesty are linked. A variety of psychological, sociological and economic theories suggest causal pathways of how widespread practices of violating rules can affect individual honesty and the intrinsic willingness to follow rules.

Generally, processes of conformist transmission of values, beliefs and experiences influence individuals strongly and thereby can produce differences between social groups[15]. The extent to which people follow norms also depends on how prevalent norm violations are[3]. If cheating is pervasive in society and goes often unpunished, then people might view dishonesty in certain everyday affairs as justifiable without jeopardising their self-concept of being honest[2]. Experiencing frequent unfairness, an inevitable by-product of cheating, can also increase dishonesty[16]. Economic systems, institutions and business cultures shape people's ethical values[8,17,18], and can likewise impact individual honesty[19,20].

Ethical values, including honesty, are transmitted from prestigious people, peers and parents. People often take high-status individuals such as business leaders and celebrities as role models[21], and their cheating can set bad examples for dishonest practices[19]. Similarly, if politicians set bad examples by using fraudulent tactics like rigging elections, nepotism and embezzlement, then the honesty of citizens might suffer, because corruption is fostered in wider parts of society[13]. If many people work in the shadow economy and thereby evade taxes, peer effects might make cheating more acceptable[22]. If corruption is endemic in society, parents may recommend a positive attitude towards corruption and other acts of dishonesty and rule violations as a way to succeed in such an environment[4,23].

To measure the extent of society-wide practices of rule violations we constructed the PRV index. We focused on three broad types of rule violations: political fraud, tax evasion and corruption. We constructed PRV by calculating the principal component of three widely used country-level variables that all rest on comprehensive, often representative data sources to capture the important dimensions of the prevalence of rule violations that we are interested in: an indicator of political rights by Freedom House that measures the democratic quality of a country's political practices; the size of a country's shadow economy as a proxy for tax evasion; and corruption as measured by the World Bank's Control of Corruption Index (Supplementary Methods).

We constructed PRV for the 159 countries for which data are available for all three variables, the earliest year being 2003. We used the 2003 data to maximize the distance between the measurement of PRV and the point in time we ran the experiments (between 2011 and 2015, that is, at least 8 years after 2003). We use the 2003 data to ensure that our experimental participants could not have affected PRV in 2003 because they were still children at that time and therefore had been in no position to commit rule violations that influenced PRV in 2003. PRV in 2003 has a mean of 0 (s.d. = 1.46), and it ranges from −3.1 to 2.8 (higher values indicate higher prevalence of rule violations).

Our strategy was to conduct comparable experiments in 23 diverse countries with a distribution of PRV that resembles the world distribution of PRV. In the countries of our sample, PRV in 2003 ranges from −3.1 to 2.0, with a mean of −0.7 (s.d. = 1.52). Thus, the distribution of PRV in our sample is approximately representative of the world distribution of PRV with a slight bias towards lower PRV countries. The countries of our sample also vary strongly according to frequently used cultural indicators such as individualism and value orientations (Extended Data Table 1 and Supplementary Methods).

Our participants, all nationals of the respective country, were young people with comparable sociodemographic characteristics (students; mean age of 21.7 (s.d. = 3.3) years; 48% females; Supplementary Methods) who, due to their youth, had limited chances of being involved in political fraud, tax evasion or corruption, but might have been exposed to (or socialized into) certain attitudes towards (dis-) respecting rules[24].

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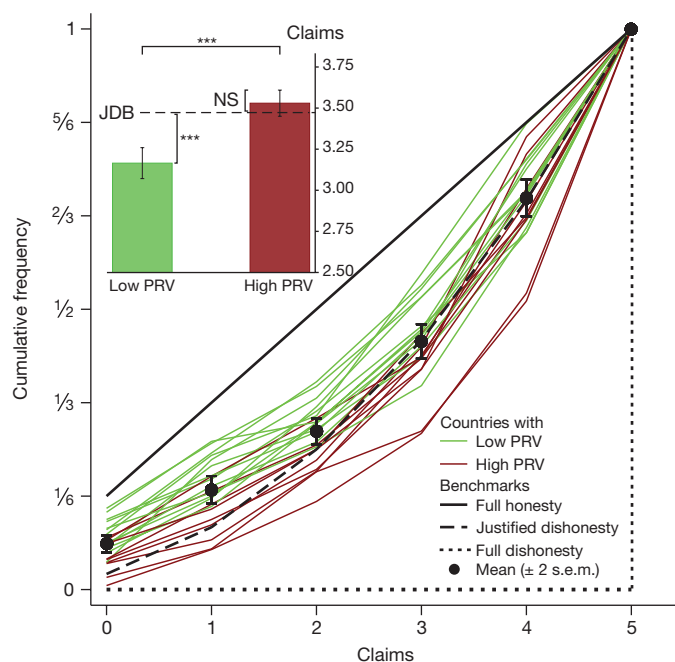
Figure 1 | Distributions of reported die rolls. Depicted are the cumulative distribution functions (CDFs) of amounts claimed compared to the CDFs of the full honesty, justified dishonesty and full dishonesty benchmarks. Green CDFs represent subject pools ($n_{low} = 14$) from countries with a below-average prevalence of rule violations (PRV; mean $PRV_{low} = -1.69$), and red CDFs represent subject pools ($n_{high} = 9$) from countries with above-average PRV (mean $PRV_{high} = 0.78$) out of 159 countries. Inset, the average claim (± 2 s.e.m.) is shown for subjects from below average ('low', $n_{low} = 1,211$) and above average ('high', $n_{high} = 1,357$) PRV countries. ***$P < 0.01$, two-sided t-tests; not significant (NS), $P > 0.14$. JDB, dishonesty benchmark.

Our experimental tool to measure intrinsic honesty was the 'die-in-a-cup' task[5]. Participants sat in a cubicle and were asked to roll a six-sided die placed in an opaque cup twice, but to report the first roll only. Die rolling was unobservable by anyone except the subject (Extended Data Fig. 1). Participants were paid according to the number they reported. Reporting a one earned the participant one money unit, claiming a two earned two money units, and so on, except that reporting a six earned nothing. Participants understood that reports were unverifiable. Across countries, money units reflected local purchasing power (Supplementary Methods). Thus, incentives in the experiment are the same for everyone, whether they live in a high or low PRV environment.

Although individual dishonesty is not detectable, aggregate behaviour is informative. In an honest subject pool, all numbers occur with a probability of one-sixth and the average claim is 2.5 money units. We refer to this as the 'full honesty' benchmark. By contrast, in the 'full dishonesty' benchmark, subjects follow their material incentives and claim 5 money units.

The die-in-a-cup task requires only a simple non-strategic decision, and it allows for gradual dishonesty predicted by psychological theories of honesty[6,7]. An experimentally tested theory of 'justified ethicality'[7] applied to our setting argues that many people have a desire to maintain an honest self-image. Lying about a die roll jeopardizes this self-image, but bending rules might not. Bending the rules is to report the higher of the two rolls, rather than the first roll as required. Reporting the better of two rolls implies the 'justified dishonesty' benchmark: claims of 0 should occur in $1/36 \approx 2.8\%$ of the cases (after rolling (6, 6)); claims of 1 should occur in $3/36 \approx 8.3\%$ (after (6,1) or (1,6) or (1,1)); claims of 2, 3, 4 and 5 should occur in 13.9%, 19.4%, 25% and 30.6% of cases, respectively.

Figure 1 illustrates the benchmarks, presented as cumulative distribution functions (CDFs). Figure 1 also shows the empirical CDF

for each subject pool. CDFs are far away from full dishonesty. CDFs are also bent away from full honesty and cluster around the justified dishonesty benchmark. One-sample Kolmogorov–Smirnov tests for discrete data reject the null hypotheses of equality of CDFs with the full honesty benchmarks for every subject pool, but cannot reject the null hypothesis in 13 subject pools in comparisons with the justified dishonesty benchmark (Extended Data Fig. 2a).

Deviations from the justified dishonesty benchmark are related to PRV. The CDFs of subject pools from low PRV countries tend to be above the CDF implied by justified dishonesty, and also above those of most high PRV countries. Comparing the distributions of claims pooled for all low and high PRV countries, respectively, reveals a highly significant difference ($n_{low} = 1,211$, $n_{high} = 1,357$; $\chi^2(5) = 40.21$, $P < 0.001$). The pooled CDF from high PRV countries first-order stochastically dominates the pooled CDF from low PRV countries, that is, subjects from low PRV countries are more honest than subjects from high PRV countries. The pooled CDF from low PRV countries also lies significantly above justified dishonesty (Kolmogorov–Smirnov test, $d = 0.103$, $P < 0.001$), whereas the pooled CDF from high PRV countries tends to be slightly below it (Kolmogorov–Smirnov test, $d = 0.058$, $P < 0.001$; Extended Data Fig. 2b and Supplementary Information).

The inset in Fig. 1 illustrates the implications of these patterns in terms of average claims. Subjects from low PRV countries claim 3.17 money units (s.d. = 1.67), that is, 0.67 money units more than under full honesty. Subjects from high PRV countries claim 3.53 money units (s.d. = 1.49) or 1.03 money units more than under full honesty. This difference in claims is significant (t-test, $t = 5.84$, two-sided $P < 0.001$); it also holds at the country level ($n = 23$; Mann–Whitney test, $z = 3.40$, two-sided $P < 0.001$). Justified dishonesty implies an expected claim of 3.47 money units. The average claim in high PRV countries is not significantly different from this benchmark (one-sample t-test, $n_{high} = 1,357$, $t = 1.48$, two-sided $P = 0.140$), but is significantly lower in low PRV countries (one-sample t-test, $n_{low} = 1,211$, $t = 6.35$, two-sided $P < 0.001$).

Next we looked at four measures of dishonesty that can be derived from our task (Supplementary Information) and related them to country-level PRV (Fig. 2). A first measure of dishonesty is mean claim, which ranges from 2.96 money units to 3.96 money units across countries (mean = 3.32 money units, s.d. = 0.26; Kruskal–Wallis test, $\chi^2(22) = 75.2$, $P < 0.001$). PRV and mean claim are strongly positively related (Fig. 2a).

A second measure is the frequency of high claims for reported numbers 3, 4 and 5, which should occur at 50% if people are honest and at 75% under justified dishonesty. Frequencies range from 61.0% to 84.3% (mean = 71.8%, s.d. = 5.7%; $\chi^2(22) = 45.0$, $P = 0.003$). PRV and high claims are strongly positively associated (Fig. 2b).

The incentive is to claim 5, irrespective of the number actually rolled. Thus, the fraction of income maximizers provides our third measure of dishonesty. It is estimated from the fraction of people who reported 5 (highest claim) minus the expected rate of actual rolls of 5 (16.7%). To account for income maximizers who actually rolled a 5, the difference has to be multiplied by 6/5 (ref. 5). The rate of income maximizers ranges from 0.3% to 38.3% across subject pools (mean = 16.2%, s.d. = 9.4%; $\chi^2(22) = 72.4$, $P < 0.001$). Given that PRV captures rule violations for selfish gains and evidence suggesting rule breakers tend to be more selfish[25], we predict that income maximizers is positively correlated with PRV. We find, however, that they are unrelated (Fig. 2c). Thus, a society's PRV does not systematically affect maximal cheating in this experiment.

This result is in contrast to the observation that the estimated fraction of fully honest people and PRV are significantly negatively related (Fig. 2d). The fraction of fully honest people, our fourth measure, is estimated from 'no claim', that is, reports of rolling 6. A report of 6 is most likely honest and honest reports can occur for all numbers. Therefore, the fraction of fully honest people can be estimated as the fraction of people reporting 6 multiplied by six. Across subject
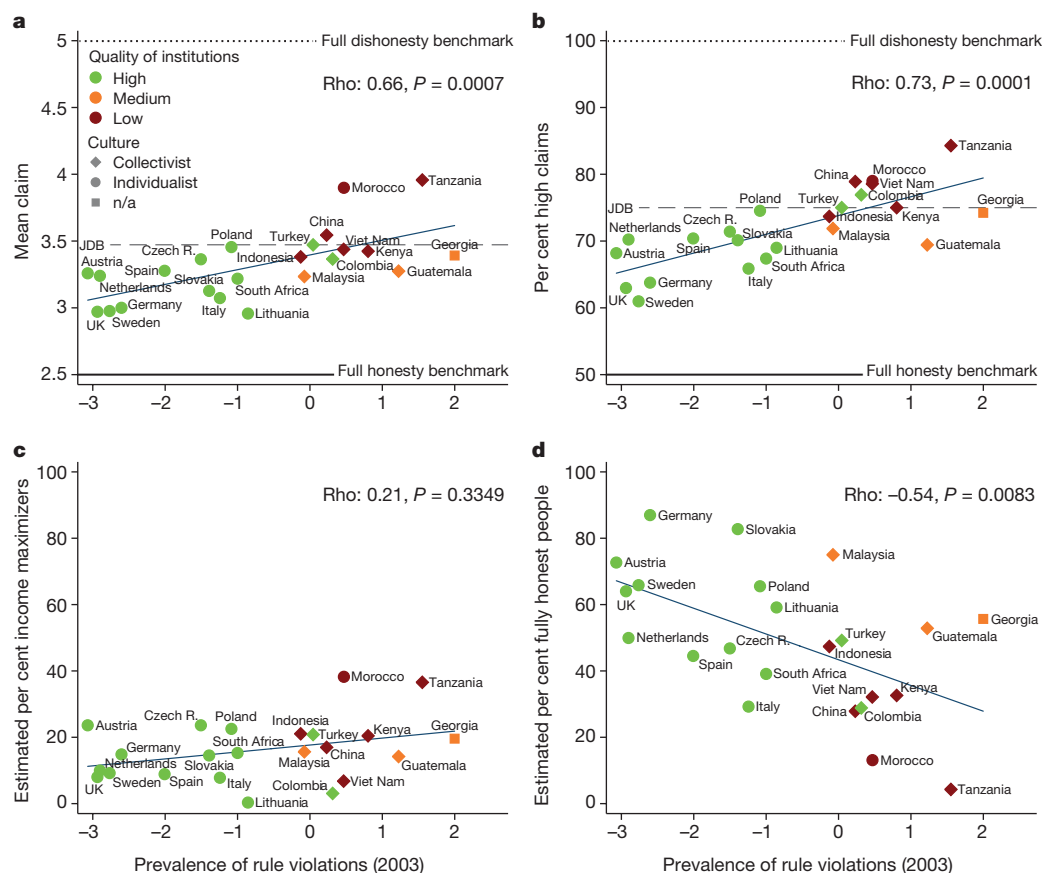
Figure 2 | Measures of honesty and the prevalence of rule violations in society. Shown are scatter plots of four measures of honesty and PRV at country level ($n = 23$); higher values indicate more rule violations. **a**, Mean claim. **b**, Per cent high claims of 3, 4 and 5 money units. **c**, Per cent income maximizers estimated from the fraction of people claiming 5 money units. **d**, Per cent fully honest people estimated from the fraction of people claiming 0 money units. Rho is the Spearman rank correlation based on country means. JDB is the justified dishonesty benchmark (not defined for **c** and **d**). Colour coding refers to the quality of institutions as measured by Constraints on Executives; shapes distinguish between countries classified as collectivist or individualist. PRV is negatively correlated with Constraints on Executives and Individualism (Supplementary Information); this also holds in our sample (Constraint on Executive: rho $= -0.76$, $n = 23$, $P < 0.0001$; Individualism: rho $= -0.79$, $n = 22$, $P < 0.0001$).

pools, fully honest people range from 4.3% to 87% (mean $= 48.9\%$, s.d. $= 21.3\%$; $\chi^2(22) = 42.1$, $P = 0.006$). In societies with high levels of PRV, fewer people are fully honest than in societies with low levels of PRV.

Regression analyses that control for individual attitudes to honesty and beliefs in the fairness of others, as well as for sociodemographics confirm the robustness of our results (Extended Data Table 2 and Supplementary Information). Sociodemographic variables, including gender, are generally insignificant. Stronger individual norms of honesty significantly reduce mean claim, high claim and highest claim. Beliefs in the fairness of others only significantly reduce highest claim.

Results are also robust using the earliest available data related to PRV, corruption in 1996; using 'Government Effectiveness', a proxy for bureaucratic quality and material security[11] and measures of institutional quality that emphasize law enforcement (rules) and not actual compliance and which extend far into the past, so they are most likely not influenced even by parents (Extended Data Fig. 3a–d and Supplementary Information).

Given that the experiment holds the rules and incentives constant for everyone, the large differences across subject pools are also consistent with a cultural transmission of norms of honesty and rule following through the generations[4,15,23] and a co-evolution of norms and institutions[8]. Societies with higher material security, as measured by Government Effectiveness, tend to be more individualist[11], and more individualist societies tend to have less corruption[10]. Consistent with this, we find that subject pools from individualist societies have lower claims than subject pools from more collectivist societies and also from

more traditional societies and societies with survival-related values (Extended Data Fig. 4a–c and Supplementary Information). Further econometric analyses developed in economic literature on culture and institutions[14] applied to PRV support the argument that both the quality of institutions, as well as culture (individualism) are highly significantly (and likely causally) correlated with PRV (Extended Data Table 3 and Supplementary Information).

Taken together, our results suggest that institutions and cultural values influence PRV, which, through various theoretically predicted and experimentally tested pathways[2,11,16,19,20,22–26], impact on people's intrinsic honesty and rule following. Our experiments from around the globe also provide support for arguments that for many people lying is psychologically costly[27–30]. More specifically, theories of honesty posit that many people are either honest, or (self-deceptively[1]) bend rules or lie gradually to an extent that is compatible with maintaining an honest self-image[6,7]. Evidence for lying aversion and honest self-concepts has been mostly confined to western societies with low PRV values[30]. Our expanded scope of societies therefore provides important support and qualifications for the generalizability of these theories—people benchmark their justifiable dishonesty with the extent of dishonesty they see in their societal environment.

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Extended Data Figure 1 | The die-in-a-cup task. Experiment following Fischbacher and Föllmi-Heusi[5]. Participants ($n = 2,568$ from 23 countries) were asked to roll the die twice in the cup and to report the first roll. Payment is according to reported roll, except that reporting a 6 earns 0 money units (across subject pools, money units in local currency are adjusted to equalize purchasing power). We used the same set of dice in all subject pools, and we also tested the dice for bias. The procedures followed established rules in cross-cultural experimental economics. See Supplementary Information for further details. This picture was taken by J.S. in the experimental laboratory of the University of Nottingham.
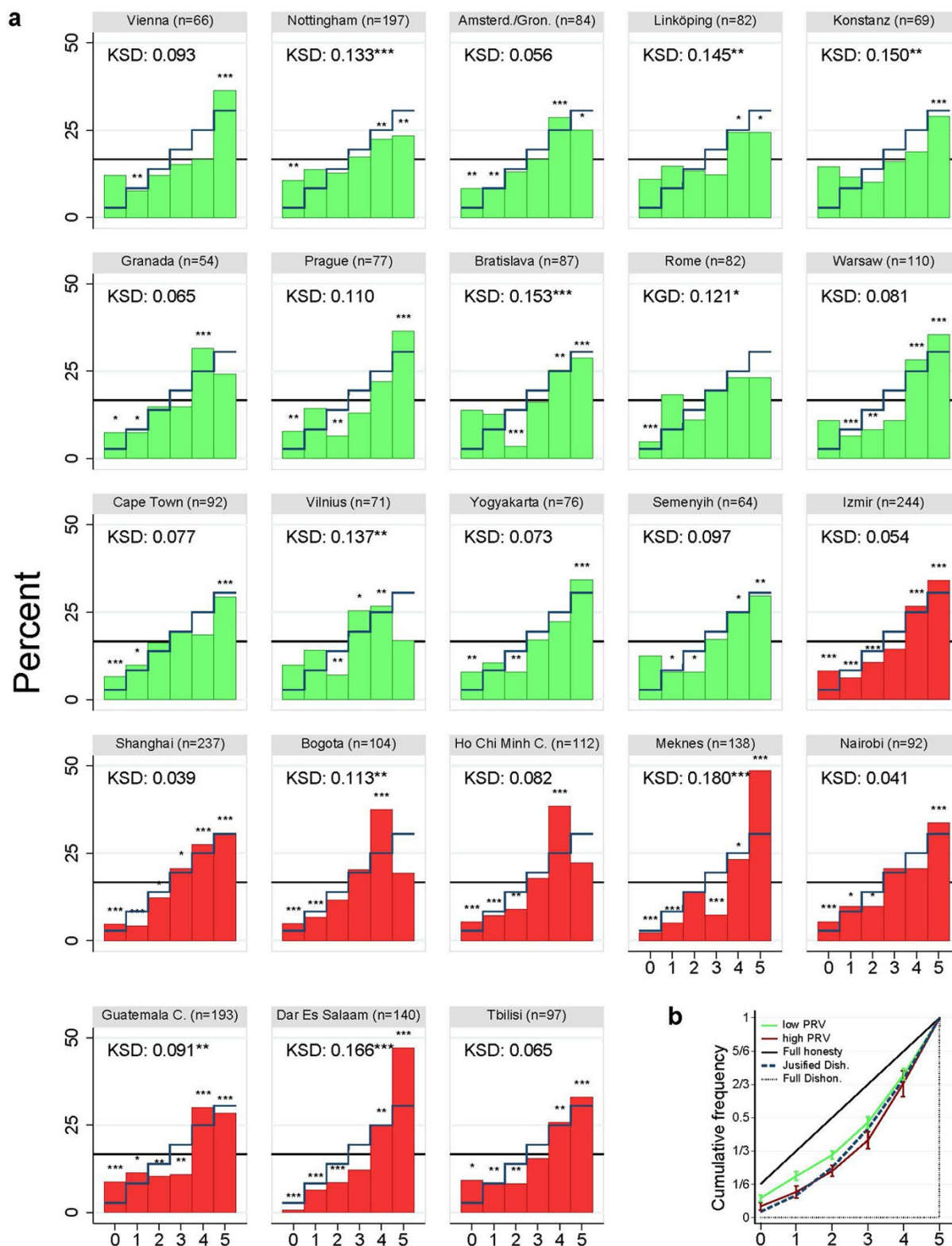
Extended Data Figure 2 | Distribution of claims. a, Distribution per subject pool. Subject pools are ordered by country PRV. The first 14 subject pools (in green) are from 'low' (below-average) PRV countries; the last 9 subject pools (in red) are from 'high' (above-average) PRV countries relative to the world sample of 159 countries. The horizontal line refers to the uniform distribution implied by honest reporting and the step function to the distribution implied by the justified dishonesty benchmark (JDB). For each subject pool, we report the one-sample Kolmogorov–Smirnov test (KS) for discrete data in comparison with JDB (KSD is the KS d value). Asterisks above bars refer to binomial tests comparing the frequency of a particular claim with its predicted value under a uniform distribution. **b**, Cumulative distributions for pooled data from subject pools from low and high PRV countries, respectively. See Supplementary Information for further information. *$P < 0.1$, **$P < 0.05$, ***$P < 0.01$.
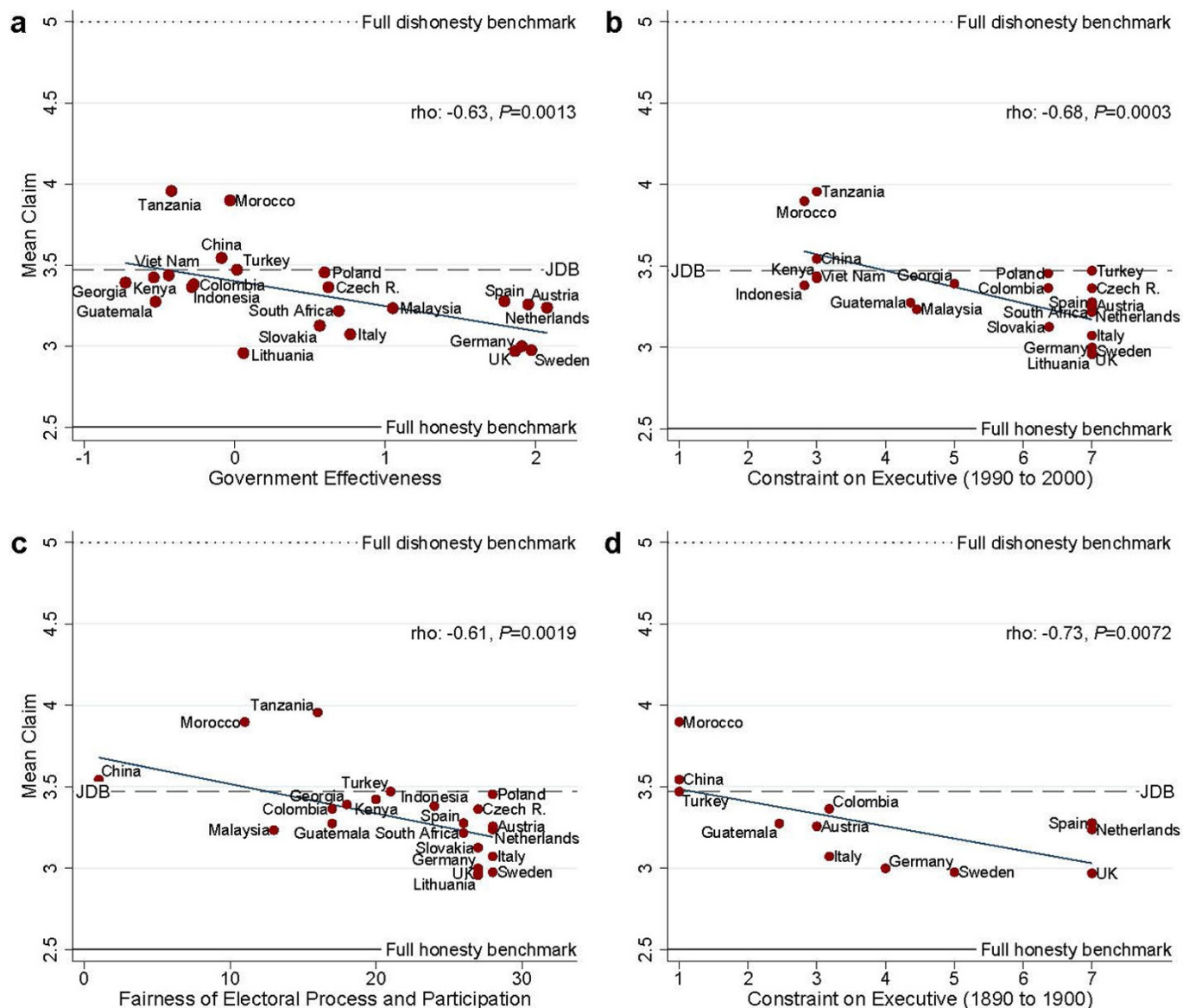
Extended Data Figure 3 | Association between indicators of institutional quality and intrinsic honesty as measured by mean claim. The solid line is a linear fit. The JDB is indicated by a dashed line. Rho indicates Spearman rank order correlation coefficients. **a–d**, Mean claim is negatively related to Government Effectiveness (**a**), Constraint on executive (**b**), 'fairness of electoral process and participation' (**c**) and Constraint on Executive (**d**) using the averages of the years 1890 to 1900 as a measure for distant institutional quality. See Extended Data Table 1 and Supplementary Information for data description, references and further analyses.
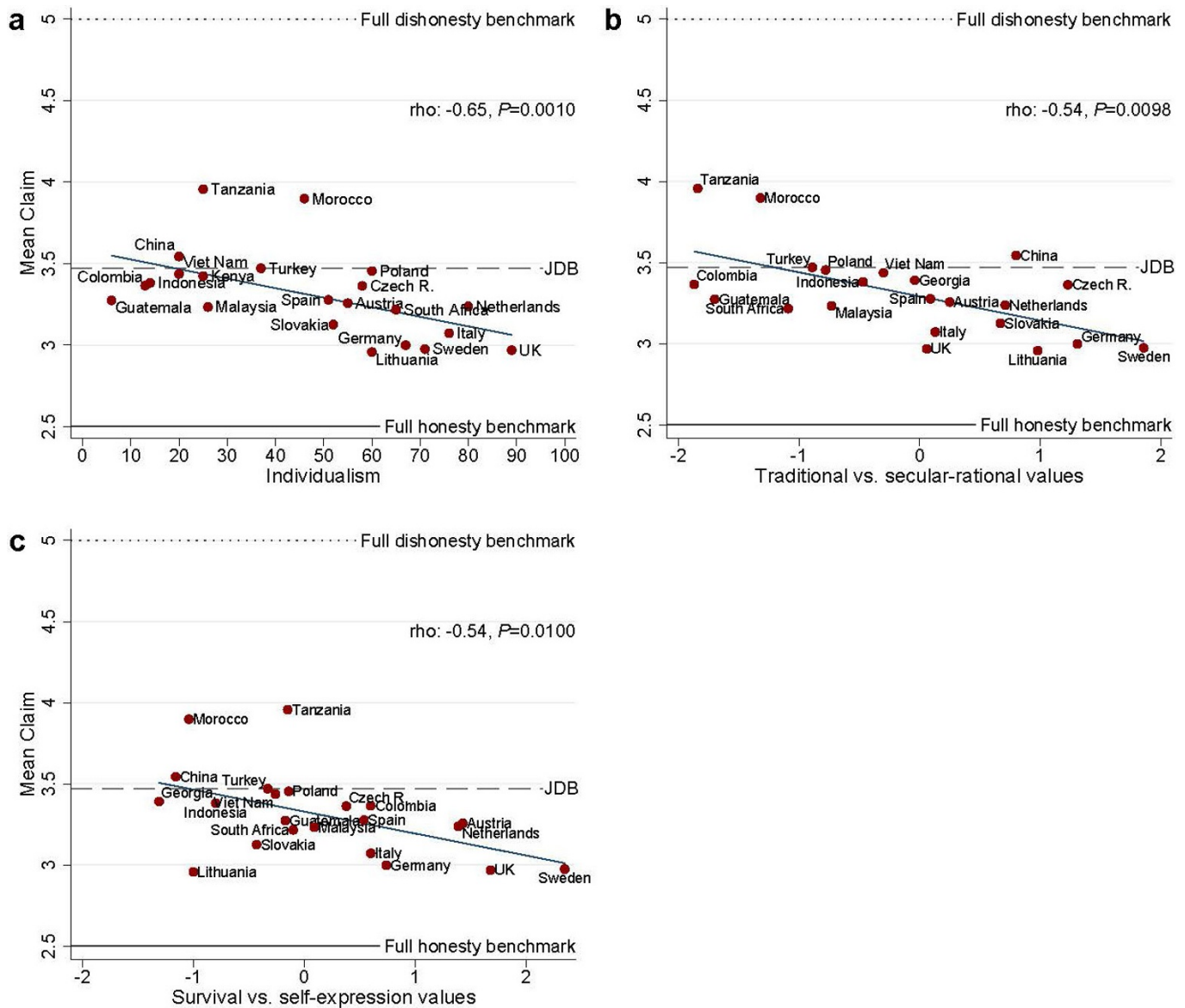
Extended Data Figure 4 | Association between cultural indicators and intrinsic honesty as measured by mean claim. The solid line is a linear fit. The JDB is indicated by a dashed line. Rho indicates Spearman rank order correlation coefficients. **a–c**, Mean claim is negatively related to individualism (**a**), traditional versus secular-rational values (**b**), and survival versus self-expression values (**c**). See Extended Data Table 1 and Supplementary Information for data description, references and further analyses.

Extended Data Table 1 | Measures of prevalence of rule violations, economic and institutional variables, as well as cultural background of our subject pools

	Indicators of rule violations				Institutional and economic indicators			Cultural Indicators		
	Control of Corruption	Shadow Economy	Political rights	Prevalence of Rule Violations	Constraint on Executive	Government Effectiveness	GDP per capita	Individualism	Traditional vs secular-rational values	Survival vs. self-expression values
Austria	2.1	10	40	-3.1	7.0	2.0	23.3	55	0.3	1.4
China	-0.4	13	3	0.2	3.0	-0.1	1.5	20	0.8	-1.2
Colombia	-0.2	38	23	0.3	6.4	-0.3	5.3	13	-1.9	0.6
Czech R.	0.4	19	37	-1.5	7.0	0.6	14.1	58	1.2	0.4
Georgia	-0.6	66	19	2.0	5.0	-0.7	1.8	n.a.	-0.0	-1.3
Germany	1.9	16	38	-2.6	7.0	1.9	22.1	67	1.3	0.7
Guatemala	-0.7	51	22	1.2	4.4	-0.5	3.4	6	-1.7	-0.2
Indonesia	-1.0	19	26	-0.1	2.8	-0.3	2.1	14	-0.5	-0.8
Italy	0.5	27	38	-1.2	7.0	0.8	20.7	76	0.1	0.6
Kenya	-0.8	35	18	0.8	3.0	-0.5	1.1	25	n.a.	n.a.
Lithuania	0.3	32	38	-0.9	7.0	0.1	8.2	60	1.0	-1.0
Malaysia	0.4	31	17	-0.1	4.5	1.1	7.2	26	-0.7	0.1
Morocco	-0.2	35	17	0.5	2.8	-0.0	2.3	46	-1.3	-1.0
Netherlands	2.1	13	40	-2.9	7.0	2.1	23.7	80	0.7	1.4
Poland	0.4	28	37	-1.1	6.4	0.6	7.6	60	-0.8	-0.1
Slovakia	0.3	18	36	-1.4	6.4	0.6	9.7	52	0.7	-0.4
South Africa	0.3	28	36	-1.0	7.0	0.7	6.0	65	-1.1	-0.1
Spain	1.4	22	39	-2.0	7.0	1.8	17.6	51	0.1	0.5
Sweden	2.2	19	40	-2.8	7.0	2.0	21.1	71	1.9	2.4
Tanzania	-0.8	57	22	1.6	3.0	-0.4	0.7	25	-1.8	-0.2
Turkey	-0.2	32	24	0.0	7.0	0.0	6.8	37	-0.9	-0.3
U. Kingdom	2.1	13	40	-2.9	7.0	1.9	20.2	89	0.1	1.7
Vietnam	-0.5	15	2	0.5	3.0	-0.4	1.0	20	-0.3	-0.3
Sample Mean	0.4	28	28	-0.7	5.5	0.5	9.9	46	-0.1	0.1
World Mean	0.0	33	24	0.0	4.5	-0.0	7.8	39	-0.3	0.0
World Min	-1.8	9	-2	-3.1	1.0	-2.3	0.3	6	-2.1	-1.7
World Max	2.5	68	44	2.8	7.0	2.2	41.7	91	2.0	2.3
World N	199	161	192	159	161	196	183	102	94	94

Data are country-level averages. Detailed descriptions, data sources and references are in the Supplementary Information. Control of corruption is a standard measure of corruption; higher values indicate more corruption. Shadow economy is measured in percent of the size of a country's gross domestic product (GDP). Political rights measures the fairness of electoral processes, political pluralism and participation, and the functioning of government; higher scores indicate higher level of political rights. Prevalence of rule violations is our self-constructed indicator based on a principal component analysis of control of corruption, shadow economy and political rights. Government Effectiveness measures the quality of public service, independence from political pressure and policy implementation; higher values indicate higher effectiveness. Constraint on Executive measures the institutionalised limitations on the arbitrary use of power by the executive; higher values indicate better control. GDP per capita (average of 1990 to 2000) is measured in units of US dollars $1,000 (purchasing power parity (PPP)). Individualism measures how important the individual is relative to the collective; higher values indicate higher individualism. Traditional versus secular-rational values measures the importance of values such as respect for authorities; higher scores indicate more secular values. Survival versus self-expression values measure the importance of values surrounding physical and economic security; lower scores indicate survival values are relatively more important than self-expression values. World mean and sample mean are the respective averages of country means.

Extended Data Table 2 | Regression analysis of societal and individual determinants of dishonesty

	(1) Claim	(2) High Claim (Numbers 3, 4, 5)	(3) Highest Claim (Number 5)	(4) No Claim (Number 6)
PRV in 2003	0.115***	0.030***	0.012	-0.016***
	(0.033)	(0.007)	(0.010)	(0.005)
Individual norms of honesty	-0.055***	-0.012***	-0.014**	0.002
	(0.018)	(0.004)	(0.006)	(0.002)
Individual beliefs in fairness (of others)	-0.075	-0.012	-0.050**	-0.004
	(0.085)	(0.030)	(0.021)	(0.009)
Age	-0.005	-0.002	0.003	0.002
	(0.011)	(0.003)	(0.004)	(0.001)
Female	-0.108*	-0.020	-0.019	0.014
	(0.058)	(0.016)	(0.020)	(0.012)
Middleclass	-0.064	-0.021	-0.001	0.002
	(0.106)	(0.033)	(0.022)	(0.018)
Urban	-0.052	-0.027	-0.013	-0.006
	(0.055)	(0.016)	(0.014)	(0.013)
Economics Student	0.122	0.042	-0.009	-0.023
	(0.099)	(0.028)	(0.032)	(0.016)
Religious	-0.061	-0.030	0.023	0.018
	(0.090)	(0.022)	(0.023)	(0.014)
% known in session	0.004	0.001	0.002**	0.000
	(0.003)	(0.001)	(0.001)	(0.001)
Constant	4.080***	0.925***	0.376***	-0.006
	(0.315)	(0.073)	(0.112)	(0.044)
Test for joint significance of Socio-demographic controls	$\text{Chi}^2(7)=9.18$	$\text{Chi}^2(7)=12.37$*	$\text{Chi}^2(7)=6.42$	$\text{Chi}^2(7)=11.88$
N	2284	2284	2284	2284
R^2	0.022	0.018	0.014	0.010

The explanatory variables are the scores of a country's prevalence of rule violations in 2003; participants' individual norms of honesty (based on individual opinions about justifiableness of various acts of cheating; higher scores indicate stronger norms); participants' beliefs in fairness (the perceived fairness of most others; a higher score indicates a higher belief). Sociodemographic controls include age; dummies for sex, urban residency, middle class status, being an economics student, and being religious; and the percentage of other participants known to a participant. Detailed data description and rationale are in the Supplementary Methods. Chi-square tests reveal that sociodemographic controls are jointly insignificant in all models except model 2, where they are weakly significant. The estimation method is ordinary least squares (OLS) with bootstrapped standard errors clustered on countries. The results are robust to various specifications (Supplementary Information). *$P < 0.10$, **$P < 0.05$, ***$P < 0.01$.

Extended Data Table 3 | Institutional and cultural determinants of PRV

	(1)	(2)	(3)	(4)	(5)	(6)	(7) IV: Sett. Mortality	(8) IV: Gram. Rule	(9) IV: Gen. Dist.	(10) IV: Gen. Dist. + Gram. Rule
Const. on Executive (1990 to 2000)	-0.25*** (0.05)		-0.23*** (0.07)	-0.21*** (0.05)	-0.09*** (0.03)	-0.25*** (0.05)	**-0.72*** (0.12)**	-0.25** (0.11)	-0.23*** (0.08)	-0.25** (0.11)
Individualism	-0.03*** (0.00)	-0.03*** (0.01)	-0.02*** (0.01)	-0.02*** (0.00)	-0.01** (0.00)	-0.03*** (0.00)		**-0.06* (0.03)**	**-0.05** (0.03)**	**-0.06** (0.03)**
Const. on Executive (1890 to 1900)		-0.26*** (0.06)								
Primary Education (1930)			-0.02*** (0.00)					0.01 (0.02)	0.00 (0.02)	0.01 (0.02)
GDP p. capita (PPP in $ 1000)				-0.07*** (0.01)						
Gov. Effectiveness (2000)					-1.10*** (0.07)					
Ethnolinguistic Fractionalization						0.41 (0.38)				
Constant	2.14*** (0.26)	1.67*** (0.17)	2.20*** (0.30)	2.02*** (0.22)	0.59*** (0.19)	1.91*** (0.33)	3.79*** (0.53)	2.69*** (0.56)	2.67*** (0.51)	2.68*** (0.51)
Controls for Legal Origin	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	96	44	79	96	96	96	60	59	79	59
R^2	0.681	0.810	0.785	0.824	0.904	0.685	0.131	0.633	0.673	0.652
1st-stage F-stat							12.4***	60.3***	51.7***	68.4***
Overid test p-value										0.907

Dependent variable is PRV in 2003. Our approach follows recent advances in the economic literature on institutions and culture (see Supplementary Information for details and references). Models 1 to 6 are OLS; models 7 to 10 use instrumental variables to identify causal relations. All regressions control for legal origin (French, British, German, Scandinavian). Model 1 shows that both a frequently used measure for institutional quality (Constraint on Executive) and a frequently used measure for culture (Individualism) are significantly correlated with PRV. Model 2 shows that past institutional quality (Constraint on Executive in 1890–1900) can have long-lasting effects on PRV. Models 3 to 6 control for important variables proposed in the literature. Models 7 to 10 report the results from instrumental variable estimation (instrumented variables are in bold); the instruments are assumed to have no direct impact on PRV but only on the explanatory variable, and thereby allow identifying a causal effect of either institutions (as measured by Constraint on Executive) or culture (as measured by Individualism) on PRV. Model 7 instruments institution with 'settler mortality' in European colonies (1600–1875). To preserve degrees of freedom we do not include Individualism. Model 8 uses language (grammatical rules) and model 9 uses genetic distance as an instrument for culture. Model 10 uses both instruments. Models 7 to 10 suggest causal effects of both the quality of institutions and culture (Individualism) on PRV. *$P < 0.10$, **$P < 0.05$, ***$P < 0.01$.