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The Democratic Transition

Short run and long run causality between income and the Gastil index

Martin Paldam, School of Economics and Management, Aarhus University, Denmark[1]
Erich Gundlach, GIGA and Hamburg University, Germany[2]

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Abstract
The paper considers the transformation of the political system as countries pass through the Grand Transition from being a poor developing country to become a wealthy developed country. In the process most countries change from an authoritarian to a democratic political system, as measured by the Gastil index from Freedom House. The basic pattern of correlations reveals that a good deal of the short- to medium-run causality appears to be from democracy to income. But the long-run causality is from income to democracy, as shown by instrumenting income with a set of extreme measures of biogeography. The long-run result survives various robustness tests. It is explained how the Grand Transition view resolves the seeming contradiction between the long-run and the short- to medium-run effects.

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1. Address: School of Economics and Management, Aarhus University, Bartholins Allé 10, DK-8000 Aarhus C, Denmark. E-mail: mpaldam@econ.au.dk. Homepage: www.martin.paldam.dk
2.Address: GIGA German Institute of Global and Area Studies/Institute of Asian Studies, Rothenbaumchaussee 32, 20148 Hamburg, Germany. E-mail: gundlach@giga-hamburg.de. Homepage: www.erichgundlach.de

1. Introduction

It has often been discussed how economic and political developments interact during the *Grand Transition* of a country from being a poor LIC to becoming a wealthy DC. One part of the Grand Transition is the *Democratic Transition*, where countries change from authoritarian to democratic political systems in the process of development. We consider possible differences in the direction of causality between income and democracy in the short and the long run.[1)]

1.1 A first view of the democratic transition

Two variables are used to study the Democratic Transition:[2)] *Income*, y, is the natural logarithm of GDP per capita from the Maddison data set. *Democracy*, G, is the average of democratic rights and civil liberties of the Gastil index from Freedom House covering the period 1972-08. G is scaled from 7 for dictatorship to 1 for democracy. The data set contains N = 5,367 pairs of (y, G)-observations. They are shown on Figure 1.

The figure is calculated by a three-step procedure: they are merged; they are sorted by income; and all 5,118 moving averages of M = 250 are calculated for all y and G. Figure 1 is the scatter of the resulting pairs of moving averages. It is interpreted as the first view of the democratic transition. The graph shows a transition curve with the following properties:[3)]

T1: For $y \leq 7$ there is a flat *traditional* level $G_T \approx 5\frac{1}{2}$ of authoritarian rule and for $y \geq 9\frac{1}{2}$ there is a flat *modern* level $G_M \approx 1\frac{1}{4}$ of democracy.

T2: The *transition* occurs for $7 < y < 9\frac{1}{2}$, where G falls by 4 points: The fall has two parts: A rocky part for $7 < y < 8\frac{3}{4}$ and a steep part for $8\frac{3}{4} < y < 9\frac{1}{2}$, with ¾ of the transition occurring in the latter part.[4)]

The y-scale covers 4½ log points, but the transition occurs over an income rage of 2.5 log points from y = 7 to 9.5, and amounts to 4 Gastil points. Thus, the transition amounts to 2/3 of the whole of the G-scale. For the analysis below we note that when the transition is estimated by a linear approximation a coefficient of about -1.0 G point is needed per log point of income to explain the whole of the transition.

One additional observation that goes beyond Figure 1 is:

T3: Most DCs, with $1 \leq G < 1½$ today, had authoritarian political systems 200 years ago, when they had incomes levels like in Africa today.[5)]

The transition curve thus has four parts: (i) a flat *traditional* part, (ii) a rocky falling part, (iii) a steep falling part, and (iv) a flat *modern* part. Parts (i)-(iv) account for 24.1%, 46.3%, 16.4%, and 13.2% of the observations, respectively.

1.2 The causality problem, the literature, and content

The causality suggested by this interpretation has remained controversial for five reasons, where the first is general and the remaining four reasons are specific to the problem at hand.

(1) Causality is undeniably a concept which is fraught with deep problems. Our paper attempts to sort out causality, by using a handful of techniques. (2) The two data series, y and G, have different statistical properties that make their interaction tricky to analyze. (3) Empirical studies have produced contradictory results. (4) Different theories give different priors about the direction of causality. (5) The US-centricity of the literature is a problem because the US is an exception with democracy ever since it won its independence in 1783, when the US income level was much like in Kenya today.

The literature on the relation between economic and political development is large. Paldam and Gundlach (2008) provide a critical survey, so we shall be brief at present. A substantial part of the literature deals with the relation between democracy and growth. Recently, Doucouliagos and Ulubaşoğlu (2008) quantitatively surveyed 84 studies in the field and concluded that no clear causal effect has been found.[6)]

The transition observations go back to Lipset (1959) and Moore (1966). They have given rise to a large literature explaining the channels through which the transition works. Recently a number of papers have looked at the short run relation with mixed results: Persson and Tabellini (2006), Booroah and Paldam (2007) and Gundlach and Paldam (2009) find a clear relation, while Acemoglu et al (2008) reject a short- to medium-run causal relation.[7)]

The paper proceed as follows: Section 2 looks at the properties of the Gastil Index. Section 3 shows that while income and democracy are strongly correlated in the short to medium term, Granger causality tests are weak. Section 3 establishes the central long-run result, using a long-run IV-test developed and explained in Gundlach and Paldam (2009), where it is applied to the Polity index for democracy (see Marshall and Jaggers, 2009). Section 5 suggests how the Grand Transition view may help to resolve the seeming contradiction between the long-run and the short- to medium-run results. Section 6 concludes.

Some extra tables are given in the Appendix, which also compares the results for the Polity and the Gastil index.

2. The Gastil data 1972-2008: All *G*s, *N* = 6,501

The Gastil-data covers 37 years, but the Grand Transition typically lasts a couple of centuries. Consequently, we apply the *equivalence assumption* that the long-run pattern of democracy and income is the same as the cross-country pattern. This assumption holds for the Polity index, so it is taken as the default.

The Gastil index uses a scale with 13 possible values. Both democratic rights and civil liberties are given as an integer from 1 to 7, and the averaging adds the 6 midpoints. The choice of scale reflects that no "natural" scale exists for a democracy index. It is made from a set of different indicators by aggregation, with the resulting number rounded to the nearest integer. The aggregation procedure seems reasonable, but it is basically arbitrary.

2.1 Some descriptive statistics

Figure 2 shows the path of the cross-country average of the Gastil index. It falls from 4.5 to 3.25 or by about 1.25 points, so democracy has increased by 1.25/4.5 = 0.28 or 28% in 1972-2008. The fall is fairly linear, but with the expected large step in the years 1989-92.

Table 1 gives some basic descriptive statistics. Overall there are 6,501 observations, which allow us to calculate 6,298 first differences. The table shows that the first difference is zero (constant index) in 76.3% of all years. Figure 3 shows that the Gastil data have a two-peaked distribution: The extreme political systems are the most common ones: Full democracy (1 to 2) occurs in 32% of the cases, and dictatorship (5 to 7) occurs in 41% of the cases. The democracy peak is more well-defined than the dictatorship peak.

The distribution of the changes is shown in Table 2. It is a distribution with a tall peak at zero, but with long tails to both sides. Due to the long tails the average change (up and down) is 0.75 points, so it is a change of 20% (0.75/3.84 = 0.20).

2.2 The distribution of the spells of a constant Gastil index

Appendix Table A2 shows the full spell distribution. A summary is given in Figure 4. It shows that if a country has a Gastil score of 1 (for full democracy), it lasts 14 years on average. If it has a score of 4, it lasts only 2 years on average. Thus, it is difficult to reach political system stability in the middle, but fairly easy at the ends, especially for full democracy. Consequently the Gastil index tends to stay constant at the two ends of the distribution most of the time.

The included line with the endpoint corrections takes into account that many spells are truncated by the sample. It is likely that some spells started well before 1972 and unlikely that all spells end in 2008. The Polity index can be used to assess the spells before 1972, but it is anyone's guess how long the spells will continue that are truncated in 2008.[8)]

2.3 Gastil vs Polity: The uncertainty in the measure for the degree of democracy

The Gastil (G) and the Polity (P) indices both try to measure the degree of dictatorship/democracy. The indices compete, and they differ as shown on Figure 5. The figure points to three observations: (1) The G-P relation is weak within short intervals on any of the two axes, especially for high levels of dictatorship.[9)] (2) The two data sets have a non-linear relation. (3) The point scatter suggests considerable measurement error.

A set of polynomial approximations is used to estimate the joint error of the Polity and the Gastil index:

(1) $G = a + b_1 P + b_2 P^2 + \ldots b_n P^n + u$, for n = 1 ,…, 7

The standard error of the regression falls to 0.72 for n = 4 and does not fall any further for higher n's. If the measurement error is the same for G and P, this gives an assessed measurement error of $0.72/\sqrt{2} \approx 0.51$ for each democracy index. Thus the 95% uncertainty interval around the true value of the Gastil index equals $\hat{G} \in G \pm 1$. This suggests that democracy indices are generally poorly measured variables.

3. The short to medium run: Consistent (y, G)-set, N = 5,367

The income data used are from the Maddison data set. Consistent (y, G)-data exist for 5,367 observations for 128-156 countries in 1972-2008.[10)] The demand for overlap thus causes a loss of 17.4% of the 6,501 Gastil data, mainly because of small countries not covered by the Maddison data. This section looks at links between the income and democracy data. Most of the analysis uses correlation analysis, but a set of formal Granger causality tests is also reported.

3.1 Comparing averages of income and Gastil for every year, 1972 to 2008

Figure 6 shows the joint path of the cross-country averages of income and democracy for each year for the available countries. The number of countries changes from N_c = 128 at the start to N_c = 156 at the end, but still a clear joint path of the two variables appears. The largest change in N_c, is from 1990 to 1991, when the USSR and Yugoslavia dissolved.

The average curve changes -1 Gastil points on the vertical axis for 0.5 log points on the horizontal axis. Section 1.1 showed that this G-change is unusually large. The most likely explanation seems to be the victory of the democratic side in the cold war.[11)]

3.2 The annual cross-country correlation of income and Gastil

Figure 7 shows the cross-country correlation of income and democracy for each individual year in the sample. The correlation is statistically significant far above the 5% level, and the movements in the coefficient of correlation are small,[12)] though a jump occurs in 1991 as expected. The average correlation is -0.586 ±0.018, where the interval of uncertainty is twice the standard error of the 37 correlations.[13)] Taken together, Figures 1, 6 and 7 suggest that our measures of income and democracy are strongly correlated across countries and over time.

3.3 Leads and lags in the cross-country income-democracy correlation

The consistent (y, G)-data covers 37 years, so a matrix of (36 x 36) = 1,296 correlations between income and democracy can be calculated. Table 3 shows how these correlations have been organized to generate the correlogram of Figure 8. There is only one correlation that has democracy leading income by 36 years ("Gastil first"), namely the correlation of the income data for 2008 with the Gastil data for 1972. Two correlations have democracy leading income by 35 years, etc. The black line in Figure 8 represents the average of the correlation coefficients that can be calculated for a given time interval between the two measures, which is surrounded by twice the standard error of the correlations for the lag given.

The basic idea of the correlogram is to see how the cross-country correlation between democracy and income is affected by alternative time intervals. If the correlation is higher when the measure of income precedes the measure of democracy ("Income first"), causality is more likely to run from income to democracy; and if the correlation is higher when the measure of democracy precedes the measure of income ("Gastil first"), causality is more likely to run from democracy to income.

The first point to note is that all 69 average correlation coefficients are (numerically) larger than 0.4, so the relation is statistically significant for all time intervals considered. This can only mean that there is a long-run relation between income and democracy (or a third factor that drives both data series). In our reading, Figure 8 confirms the validity of a cross-country approach which is used to study the long-run (y, G)-relation in Section 4.

Secondly, the averages of the correlation coefficients are significantly different for the two sections of Figure 8. The correlation peaks on the left hand side, where the Gastil index precedes income with a time interval of 17 years. Figure 8 indicates a medium-run causality from democracy to income. When democracy changes so does income. However, it often happens with a long lag.[14)] Before this result is further discussed, we look at a formal test.

3.4 The Granger causality tests[15)]

Table 4 reports results based on the equations:

(2a) $$G_{ti}^{T} = \beta_i + \beta_1 G_{t-1i}^{T} + ... + \beta_n G_{t-ni}^{T} + \beta_{n+1} y_{t-1i} + v_{ti},$$ test for $y \rightarrow G$

(2b) $$y_{ti}^{T} = \beta_i + \beta_1 y_{t-1i}^{T} + ... + \beta_n y_{t-ni}^{T} + \beta_{n+1} G_{t-1i} + v_{ti},$$ test for $G \rightarrow y$

which are estimated with country-fixed effects, β_i, for alternatively time-averaged data, T = 3, 5 and 7, for 156 countries in 1972-2006. The Granger causality test is an F-test of the statistical significance of the inclusion of the additional lagged explanatory variable, y_{t-1} in equation (2a) and G_{t-1} in equation (2b).

The table reports a total of 12 Granger causality tests, of which only two are significant. It is the short run tests using 3-year lags that are significant from democracy to income. For time intervals of 5-year averages and the 7-year averages, the test results do not point to Granger causality either way.

These results do not provide strong evidence in favor of one direction of causality over time intervals of up to 15 years. They reveal that the short to medium run is probably not well suited to identify the main direction of causality between income and democracy. Income and democracy may be affected by many variables in the short and medium run, which may overlay their direct relation. In previous Granger causality testing, first by Brunk, Caldeira, and Lewis-Beck (1987) and then by Paldam and Gundlach (2008), the dominating direction of causality is found to be from income to democracy. Obviously, something complex is going on in the data.

4. Causality tests for the long run: IV calculations with DP-instruments

The long run causality test is an IV-estimate, which uses a set of rather extreme DP (for development potential) variables as instruments. However, the analysis goes one step further by comparing the IV estimate with the corresponding OLS estimate to see if the causal relation explains the full transition path. The estimating equations are discussed in section 4.1 and the DP-variables are briefly surveyed in 4.2. The test results are reported in section 4.3, which covers one cross-section (1995), and in section 4.4, which extends the analysis to all years of the sample. Sections 5.5 and 5.6 bring various robustness tests.

4.1 The two models of the test

Our test for long-run causality uses two equations:

(3) $G_i = \beta_0 y_i + \alpha + u_i$ (OLS regression), and

(4) $G_i = \beta_0^{DP} y_i^{DP} + \alpha + u_i$ (second stage IV regression),

where β_0 catches the size of the potential effect of *y* on *G* and β_0^{DP} catches the causal effect $y \Rightarrow G$ if the instruments are not weak.

Thus the validity of the IV-regression has to be examined before the results can be interpreted. To this end Table 5 reports three tests: The Sargan test for overidentification tests the joint null hypothesis that the instruments are valid and correctly excluded from the estimate. The Cragg-Donald F-test analyzes strength of the instruments. It rejects weak instruments if the CD-statistic is above the critical value (10% test size). Finally, a reverse causality CD-test is used to see if the DP-instruments also work as instruments for *G* in an IV-regression $G \Rightarrow y$.[16)]

The logic of our test is as follows. Given that the IV-estimates are not rejected as weak in the first stage, the second stage estimate of (4) is used to determine if there is causality from *y* to *G*. If $\beta_0^{DP} \neq 0$ cannot be rejected, we conclude that $y \Rightarrow G$. Then we assess if the size of the causal effect can fully explain the size of the observed transition. This is the case if three (somewhat overlapping) conditions are met. (i) The causal effect β_0^{DP} has the same size as the OLS-effect, which is tested by the Hausman C-test of parameter homogeneity. (ii) The joint estimate of β has a size of about -1.0, which is needed to explain the full transition as reported in the introduction. (iii)The instruments turn out to be weaker in the reverse causality specification ($G \Rightarrow y$).

4.2 Some candidates for the set of DP-variables

The historical (pre-industrial) *development potential* (DP) of countries can be proxied by measures of biogeography. The DP-variables are used to instrument modern income levels, which reflect long run cross-country differences in the rate of economic growth. The instrumented cross-country set of incomes is unaffected by the realized degree of democracy, hence it can be used to identify an unbiased causal effect on democracy. The set of DP-variables has been used as instruments in Gundlach and Paldam (2009). Since the DP-variables appear rather extreme, they need to be justified.

Many theories have been presented to suggest what causes development in the long run, but few of these long-run theories are open to rigorous empirical investigation. The most suggestive empirical approaches are probably Boserup (1965) with a focus on agricultural development and Diamond (1997) with a focus on geographic and biological constraints. Other influential studies are Hall and Jones (1999), Pommeranz (2000), Sachs and Warner (2001), Acemoglu, Johnson, and Robinson (2001), Williamson (2006), and Clark (2007).

Diamond's book inspired Hibbs and Olsson (2004, 2005) to compile an amazing set of DP-variables, which have been supplemented as suggested by other recent empirical studies. Two biological variables measure the conditions that prevailed in various regions of the world at the time of the Neolithic Revolution about 10,000 years ago, with Europe as the most favorable region and Sub-Saharan Africa as the least favorable. One measure is the number of domesticable big mammals (*animals*) that are believed to have existed in prehistory, which goes from zero for Sub-Saharan Africa to nine for Europe. The other is the number of annual perennial wild grasses (*plants*) known to have existed in prehistory, which goes from less than five for Sub-Saharan Africa to more than 30 for Europe.

The geographic variables measure the specific conditions that have constrained or enabled the spread of the Neolithic innovations to neighboring regions. One measure is based on a ranking of climates according to how favorable they are to agriculture (*climate*). A second measure captures the degree of east-west orientation as the relation between the east-west distance and the north-east distance (*axis*) of a country, which eases the flow of early agricultural innovations. A third measure calculates the size of the landmass to which a country belongs, such as belonging to Eurasia vs. being a small island (*size*).

Averages and first principal components of these measures are used as instrumental variables. Moreover, an alternative set of DP-variables related to geography is also expected to affect the income level of a country through various channels. For instance, the number of frost days per winter (*frost*) may affect the productivity of agriculture, the potential for malaria transmission (*maleco*) may affect the accumulation of human capital, and the proportion of a country that is close to the open sea (*coast*) may affect the possibilities for international trade.

Appendix Table A1 lists all the DP-variables and their sources. Most of the variables are measuring exogenous geographical facts and the biological preconditions before the start of recorded history. So these variables can be taken to be truly exogenous conditions for long-run development. Olsson and Hibbs (2005) demonstrate a statistically significant correlation of the DP-variables with modern cross-country levels of income. This statistical property and the fact that most of our DP-variables are exogenous in the perspective of a thousand years or more allow us to use them as instruments for modern income levels; i.e. to predict income levels that are independent of the level of democracy between 1972 and 2008.[17)]

Diamond (1997) discusses development in the world until about the year 1500 – that is, before the medium-term growth rate reached 0.2% in any country. A take-off to modern economic growth (Rostow, 1960) occurred from about 1800, when an increasing number of countries acquired medium-term growth rates in excess of 1%. The unified growth theory by Galor (and various coauthors) is an attempt to integrate the pre-take-off period with modern economic growth into one consistent theory, see Galor (2005) for a survey. Unified growth theory claims that development becomes inevitable once technological change starts back in prehistoric times and human capital is being accumulated until a critical mass is reached that allows the economy to take off from Malthusian stagnation to a modern growth regime. Thus, unified growth theory provides a theoretical justification for the use of the extreme DP-variables as our instruments in our empirical specifications.

4.3 Our basic cross-country result: Income can fully explain democracy in the long run

The DP-variables are time invariant and available for 100-143 countries. Table 5 reports the estimates of equations (3) and (4) for different combinations of DP-variables. The two regressions in the same column are always for the same sample of countries.

All the various combinations of the DP-variables work rather well as instruments for income. The first stage partial R-squared is reasonably high, the Cragg-Donald test statistic (first stage F-statistic) is well above the critical value for weak instruments. The Sargan test for overidentification does not signal that one of the instruments may directly belong into the estimation equation, except in column (2). All five instrumentations perform quite similarly in terms of the size and the statistical significance of the estimated income coefficient. The instruments are much weaker in the reverse model. Moreover, the Hausman test shows that the OLS-estimates β_0 are not different from the IV-estimates β_0^{DP} (column (2) is a border case), and none of the estimates is statistically significantly different from the value of -1.0 mentioned in the introduction. Thus we conclude that β_0^{DP} is an estimate of the long run causal effect of income on the Gastil index that explains the full path of the democratic transition.

Given the point scatter of the Gastil index and income, it is obvious that the transition only explains some of the variation in the data. For instance, the difference in log GDP per capita between Kenya and Thailand, which are close to the 25 percentile and the 75 percentile of the distribution in our sample, is about 1.86 points. An OLS/IV regression coefficient of -1.0 thus predicts a difference in the Gastil democracy score of 1.86 points. The actual difference in the Gastil score for the two countries is 3 points, so our estimated income effect accounts for about 60 percent of the observed difference in the degree of democracy between Kenya and Thailand.

4.4 The results for all available years: 1972-2008

Table 5 only looks at one particular year (1995) but specification (1) with the first principal components of the two measures of biogeography as instruments has also been estimated for all other years where the Gastil index is available. The relative stability of the OLS and IV regression results for each year in 1972-2008 is shown in Figure 9. The estimates of the two income coefficients are represented by the black (IV) and the grey (OLS) lines, and the dashed lines represent two respective standard errors around the estimates.

For a number of years, both lines are within both intervals of one standard error, and both lines are almost always within two standard errors of each other. This confirms that it does not matter which year is used to derive our basic cross-section result: The difference between the OLS and the IV estimates is always statistically insignificant. Moreover, a horizontal line can be drawn within both significance intervals,[18)] so the hypothesis cannot be rejected that the true long-run coefficient is constant at about –1, or perhaps a little larger in absolute value.

The conclusion till now is that income can fully explain democracy in the long run. Before this strong conclusion is accepted, a few objections will be considered. The robustness of the long-run causality from income to democracy is tested (i) by including 10 alternative control variables; and (ii) by including country- and time-fixed effects.

4.5 Controlling for ten socio-political and ethno-cultural variables

As a further robustness test, ten socio-political and ethno-cultural control variables are considered in Tables 6 and 7. Each of these measures may affect the degree of democracy in ways that are independent of our income measure. However, the control variables proxy for a shorter time horizon than our preferred DP-variables, and may thus be affected by the level of income. Hence we would expect that their inclusion could reduce the estimated effect of income on democracy, either directly or indirectly.

The four socio-political control variables included in Table 6 are the share of mining in GDP (*mining*), the Gini coefficient (*gini*), and the relative numbers of deaths by homicide (*homicavg*) and by suicide (*suicide*). These variables may be interpreted as capturing cross-country differences in the availability of resource rents, the degree of income inequality, the prevalence of violent conflict among individuals, or the disposition for psychic depression.

Table 6 shows that, conditional on instrumented income, none of these variables is statistically significantly correlated with the degree of democracy. Moreover, the inclusion of each of these variables does not significantly affect the size of the estimated income effect. The Cragg-Donald test for weak instruments performs less well in three specifications as compared to Table 5, but the first stage partial R^2 remains relatively high, and the Sargan test statistic does not reject the exclusion restriction. The key observation is that there is still no statistically significant difference between the two (OLS and IV) income coefficients, even when these controls are added (Hausman test).

Our six ethno-cultural control variables included in Table 7 are an index of ethno-linguistic fractionalization (*ethnoel*), dummies for French or English legal origins (*lofre* and *loeng*), and the share of the population that has Protestant, Roman-catholic, or Muslim religious beliefs (*prot*, *romcat*, *muslim*). These variables have been used as controls in many other papers. Here we speculate that the degree of ethnic and linguistic diversity, the origin of the legal framework of a country, or the adherence to a large religious community may affect democracy in ways that are independent of the level of income.

However, the ethno-linguistic or legal control variables generate no statistically significant effect, directly or indirectly through an income effect. Only the share of the population with Protestant religious belief is statistically significantly positively correlated with the degree of democracy, and the share of the population with Muslim religious belief is statistically significantly negatively correlated with democracy.[19)] In both specifications with religious beliefs, the size of the estimated income effect is statistically not significantly different from the results in Table 5, and there is no evidence of weak instruments (Cragg Donald statistic) or a rejection of the exclusion restriction (Sargan statistic). Once again, our key result holds: The two income coefficients do not differ (Hausman test).[20)]

4.6 Fixed effects estimates: Sorting out the within- and between-effects

One objection against our result for the long run is that it may have missed the relevant control variables. The problem is that our income variable could identify idiosyncratic factors that show up in a cross section approach but are otherwise unrelated to the effect of income on the degree of democracy within a country.

This possibility is addressed by estimating the relation between income and democracy with country-fixed effects for alternative samples taken from panel data for the time period 1972-2008. The upper half of Table 8 presents the estimates for samples of 18- and 12-year interval data. For each of these samples, the first column employs a country-fixed effect, the second a time-fixed effect, and the third both of them.

The results show that the effect of income on democracy that is derived from the within-country variation, i.e., with country-fixed effects, is slightly smaller but not significantly different from the previous cross-country estimates. The same result holds when time-fixed effects are used to control for the within-country variation. The similarity of the two estimates suggests that they actually identify the effect of income on democracy, and neither a spurious cross-country relation nor a simple time effect. That is, the inclusion of only one of the fixed effects reproduces a statistically significant income effect of about the same size as in Tables 5-7. All this also holds for a sample of 5-year interval data, presented on the left side of the lower half of Table 8.

Since income appears to be strongly correlated with democracy across countries and over time, it is probably no surprise that the income effect becomes small and statistically insignificant if country- *and* time-fixed effects are included simultaneously, as in the third column of each sample.[21)] However, if the panel data are restricted to the time before the demise of socialism, which brought an exogenous increase in the average cross-country democracy score, income does have a statistically significant effect on democracy even in the presence of jointly statistically significant country- and time-fixed effects, as shown in the last column of the lower half of Table 8.

Overall, we prefer the IV framework used in sections 4.3−4.5, but it is reassuring that the fixed effects estimation used in the present section gives consistent results.

5. Solving the puzzle

Section 3 shows that causality between income and democracy goes both ways in the shorter run, but that it is stronger from democracy to income. Section 4 shows the opposite, namely that causality from income to democracy dominates in the long run; it is even dubious if there is any reverse long-run causality from democracy to income. These seemingly contradictory empirical results can be reconciled by the Grand Transition view as presented in Paldam and Gundlach (2008).

The Grand Transition view understands development as an interdependent set of transitions in economics, politics, and culture. For any given level of development, there appears to be an *optimal level* of a broad range of economic, political, and cultural variables. If the observed pattern gets too far away from the optimal level predicted by the Grand Transition view, the mismatch becomes a brake for further development.

The concept of an optimal level can be illustrated with regard to education. Production at any level needs an appropriate amount of skills in the population. If too few have these skills, development is slowed down, but if too many are educated, the resulting unemployment and social tensions may also put a brake on development. The same logic applies to the political system, and here the problems are reinforced by its stepwise stability, as discussed in section 2. The stepwise nature of the political system makes it difficult to adjust smoothly to the optimal level of democracy demanded by the continuously changing level of development of a growing economy.

Many examples can be given of systems that have failed to adjust to the rising demands of modernization. Pressures accumulate and in the meantime development is likely to suffer. But finally the pressures bring about the desired change in the political system, and society adjusts along a transition path until the long-run equilibrium path is reached. Our hypothesis is that the political system can be interpreted as a long-run "output" variable that is strongly constrained by the status quo, and thus may get far away from the optimal level that is determined by the level of income.

Hence in the short to medium run, an adjustment of the political system seemingly causes extra growth because it looks as if it speeds up development. Yet from a long-run perspective, the political adjustment is an endogenous reaction to the widening gap between actual and potential economic development. Consequently, the long-run direction of causality from income to democracy is held to be a restriction that underlies the short-run adjustment of income to a change in democracy.

6. Conclusion

The two main results in the paper are that (i) income and democracy are strongly correlated both over time and across countries and that (ii) long run causality seems to be mainly – if not exclusively – from development to the political system. There is indeed a democratic transition. If income were to freeze at any one level, the political system would converge to the corresponding level.

In the short to medium run – which extends to half a century – the connections between income and democracy represent interactions rather than one-way causality. There are wide margins for idiosyncratic factors and historical accidents that may shape the performance of an individual country.

However, the data also suggests that it would be a grave error to ignore the long-run restriction that underlies the relation between the level of development and the relative degree of democracy. Our findings suggest that imposing high-income-style democracy is unlikely to succeed in a country with low-income-style economic, political, and cultural traditions. Ending with a more positive note, our findings also suggest that fast-growing countries–such as China–will turn into democracies within a foreseeable future.

Notes

1. The paper uses the word *transition* to describe the changes occurring when a country (C) changes from being a LIC (low income) through MIC (middle income) to become a wealthy DC (developed). In transitions, time periods of less than 10 years are considered *short run* and time periods above 50 years are considered *long run*.

[2]. The data were downloaded in March 2010, when the Gastil data covered 1972-2009 and the Maddison data ended with the year 2008.

[3]. Moving averages for a set of $100 \leq M \leq 500$ have also been calculated. They show the same picture. The corresponding graph based on the Polity index also reveals the same pattern (see Gundlach and Paldam 2010b).

[4]. $G \approx 9$ in 2008 in countries like Mexico, Turkey, Thailand and Croatia, which do struggle to acquire full democracy; but also in Syria and Saudi Arabia – income is surely not the only factor that counts.

5. Item T3 is based on the Polity data. It has two major exceptions: Switzerland and the USA.

6. By emphasizing the empirical evidence for causal effects, our approach differs from a further strand of the literature that considers theoretical arguments for the direction of causality and focuses on the timing of country-specific democratic transitions. See, e.g., Feng and Zak (1999).

7. The rejection confirms the Primacy of Institutions view, which argues that there is no such causal relation. See the survey in Acemoglu et. al. (2005, notably p 392). Note 21 discusses the method used in the rejection.

8. Switzerland has $G = 1$ from 1972 to 2008. The Polity index suggests that the spell started in 1848. It is likely to continue for some time after 2008, but it is not certain to continue forever. North Korea has had the opposite spell (with $G = 7$) throughout. It started right from 1946, and it may still last for the next 10 or even 20 years.

9. For the 106 observations of (G, P) where $-10 \leq P \leq -5$, the correlation is -0.02. However, it is -0.91 for all 297 observations.

10. To maximize Gastil data points, we have used the biggest part for merged and dissolved countries, adjusted for the change in the Maddison income data. Thus North Vietnam, North Yemen and West Germany continue as Vietnam, Yemen and Germany in our data base, while the Czech Republic, Russia and Serbia inherit Czechoslovakia, the USSR and Yugoslavia.

11. Another possible explanation is that unusually many countries might have been on the steep part of the transition curve in that period. However, since only 16.4% of the observations are in that part of the curve this appears not to be the explanation.

12. The correlations have a positive trend, with a p-value of 0.05, but the annual rise is 0.0017 only.

13. This calculation and Figures 2 and 8 (below) use the standard error calculated from the standard deviations of the correlations. Both income levels and Gastil scores have strong inertia, so the correlations from neighboring years are dependent, so these se's are too small. Figure 7 uses the significance points for one correlation. Figures 7 and 8 have been re-calculated using Kendall's τ as well. These figures look similar to the ones included and have similarly high levels of significance.

14. In Borooah and Paldam (2007), a similar slow pattern of adjustment is found from estimating dynamic regression models on panel data. An income jump in the average sample country is estimated to cause an adjustment of democracy with only 50% of the adjustment taking place after 20 years.

[1]5. Formally the Granger test for "*y* causes *G*" examines the hypothesis that *y* does not cause *G*. If this hypothesis is rejected, it means that $y \Rightarrow G$. The number of lags (n) included for the dependent variable should be so many

that the residuals are white noise. The appropriate tests are not strong, but fulfilled already for n = 2. To be on the safe side tests for n = 3 are also reported.

16. We have applied our long-run causality test to other transition variables as well (see Gundlach and Paldam 2010a), where we have found more complex cases than reported below.

17. Other variables listed in the appendix with a shorter time horizon of exogeneity, such as measures of religious affiliation, are also correlated with modern income levels and are used as control variables, see Table 7 below.

18. Except for the years 1989 and 1990 for the OLS regressions.

19. For similar results, see Borooah and Paldam (2007).

20. For a comparison of the income effects derived with the Gastil index and the Polity index, see Appendix Table A3.

21. This is also demonstrated in a recent paper by Acemoglu et. al. (2008), which explains democracy by democracy lagged and fixed effects for countries and time. This empirical model leaves virtually nothing to be explained by income, and consequently the effect of income becomes insignificant, and is declared spurious. Using the same empirical model, Gundlach and Paldam (2009) demonstrate the statistical insignificance of the relation between income and the share of agriculture in GDP, which consequently would have to be interpreted as spurious, in contrast to a large literature in agricultural and development economics. The empirical model of Acemoglu et. al. (2008) may be excellent at revealing type II errors (the acceptance of false models), but it may do so at the cost of increasing the probability of Type I errors (the rejection of true models). Maybe their approach is a bit like the weed-killer *roundup*, which kills all weeds and everything else. More research is necessary to clarify this point.

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Appendix: Table A1. Definitions and sources of variables used in the tables

Dependent variable and main explanatory variable used in all tables	
G	The average of democratic rights and civil liberties of the Gastil index from Freedom House. Source: The Freedom House homepage: http://www.freedomhouse.org/
y	Natural logarithm of GDP per capita, measured in 1990 international Geary-Khamis dollars. Source: Maddison (2003) and Maddison homepage: http://www.ggdc.net/maddison/
Biological instruments used in Table 5. Tables 6 and 7 only use *biofpc*.	
animals	Number of domesticable big mammals, weighing more than 45 kilos, which are believed to have been present in prehistory in various regions of the world. Source: Olsson and Hibbs (2005).
bioavg	Average of *plants* and *animals*, where each variable was first normalized by dividing by its maximum value. Source: Hibbs and Olsson (2004).
biofpc	The first principal component of *plants* and *animals*. Source: Olsson and Hibbs (2005).
maleco	Measure of malaria ecology; combines climatic factors and biological properties of the regionally dominant malaria vector into an index of the stability of malaria transmission; the index is measured on a highly disaggregated sub-national level and then averaged for the entire country and weighted by population. Source: Kiszewski and Sachs et al. (2004).
plants	Number of annual perennial wild grasses known to have existed in various regions of the world in history, with a mean kernel weight exceeding 10 milligrams. Source: Olsson and Hibbs (2005).
Geographical instruments used in Table 5. Tables 6 and 7 only use *geofpc*.	
axis	Relative East-West orientation of a country, measured as east-west distance (longitudinal degrees) divided by north-south distance (latitudinal degrees). Source: Olsson and Hibbs (2005).
climate	A ranking of climates according to how favorable they are to agriculture, based on the Köppen classification. Source: Olsson and Hibbs (2005).
coast	Proportion of land area within 100 km of the sea coast. Source: McArthur and Sachs (2001).
frost	Proportion of a country's land receiving five or more frost days in that country's winter, defined as December through February in the Northern hemisphere and June through August in the Southern hemisphere. Source: Masters and McMillan (2001).
geoavg	Average of *climate*, *lat*, and *axis*, where each variable was first normalized by dividing by its maximum value. Source: Hibbs and Olsson (2004).
geofpc	The first principal component of *climate*, *lat*, *axis* and *size*. Source: Olsson and Hibbs (2005).
lat	Distance from the equator as measured by the absolute value of country-specific latitude in degrees divided by 90 to place it on a [0,1] scale. Source: Hall and Jones (1999).
size	The size of the landmass to which the country belongs, in millions of square kilometers (a country may belong to Eurasia or it may be a small island). Source: Olsson and Hibbs (2005).
Socio-political control variables used in Table 6	
mining	Share of GDP in the mining and quarrying sector, approx. 1988. Source: Hall and Jones (1999).

gini	Gini coefficient, approx. 1990. Source: Deininger and Squire (1996).
homicavg	Total intentional completed homicides per 100,000 population, average for 1990-2000. Source: UNODC (2005).
suicide	Total number of suicides per 100,000 population, estimates for early 1990s. Source: Parker (1997).
Ethno-cultural control variables used in Table 7	
ethnoel	Average value of five different indices of ethnolinguistic fractionalization: the probability that two randomly selected persons from a given country: (i) will not belong to the same ethnolinguistic group, (ii) will speak different languages, (iii) will not speak the same language; (iv) the percentage share of the population not speaking the official language; (v) and the percentage share of the population not speaking the most widely used language. Source: La Porta et al. (1998).
loeng	Dummy for English Common Law legal origin of the Company Law. Source: La Porta et al. 1998.
lofre	Dummy for French legal origin of the Commercial Code: La Porta et al. 1998.
muslim	Share of the population with Muslim religious belief. Source: La Porta et al. (1998).
prot	Share of the population with protestant religious belief. Source: La Porta et al. (1998).
romcat	Share of the population with roman-catholic religious belief. Source: La Porta et al. (1998).

Table A2. Spells with constant Gastil score in all 6501 observations 1972-2008

Length	Democracy						Gastil score					Dictatorship		Number
of spell	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7	of obs
1	4	18	27	39	43	62	74	62	77	73	62	30	14	585
2	2	8	12	24	30	23	28	30	36	32	28	16	11	280
3	4	5	20	18	15	17	15	22	20	24	31	15	10	216
4	5	13	12	6	10	6	14	12	14	20	9	19	4	144
5	8	7	8	10	6	3	6	2	9	9	11	9	4	92
6	7	7	8	4	4	8	4	5	6	6	4	5	5	73
7	7	3	2	4	2	3		5	2	6	6	2	5	47
8	1	8	6	1	3	1	2	2	3	3	5	4	1	40
9	1	5	4	3	3	5			3	6	3	4	3	40
10	2	4	3	3	1	1		1	1	2	2	3	2	25
11-12	2	10	2	5					3	4	3	3	3	37
13-14	2	2	2	2	1				2	1	2		3	19
15-16	2	2	2				2			3	2		2	15
17-18	6	1	1							1			4	13
19-20	3											1	4	8
21-23	3	1	1									1		6
24-26	1	2											1	3
27-33	2													2
37	10												1	11
Spells	72	95	110	119	118	130	145	142	176	190	168	114	77	1656
Obs	980	585	494	417	331	342	333	349	480	632	546	473	539	6501
Avs [a)]	13.6	6.2	4.5	3.5	2.8	2.6	2.3	2.5	2.7	3.3	3.3	4.1	7.0	3.9

Note: No endpoint correction is made. *Avs* is the average length of spells. *Obs* are calculated as the sum of the product of the number of spells and their length (in years). (a) Line depicted on Figure 4.

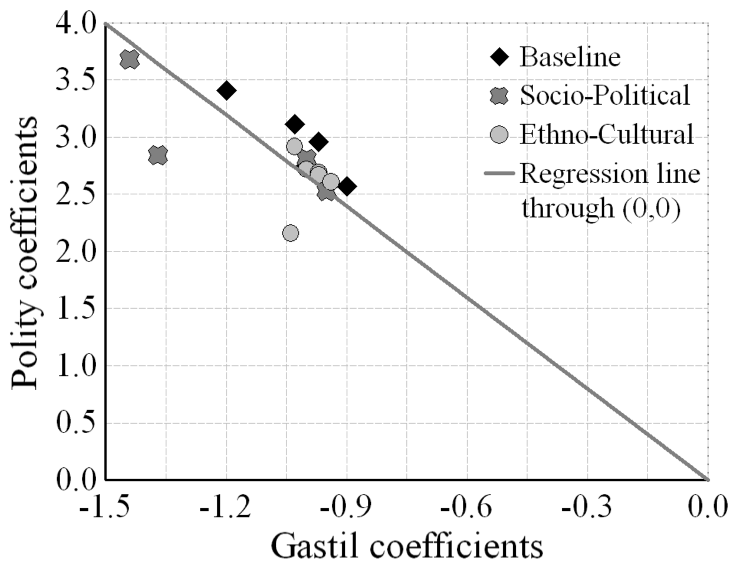
Table A3. Comparing income effects on the Gastil and the Polity index

	Index	Reference	(1)	(2)	(3)	(4)	(5)	(6)	Average
Baseline	Gastil	Table 5	-1.00	-1.20	-0.90	-0.97	-1.03	-	-1.02
	Polity	Table 1*	2.75	3.41	2.57	2.96	3.11	-	2.96
Socio-political	Gastil	Table 6	-0.95	-1.00	-1.44	-1.37	-	-	-1.19
	Polity	Table 2*	2.53	2.81	3.68	2.84	-	-	2.97
Ethno-cultural	Gastil	Table 7	-1.04	-0.97	-1.00	-0.94	-1.03	-0.97	-0.99
	Polity	Table 3*	2.16	2.69	2.72	2.61	2.92	2.67	2.63

Note: The reference with a * is to Gundlach and Paldam (2009a) giving the Polity results.

Our regressions with the Gastil index produce results that are similar to the ones for the Polity index previously reported. Table A3 shows the corresponding two sets of IV income coefficients derived from the baseline specifications and from the specifications with additional control variables, which are given in Tables 5-7 for the Gastil index and in Tables 1-3 in Gundlach and Paldam (2009a,) for the Polity index. Figure A1 is a scatter plot of the two coefficients. Since the Gastil (*G*) and the Polity (*P*) index are related as discussed in section 2.3, the two estimated income effects should be roughly proportional, as they actually are.

Figure A1. Gastil vs. Polity income effects



The Democratic Transition

Short run and long run causality between income and the Gastil index

Figures and tables

Figure 1. The democratic transition, shown by moving averages of all (y,G)-pairs

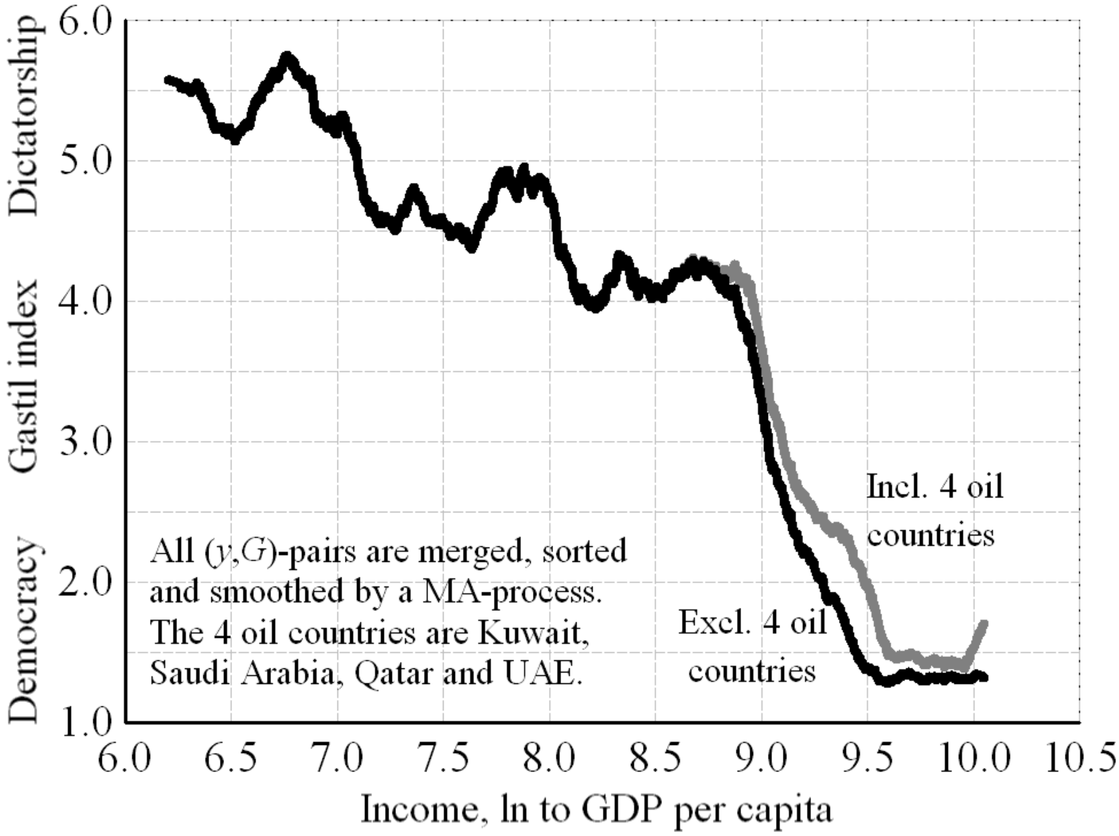


Figure 2. The path of the cross-country average for the Gastil Index, 1972 – 2008

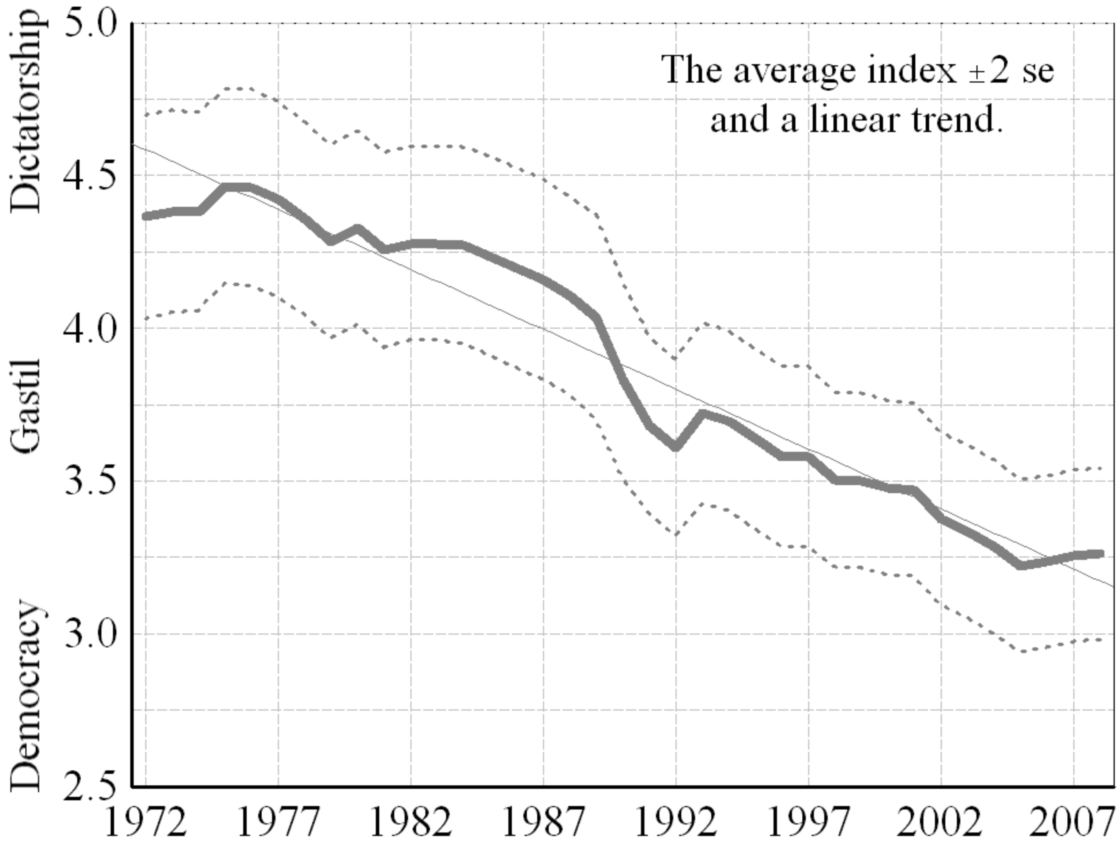


Figure 3. The frequency of the different values given for the Gastil index, N = 6,501

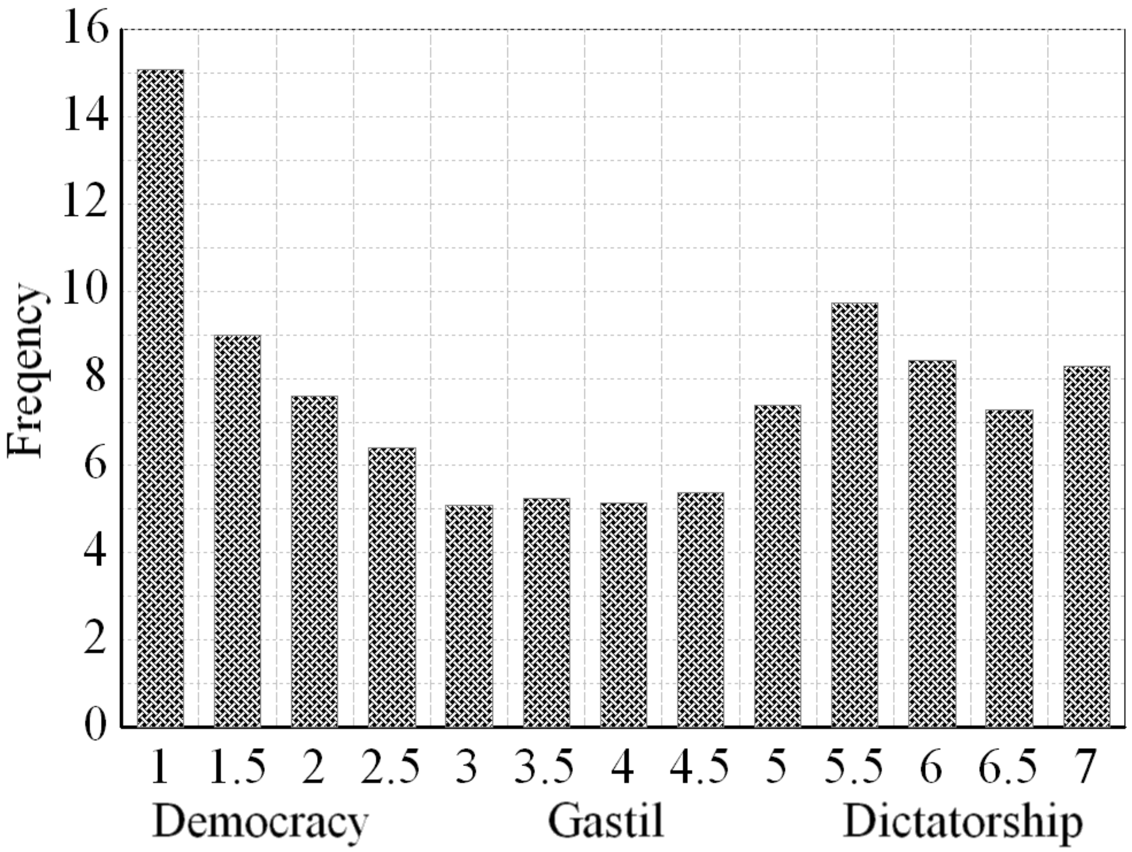


Figure 4. The average length of spells for different values of the Gastil Index

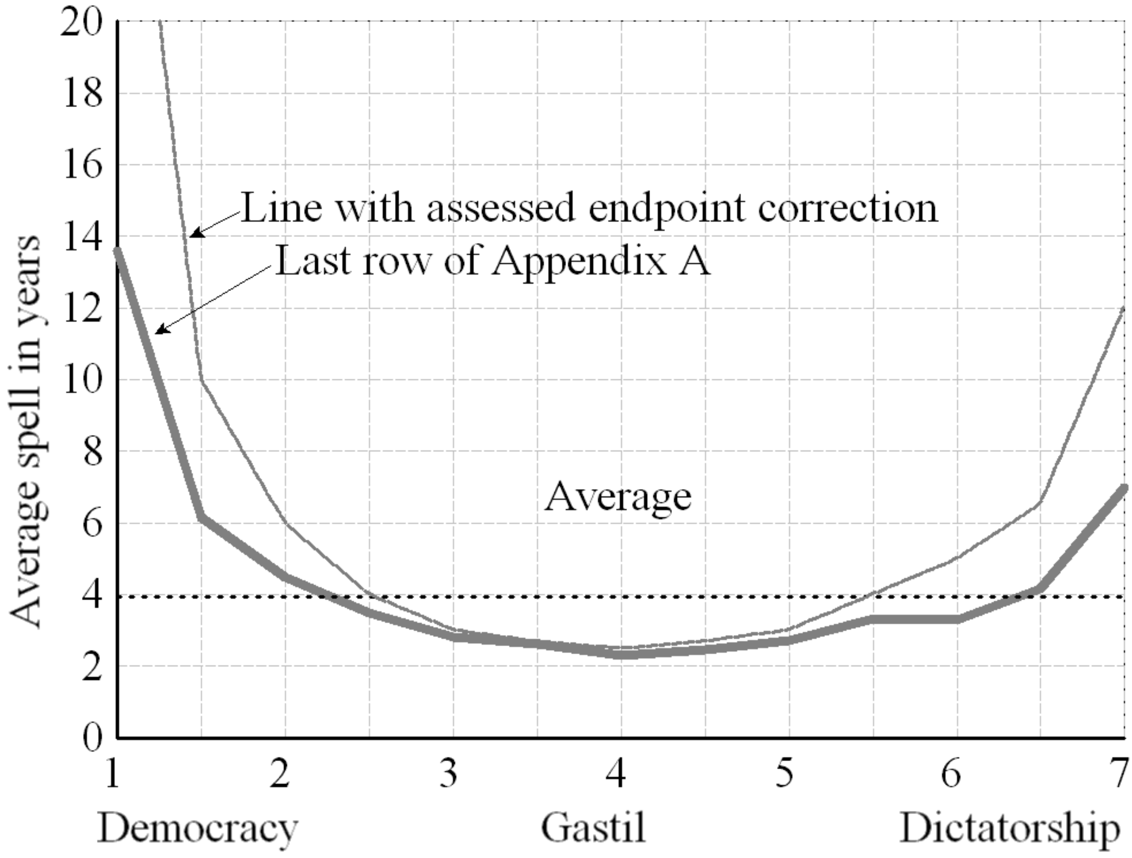
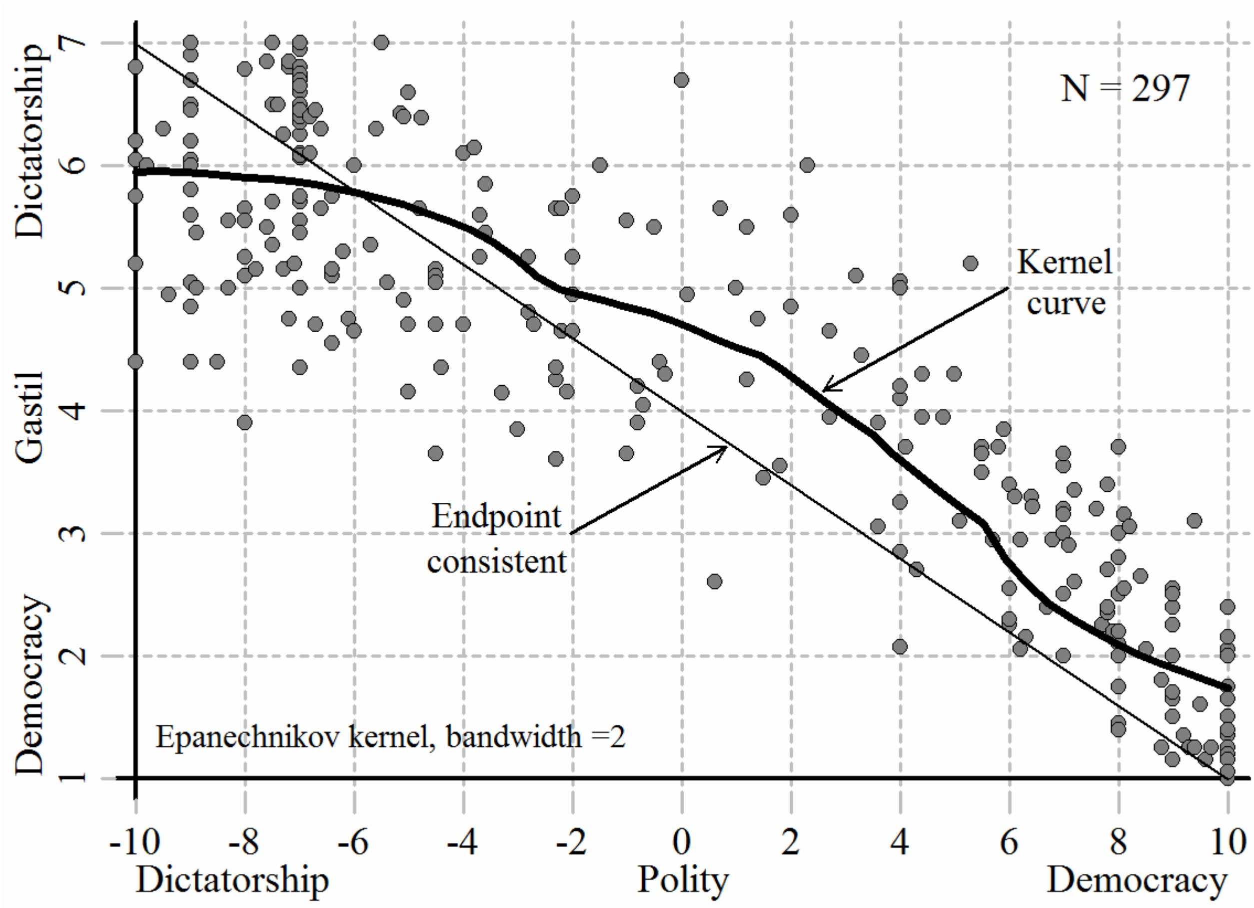


Figure 5. Comparing average values for the *G* and the *P* indices for two decades



Notes: The kernel curve is a continuous MA-curve, with a fixed bandwidth. The data cover two decades 1972-81 where data exists for 141 countries and 1999-2008 where data for 157 countries are available. 26 observations have full democracy (10, 1) by both indices – all western. The endpoint consistent line is: $3 \cdot P = 40 - 10 \cdot G$.

Figure 6. Cross-country averages of income and democracy, 1972-08

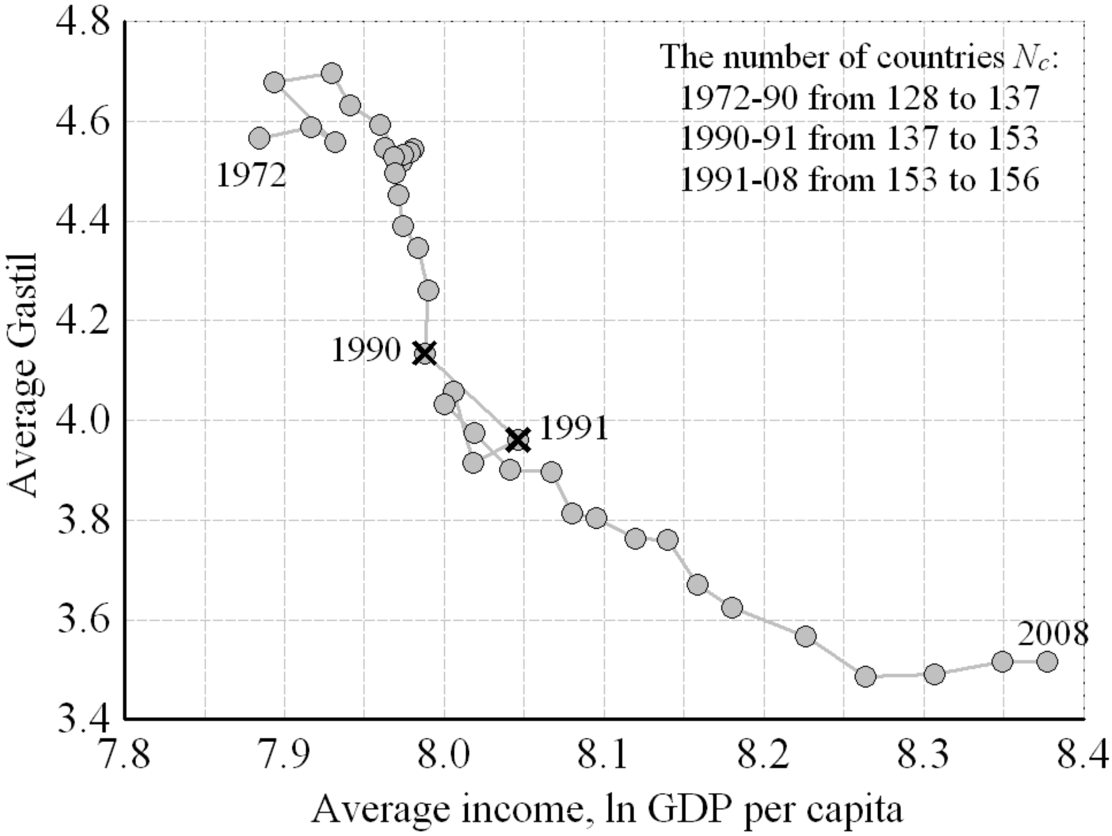


Figure 7. The annual cross-country correlation of income and democracy, 1972-08

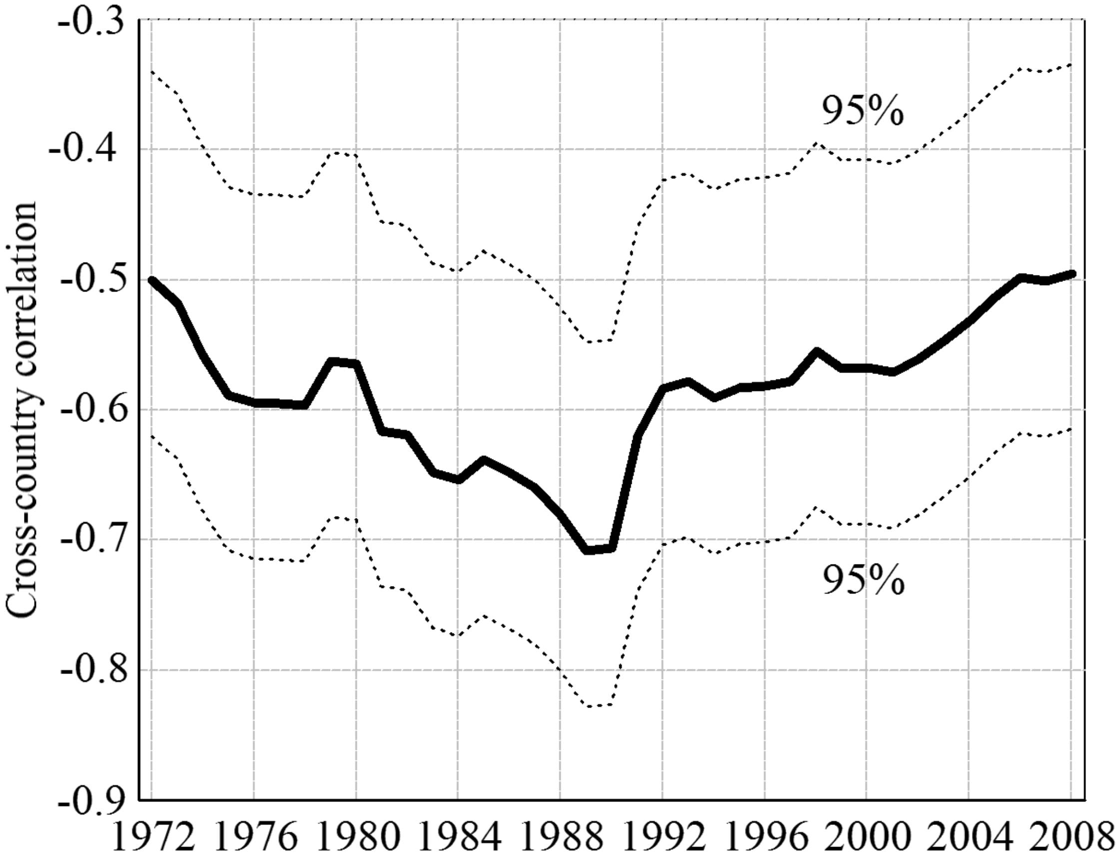


Figure 8. Average cross-country correlograms

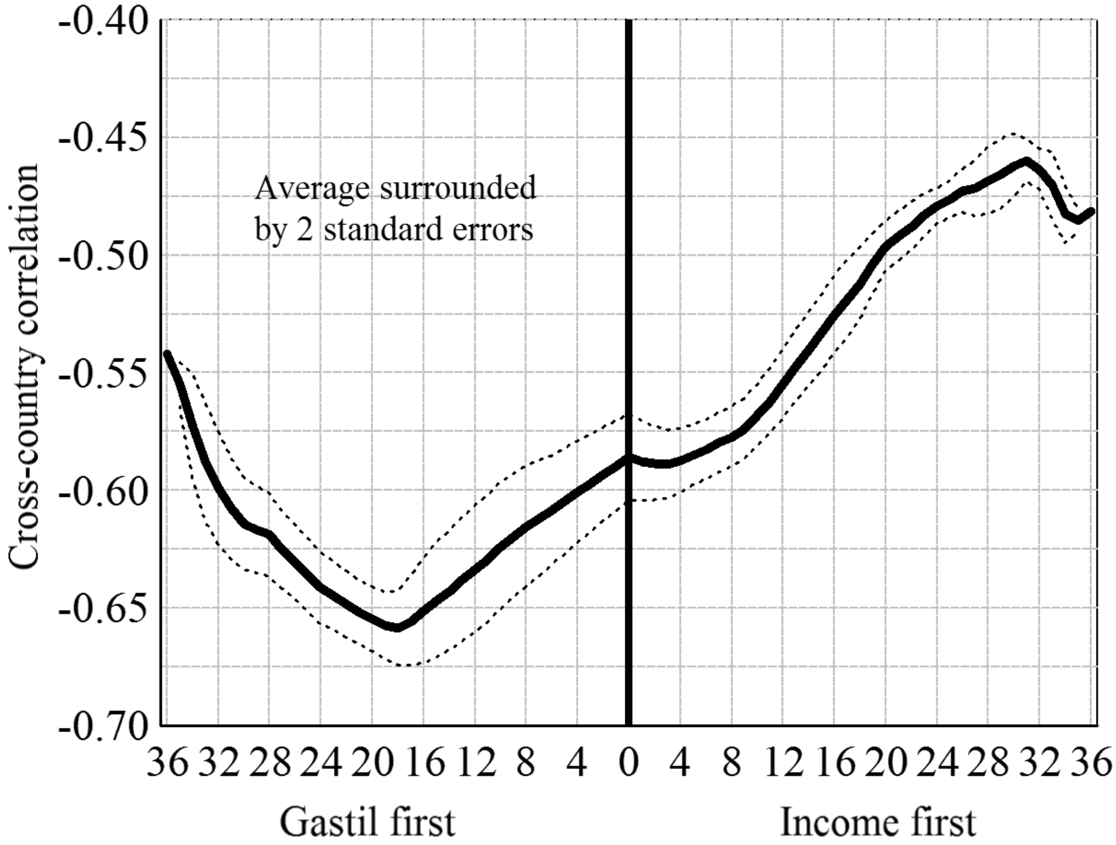
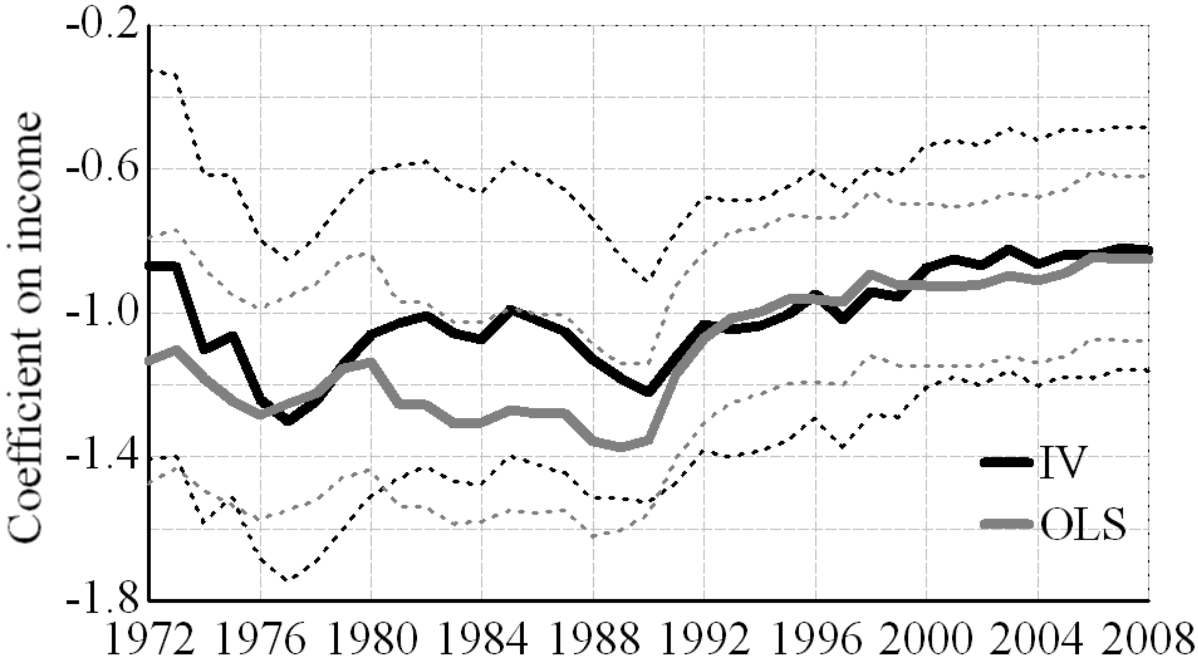


Figure 9. The IV and the OLS income coefficients, 1972-2008



Notes: Both curves are surrounded by two standard errors. All coefficients are statistically significantly smaller than zero, and they never differ statistically significantly from each other.

Table 1. The structure of the observations for the Gastil index, 1972-2008

Basic counts		Number of changes			Descriptive statistics	
Observations	6,501	No change	4,807	76.3%	Aver	3.84
Countries	202	Change	1,491	13.7%	Median	4
First differences	6,298	Consecutive	585	9.3%	St. Dev	2.06

Note: Consecutive means changes that are taking place at least two years in a row

Table 2. The distribution of the 6,298 changes

	Down: N = 846, avr = -0.74								Constant	Up: N = 645, avr = 0.75									
Size of jump	-4	-3.5	-3	-2.5	-2	-1.5	-1	-0.5	0	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5
Number	2	5	3	12	19	54	133	618	4,807	482	104	22	13	9	7	2	2	2	2
Frequency in %			0.7			0.9	2.1	9.8	76.3	7.7	1.7	0.3	0.2	0.1			0.2		

Table 3. All possible income-democracy correlations, 1972-08

	Lag	Number of correlations	Correlations used
Gastil first	36 years	1	(y_{2008}, G_{1972})
Gastil first	35 years	2	$(y_{2008}, G_{1973}), (y_{2007}, G_{1972})$
…	…	…	…
Gastil first	1 year	36	$(y_{1973}, G_{1972}), (y_{1974}, G_{1973}), \dots, (y_{2006}, G_{2005})$
Contemporaneous	0	37 [a)]	$(y_{1972}, G_{1972}), (y_{1973}, G_{1973}), \dots, (y_{2006}, G_{2006})$
Income first	1 year	36	$(y_{1972}, G_{1973}), (y_{1973}, G_{1974}), \dots, (y_{2005}, G_{2006})$
…	…	…	…
Income first	35 years	2	$(y_{1972}, G_{2007}), (y_{1973}, G_{2008})$
Income first	36 years	1	(y_{1972}, G_{2008})

Note: [a] These correlations are shown in Figure 7.

Table 4. Granger causality tests between the Gastil index and income, 1972-2008

Formulas (2a) and (2b)	Test for y ➔ G F-test	p-value	N	Test for G ➔ y F-test	p-value	N
			3-year averages			
n = 2	0.11	0.74	1723	**4.47**	0.03	1723
n = 3	0.03	0.86	1589	**4.34**	0.04	1589
			5-year averages			
n = 2	0.10	0.75	1006	1.41	0.24	1006
n = 3	0.01	0.93	1005	2.08	0.15	1005
			7-year averages			
n = 2	0.37	0.54	719	0.46	0.50	719
n = 3	0.63	0.43	714	0.42	0.52	714

Notes: All specifications include country-fixed effects. The F-test is for the inclusion of the additional explanatory variable, N is the number of observations, and n is the number of lags. Figures in bold are statistically significant at the 5 percent level. The sample is reduced as per the lags used.

Table 5. The estimated effect of income on the degree of democracy

Time t is 1995	Dependent variable: Gastil index, G				
	(1)	(2)	(3)	(4)	(5)
No. of obs. (countries)	101	106	101	101	144
	OLS estimates, equation (3)				
β_0 on income, y_{it}	**-0.96** (0.12)	**-1.00** (0.11)	**-0.96** (0.12)	**-0.96** (0.12)	**-1.08** (0.11)
Centered R²	0.40	0.45	0.40	0.40	0.38
	IV estimates, equation (4), y is instrumented				
β_0^{DP} on income, y_{it}^{DP}	**-1.00** (0.18)	**-1.20** (0.15)	**-0.90** (0.18)	**-0.97** (0.16)	**-1.03** (0.17)
Instruments	*biofpc, geofpc*	*bioavg, geoav*	*animals, plants*	*axis, size, climate*	*coast, frost, maleco*
First stage partial R^2	0.44	0.53	0.43	0.54	0.46
Sargan test (p-value)	3.40 (0.07)	5.61 (0.02)	2.97 (0.08)	0.58 (0.75)	2.95 (0.23)
	Hausman test for parameter consistency of OLS and IV estimate				
C-statistic (p-value)	0.10 (0.76)	3.72 (0.05)	0.23 (0.63)	0.00 (0.97)	0.18 (0.68)
	Cragg-Donald F-test for weak instruments				
CD-test, causality y ➔ G	38.02	57.94	37.51	37.81	40.02
CD critical 10% size	19.93	19.93	19.93	22.30	22.30
CD-test, causality G ➔ y	13.12	22.81	10.02	9.23	15.64

Notes: See Table 4 and the text in section 4.1. The parenthesis report standard errors. All specifications include a constant term (not reported).

Table 6. The effect of additional socio-political variables

Time t is 1995	Dependent variable: Gastil index, *G*			
	(1)	(2)	(3)	(4)
No. of obs. (countries)	93	72	61	39
Control used in column	*mining*	*gini*	*homicavg*	*suicide*
	OLS regressions, including one control			
β_0 on income, y_{it}	**-0.94** (0.12)	**-1.02** (0.14)	**-1.19** (0.18)	**-1.04** (0.21)
Control (of column)	-1.69 (2.01)	0.01 (0.02)	-0.00 (0.01)	-0.04 (0.02)
Centered R^2	0.41	0.45	0.44	0.55
	IV estimates: *y* is instrumented with *biofpc* and *geofpc*			
β_0^{DP} on income, y_{it}^{DP}	**-0.95** (0.17)	**-1.00** (0.25)	**-1.44** (0.30)	**-1.37** (0.37)
Control (of column)	-1.69 (2.01)	0.01 (0.02)	-0.01 (0.01)	-0.02 (0.02)
First stage partial R^2	0.47	0.33	0.35	0.35
Sargan test (p-value)	2.49 (0.11)	2.46 (0.12)	1.24(0.26)	0.67 (0.41)
	Hausman test for parameter consistency of OLS and IV estimate			
C-statistic (p-value)	0.00 (0.95)	0.01 (0.91)	1.10 (0.29)	1.33 (0.25)
	Cragg-Donald F-test for weak instruments			
CD-test ($y \Rightarrow G$)	39.03	16.68	15.04	9.53
CD critical value (size)	19.93 (10%)	11.59 (15%)	11.59 (15%)	8.75 (20%)

Notes: See Table 5.

Table 7. The effect of additional ethno-cultural variables

Time t is 1995	Dependent variable: Gastil index, *G*					
	(1)	(2)	(3)	(4)	(5)	(6)
No. of obs. (countries)	97	101	101	101	101	101
Control used in column	*ethnoel*	*lofre*	*loeng*	*prot*	*romcat*	*muslim*
	OLS regressions, including one control					
β_0 on income, y_{it}	**-0.97** (0.15)	**-0.95** (0.12)	**-0.96** (0.12)	**-0.90** (0.12)	**-0.92** (0.12)	**-0.82** (0.12)
Control (of column)	-0.16 (0.56)	0.18 (0.28)	0.09 (0.31)	**-1.72** (0.65)	-0.65 (0.37)	**1.46** (0.43)
Centered R^2	0.39	0.40	0.40	0.44	0.42	0.46
	IV estimates: *y* is instrumented with *biofpc* and *geofpc*					
β_0^{DP} on income, y_{it}^{DP}	**-1.04** (0.28)	**-0.97** (0.18)	**-1.00** (0.18)	**-0.94** (0.18)	**-1.03** (0.17)	**-0.97** (0.17)
Control (of column)	-0.31 (0.77)	0.18 (0.28)	0.07 (0.32)	**-1.67** (0.67)	-0.58 (0.38)	**1.26** (0.46)
First stage partial R^2	0.28	0.43	0.42	0.43	0.50	0.50
Sargan test (p-value)	2.85 (0.09)	3.27 (0.07)	3.36 (0.07)	2.50 (0.11)	3.03 (0.08)	1.48 (0.22)
	Hausman test for parameter consistency of OLS and IV estimate					
C-statistic (p-value)	0.07 (0.79)	0.02 (0.88)	0.07 (0.79)	0.08 (0.78)	0.86 (0.35)	1.66 (0.20)
	Cragg-Donald F-test for weak instruments					
CD-test ($y \rightarrow G$)	17.94	35.97	35.68	36.10	49.46	49.15
CD critical value (size)	11.59 (15%)	19.93 (10%)	19.93 (10%)	19.93 (10%)	19.93 (10%)	19.93 (10%)

Notes: See Table 5.

Table 8. Fixed effects estimates

	Dependent variable: Gastil index, G					
	18-year interval data			12-year interval data		
No. of observations.	421	421	421	576	576	576
No. of countries	156	156	156	156	156	156
No. of years	3	3	3	4	4	4
β_0 on income, y_{it}	**-0.85** (0.17)	**-0.85** (0.09)	-0.22 (0.19)	**-0.69** (0.15)	**-0.78** (0.09)	-**0.07** (0.17)
Country-fixed effects	yes	no	yes	yes	no	yes
F-test (p-value)	3.47 (0.00)	-	4.06 (0.00)	4.62 (0.00)	-	5.54 (0.00)
Time-fixed effects	no	yes	yes	no	yes	yes
χ^2-test (p-value)	-	20.99 (0.00)	18.50 (0.00)	-	43.35 (0.00)	22.73 (0.00)
	5-year interval data			5-year interval data, pre 1989		
No. of observations.	1162	1162	1162	538	538	538
No. of countries	156	156	156	137	137	137
No. of years	8	8	8	4	4	4
Income, y	-0.62 (0.11)	**-0.64** (0.08)	**-0.06** (0.11)	**-0.76** (0.20)	**-1.05** (0.10)	**-0.64** (0.21)
Country-fixed effects	yes	no	yes	yes	no	yes
F-test (p-value)	11.37 (0.00)	-	13.72 (0.00)	14.93 (0.00)	-	15.18 (0.00)
Time-fixed effects	no	yes	yes	no	yes	yes
χ^2-test (p-value)	-	111.66 (0.00)	24.62 (0.00)	-	242.84 (0.00)	3.10 (0.03)

Notes: Panel data for 1972-2008; standard errors in parentheses. All specifications include a constant term (not reported). The 18-year and the 12-year interval data start in 1972, the 5-year interval data start in 1973. The F-test (for countries) and the χ^2-test (for years) estimate the joint significance of the fixed effects.