The pattern of democracy in the 20th century
A study of the Polity Index

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Abstract:

The Polity Index for the degree of democracy covers the whole of the 20th century for most independent countries: It started with 52 countries, and the number of countries covered has gradually grown to almost 160. We demonstrate that income has a strong and robust connection to democracy, when the persistence factor in the political system is properly dealt with. This is the case even if we control for initial level democracy, and for fixed effects for countries. We show that the Muslim-Oil complex is detrimental to democracy, while the Old West is more democratic than other rich countries.

Keywords: Democracy, Lipset's law, Western vs Muslim Culture
Jel: D7, P50

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1.   Introduction

The Polity index – from now Π – provides a measure of democracy/dictatorship for about 52 independent countries since 1900. For a few countries it goes back even further, and gradually about 100 countries have become independent and been added. The index is scaled from +10 for "perfect" democracy to –10 for "perfect" dictatorship.

Figure 1 shows the average Π-score for all countries and for the 52 countries that are covered nearly all years. For most of the 20th century the Π-index has fluctuated around zero. The 52 old countries of the index are dominated by countries in Europe and the Americas with European culture. The 100 new countries are mostly poorer, and have less democracy.

The pattern showed corresponds to our knowledge of a slow increase in democracy in the world. It also shows some well-known crises: The late 1920s and the 1930s represented a swing away from democracy, notably in Europe. In fact, the trend from year 1900 to 1972 is dubious, but since then there has been a large increase in democracy in the World.

For the whole of the 20th century few variables are available for many countries for the whole of the century, so we are studying the following three sets of variables only:

Figure 1. The path of the Polity Index from 1900 to 2003
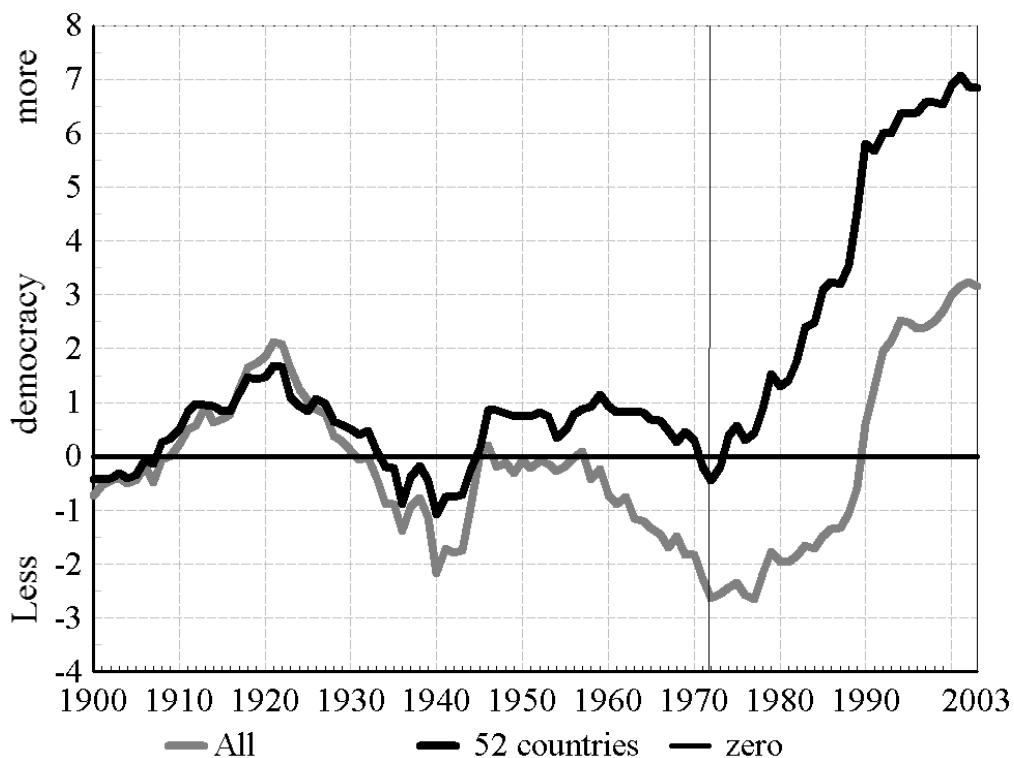
Set 1: Income and political system persistence. The long run development is represented by gdp, i.e. GDP per capita. Income is a catch-all variable, which covers the totality of development in a rather crude way. Political regimes, Π, have much persistence, which is included in two ways: (i) The explained variable, Π_{it}^{T}, is the average Π for a period of T years, from t to $t+T$. (ii) The initial value, Π_{t-1}, is used as an explanatory variable.

Set 2: Periods. For reasons to be discussed we have divided the data in 5 periods of T = 20 years each. An important criterion of validity of our analysis is if the effects found are stable across these periods. It is formally tested in table 7.

Set 3: The "story" variables: Oil, Old West and Muslim. (i) We want to compare two ways of obtaining income: Production and resource rent. Oil-export is considered the cleanest case of resource rent. (ii) The countries of the West and the Muslim countries seem to be diverging in many ways of which one is the form of government as measured by the Π-score. We here speak of the *Muslim Gap*. Consequently, binary dummies are used for three types of countries: Major oil exporters, Old Western countries and Muslim countries.

Section 2 considers the theories examined, and section 3 looks at the data asking how much we can expect these data to say. Section 4 gives a set of OLS-estimates, while section 5 shows that little happens when the estimates are corrected for a set of potential problems. Section 6 gives the conclusions. Finally, an appendix compares the scores of the Polity and the Gastil indices.

2. The theories examined

We consider the complex of theories shown on figure 2. The 6 solid boxes are the 6 variables used. Variables 4 to 6 are binary dummies, which are 1 the event occurs and zero else.

(1) Π_{it}^{20}, average Π-score for each of 5 periods of $T = 20$ years. Range from -10 to +10.

(2) Π_{it-1}, initial Π-score for the year before each period starts. Integer range -10 and +10.

(3) y_{it-1}, log to initial gdp, i.e. GDP per capita for the year before each period starts. We use the natural logarithm to the data from Maddison (2003).

(4) OW_i, the Old West is western countries that were already rich in the first period, where "rich" means that the gdp is above half of the gdp of the USA.

(5) Oil_{it}, countries where more than 50% of exports are oil and gas.

(6) Mu_i, countries with a majority of Muslims. If it is dubious if the criterion is fulfilled

(e.g. in the cases of Nigeria and Sudan) we use the secondary criterion that the government is Muslim (so that Nigeria is non-Muslim, while Sudan is Muslim).

Figure 2. The causal structure considered in the paper
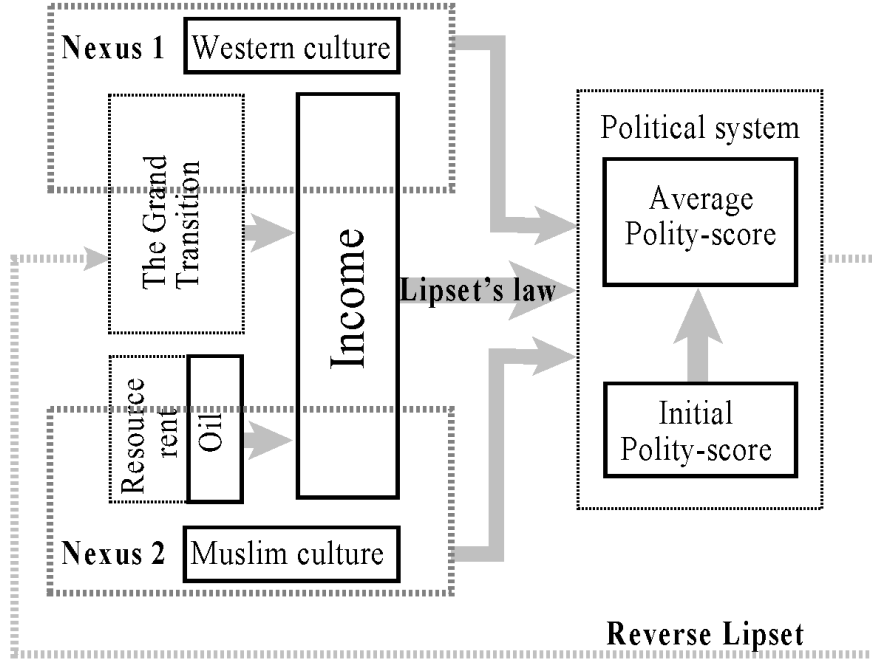
The introduction mentions two main problems: The catch-all character of the gdp-variable used to measure the relation between development and political system, and the strong inertia in political systems. These two problems are connected in two ways:

The first connection is that the following simple relation exists between the estimate of the coefficient to initial Polity β and to income γ :

(1a) $\quad \Pi_{it}^T = \alpha_{(i)}^T + \beta^T \Pi_{it-1} + \gamma^T y_{it-1} + u_t \qquad$ as estimated

(1b) $\quad \Pi_i^\infty = \dfrac{\alpha^T}{1-\beta^T} + \dfrac{\gamma^T}{1-\beta^T} y_i = \alpha^\infty + \gamma^\infty y_i \quad$ gives the implied steady state values

(1c) $\quad \Pi_{it}^T = \alpha_{(i)} + \mu^T y_{it-1} + u_t \qquad$ as estimated. Here $\mu^T \to \gamma^\infty$, for large T´s

If T is small, β becomes large and γ small and vice versa, but we expect $\gamma^\infty = \gamma^T /(1-\beta^T)$ to be fairly stable, for some range of T. (1c) forces the regression to make the full adjustment to y within T. This is a shortcut, but $\mu^T \approx \gamma^\infty$ if T is sizable. However, as T grows the distance to y_{it-1} becomes so large that the estimate looses precision, and the number of observations falls. The choice of T is thus crucial.

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The second connection between the effects of initial Polity and income is the statistical consequence of the above. If T is chosen too small, $\beta \approx 1$, and given the time series variation in the polity data, the other coefficients will be estimated with low precision. In other words the unit root in the regression causes the estimates to become nonsense.

The key causal relation modeled is the effect of income on the Π-score. Most of the literature argues that as income goes up the political system gradually turns more democratic. This is known as **Lipset's Law** (since Lipset, 1959, 1994). Lipset himself and several other writers (as Przeworski *et al* 2000) argue that there may be causality the other way too. On the figure this is termed **the Reverse Lipset** connection, it has been researched in no less than 81 studies, covered in the Doucouliagos and Ulubasoglu (2006) conclude that even when the effect is positive it is small. Column (4) in table 8 confirm this result.

As argued in Paldam (2007), we consider the change in political system as a typical part of a whole set of changes known as the Grand Transition, where a poor country becomes rich through a complete transformation from low to high productivity. Here the level of education rises dramatically, society becomes secularized, corruption falls, family patterns change, happiness rises etc. In order to untangle some of the complex we divide it in two:

Figure 3. The *Muslim Gap* in the Polity data
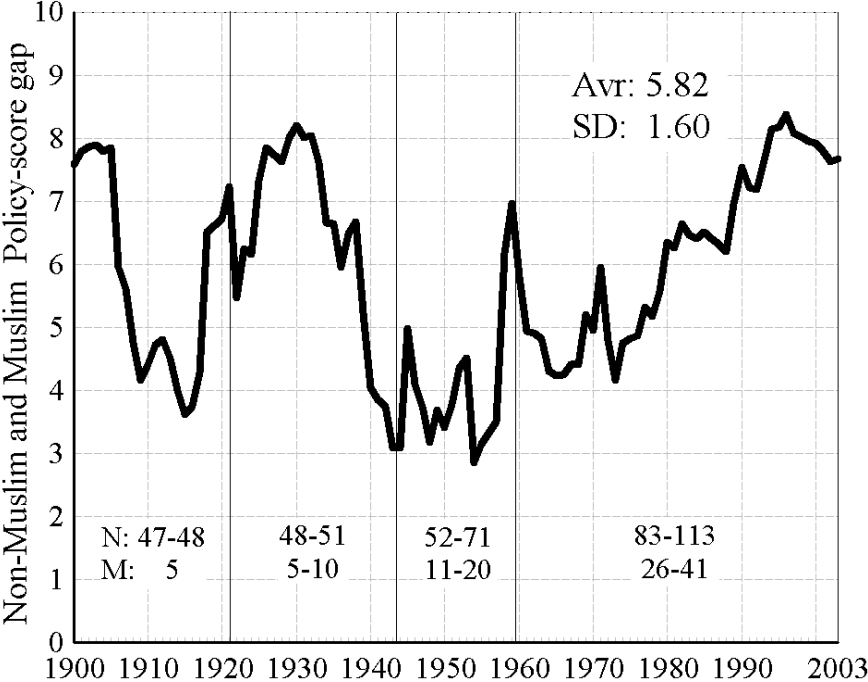
Note: The country composition has changed by a gradual inclusion of more and more countries. From 1900 to 1921 the sample included 47-48 Non-Muslim countries and (only) 5 Muslim ones. Since 1959 the sample has included 83-113 Non-Muslim and 26-41 Muslim ones.

The Muslim-Oil Nexus, where we use the two binary dummies *Mu* and *Oil*. They both get negative coefficients in the regressions – also in the other studies of the project. Most, but not all, of the oil-countries are Muslim too. Some countries in the Old West group are large oil producers too, but they produce so much that oil does not dominate their export. In many fields a gap between the West and the Muslim World is appearing. Figure 3 shows the *Muslim gap* in the Π-score. It is no less than 5.82 points, and it is even larger between the West and the Muslim community. Though the relative movements were unclear before World War II where data are thin anyhow, there is a clear upward trend ever since. We study the robustness of the negative coefficient to *Mu* to the initial levels of income and Π, and to oil. In particular, we want to study the dynamics of the gap. It is often alleged that Muslims have values that dominate the ones of democracy. This indicates that the gap is permanent, but others argue that this does not need to be the case, and they state that the gap thus is transitory.

The ***Old West Nexus*** deals with the path dependency caused by an early transition. A hundred years ago all rich countries were Western, and also democracy originated in the West. So arguably, the West had an *historical advantage*. If we do not control for "Old West" we will get an exaggerated effect of income.

As a lot of the action in the data is connected to the Grand Transition this introduces a large element of mutual interaction into the reactions. The Grand Transition means that a large number of changes take place simultaneously. If enough variables are included in the relations they come to contain much collinearity. Therefore, coefficients become significant or insignificant due to small flukes in the series.

We use gdp as the main variable covering the Grand Transition. However, instead of going through the Grand Transition there is an alternative way of producing a high gdp, namely from resource rent. The most extreme type of resources rent comes from oil, where the production technique is fully international and not very labor intensive. The oil dummy is always highly significant and negative. It is hence not enough to be rich to become democratic. It is a product of the complex changes generated by Grand Transition.

Recently, Acemoglu *et al* (2005) demonstrated that the connection between income and democracy is weaker then hitherto believed. When they control for the initial Π-score and fixed effects for countries the coefficient disappears in most of their estimates. It is well known that the tool of fixed effects for countries is a powerful test of a cross-country model. It has made many effects vanish.[1] However, in section 3 we study the relation between the

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1. In Jensen and Paldam (2004) we demonstrate how the two most successful models linking development aid to development react to fixed effects. One of the two disintegrates, while the other remains.

average and the initial level of Π, i.e. between Π_{it}^{T} and Π_{it-1}. Acemoglu *et al* work with an average of $T = 5$ years. As will be demonstrated, his T often causes a (near) unit root in the relation, and with fixed effects added everything washes out. With a reasonable size of T, the model proves robust to fixed effects.

It is hence important to study the persistence in the Polity data to determine a proper size of T, and to calculate the effects of the choices.

3.   The Data: What can they tell?

The Polity Index is an old project at the Center for International Development and Conflict Management, University of Maryland, with M.G. Marshall, K. Jaggers and T.R. Gurr as the main researchers. The index has gone through several versions, and we use the one presently posted (downloaded in the early fall of 2005). We use the data as posted, though to get the consistent series for 52 countries from 1900 to 2003 we have filled in a few gaps as best we could. These interpolations are only used in the graphs, not in the regressions.

Table 1. Some descriptive statistics: The data of the regressions

	Per 1 1901-20	Per 2 1921-40	Per 3 1941-60	Per 4 1961-80	Per 5 1981-00	Total Stacked
	Number of observations of the variables					
N	31	34	41	99	124	329
Oil	1	1	1	10	14	27
Old West	13	13	12	12	12	62
Muslim	0	0	1	25	35	61
Constant Π [a]	10	11	16	32	29	98
Of which 10-10[a]	5	9	12	18	17	61
	Averages and standard deviations of observations					
Polity	2.24	3.00	2.77	-1.40	0.61	0.67
SD	(5.50)	(6.28)	(6.67)	(6.95)	(6.50)	(6.76)
Init Polity	1.42	4.00	0.71	-0.46	-1.94	-0.23
SD	(6.09)	(6.35)	(7.60)	(7.55)	(7.49)	(7.53)
Dif	-0.82	1.00	-2.07	0.93	-2.54	-0.91
SD	(2.71)	(3.22)	(4.94)	(3.59)	(4.36)	(4.30)
Log y	7.58	7.74	7.93	7.64	7.98	7.81
SD	(0.58)	(0.52)	(0.55)	(0.85)	(1.30)	(0.89)
Init gdp	2287	2633	3222	3004	5182	3746
SD	(1162)	(1341)	(1731)	(2735)	(5647)	4035

Note a: Cases where the average Polity-score is equal to the initial one and of these cases where both are 10.

The gdp data are from Maddison (2003). Some countries are covered by the Polity index, but have no gdp observations. Unfortunately this is the case for most Muslim countries before 1960. Table 1 gives the dimensions in the data for the different periods.

Note that Western countries are prominent in the long series, while Muslim countries are included for the last 2 periods only. Altogether 61 of the observations are of the ten-ten type, where both the initial and the average Π-score are 10. Most of the Old West observations are in this category. When fixed effects for countries are added these observations are effectively removed, and one end of the income spectrum is greatly reduced.

As discussed it is important that T is chosen within a certain range: If T is small a unit root enters the regression, and if T is large information is lost. We decided to chose $T = 20$ after consideration of the following three persistence measures,[2] where the first 2 measure the persistence of the cross country pattern and the 3rd measures the inertia over time:

(2a) $\quad \text{Cor}_i(\Pi_t, \Pi_{t+j}), \text{ for } j = 1,..., 20$ $\qquad$ cross country persistence function

(2b) $\quad \text{Cor}_i(\Pi_t, \Pi_{t+1}^T), \text{ for } T = 1,..., 20$ $\qquad$ cross country persistance of initial and average Π

(2c) $\quad \text{Avr}_i(\text{cor}_t(\Pi_{it}, \Pi_{it+j})), \text{ for } j = 0,...30$ $\qquad$ standard autocorrelation function

Figure 4. Three measures of persistence in the Polity data

Figure 4a. Cross-country (2a) and (2b) $\qquad$ Figure 4b. The over time (2c)
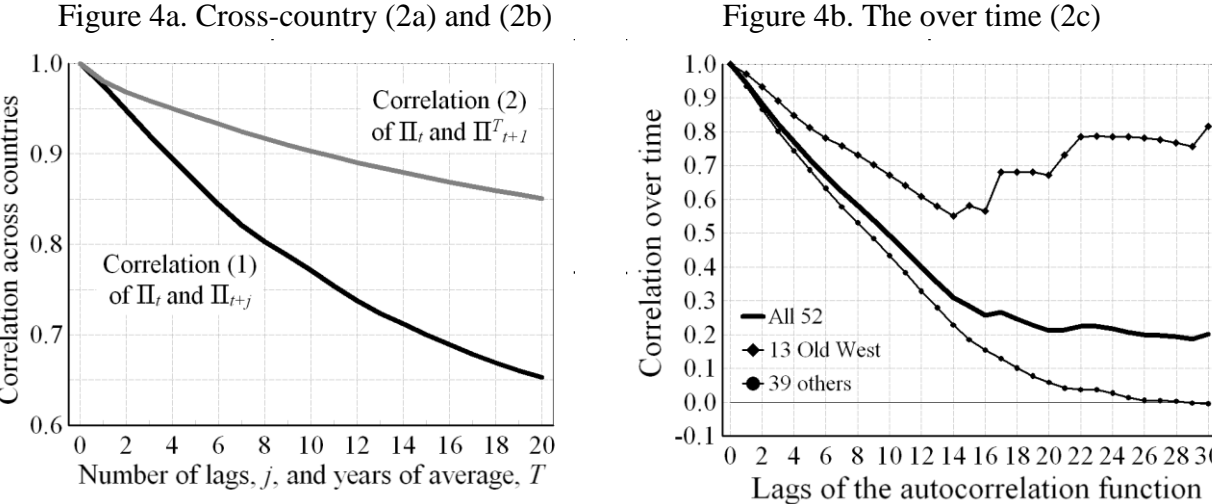
Note: Calculation done after stacking of the observations for the 5 periods. Every correlation is done on more than 5000 pairs of observations.

Note: The autocorrelations are calculated for each of the 52 countries and 3 averages are presented.

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2. We could probably have chosen T as low as 15 and as high as 30, and still have reached virtually the same results. So we have used the secondary criterion that an integer should result, when T is divided into 100.

Figure 4 shows the three functions. They are calculated for the 52 countries where the data are complete for all periods (with a few interpolations), with the said lags.

The cross country persistence (2a) starts at 0.98 (for $j = 1$) and falls to 0.9 (for $j = 5$), so the correlation between the initial and the average Π-score is no less than 0.94 for a 5-year average. This is too close to a unit root. Even for a 10-year average the correlation between the average Π-score and the initial is still 0.9. For a 20-year average the correlation (2) is 0.85. This is high, but it proves to work, and it still gives 329 observations.

The autocorrelation functions confirm the observation of high persistence. Note the cyclical pattern of autocorrelation in the 13 countries of the Old West. It reflects the fact that a few of these countries (notably Germany) have had one period of dictatorship in the 20th century. However, in the second half of the century all Old Western countries have deviated little from the ideal 10 points, see figure 5.

The figure shows how much the Old West deviates from the average path, which was also depicted on figure 1. Note that once we control for the initial level the Old West hardly contributes anything to the rise in democracy for the period since 1920, where the series is virtually trendless for these countries.

Figure 5. The average for the Old West countries
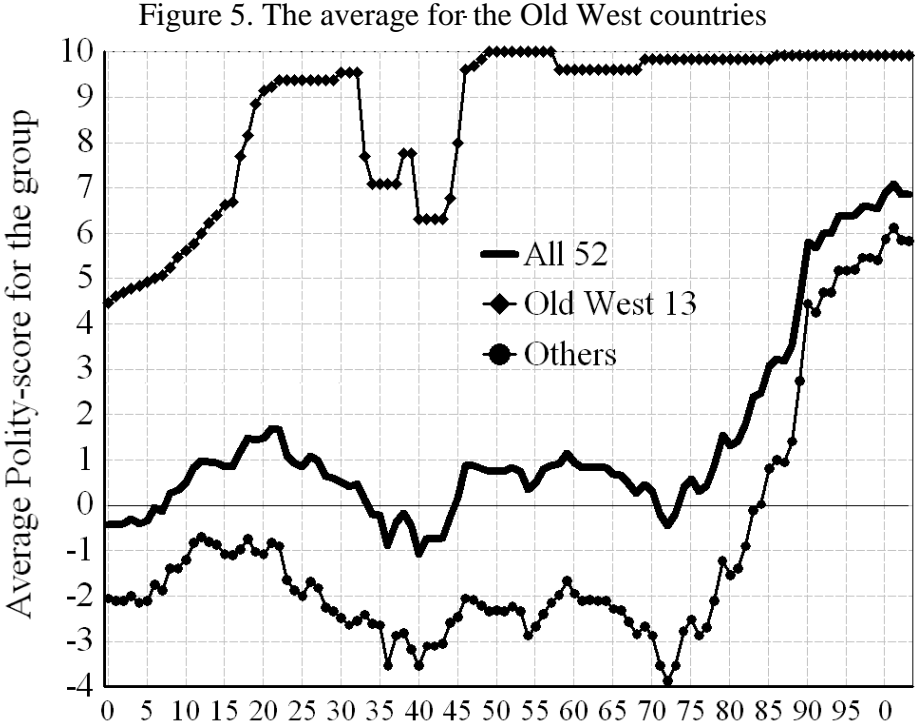
4. The basic OLS regressions

This section presents OLS-regressions for the individual periods and for all periods stacked. Section 5 demonstrates that only rather marginal improvements occur when these regressions are re-estimated using estimators that correct for various potential problems.

The model used is a simple exploratory framework between the variables defined at the start of section 2. All regressions in tables 2 to 7 have Π_{it}^{20} – the average Polity-index for a 20-year period – as the variable explained. If the constant α is broken up into fixed effects the sub sign i applies – this is only done in table 8:

$$(3) \quad \Pi_{it}^{20} = \alpha_{(i)}^{20} + \beta^{20}\,\Pi_{it-1} + \gamma^{20} y_{it-1} + \lambda_1^{20} OW_i + \lambda_2^{20} Oil_{it} + \lambda_3^{20} Mu_i + u_t$$

With this model we have experimented with deletion of variables in various combinations and with various estimators. From the model the steady state values of the coefficients are estimated by multiplying with $z = 1/(1-\beta^{20})$, so that $\gamma^\infty \approx z\gamma^{20}$, $\lambda_1^\infty \approx z\lambda_1^{20}$ etc. We can then examine how robust these estimates relate to the corresponding ones when the second term, lagged initial value of Π, is omitted as explained above.

Table 2. OLS cross country estimates for each 20-year period – and stacked

Explaining avr Polity Π_t^{20}	(1)	(2)	(3)	(4)	(5)	(7)
	Cross country estimate for 20 year periods					Stacked
	1900-20	1921-40	1941-60	1961-80	1981-00	
Constant	**-19.71**	**-23.48**	**-28.84**	**-14.99**	**-5.40**	**-12.14**
	(-3.3)	(-2.1)	(-2.4)	(-4.4)	(-1.9)	(-6.1)
y_{t-1}, income init	**2.77**	**3.07**	**3.94**	**1.82**	**0.91**	**1.66**
	(3.5)	(2.1)	(2.6)	(4.1)	(2.6)	(6.5)
Π_{t-1}, initial	**0.67**	**0.68**	**0.49**	**0.69**	**0.65**	**0.65**
	(8.9)	(5.6)	(4.5)	(13.8)	(12.9)	(21.6)
R^2 adjusted	0.85	0.77	0.63	0.80	0.68	0.72
N	31	34	41	99	124	329
	Implied steady state value of the effect of income					
y, long run	8.39	9.59	7.73	5.87	2.60	4.74

Note: Bolded estimates are significant. Below each is the t-ratio (in brackets).

Table 2 shows that when we include only initial Polity and income everything becomes significant. Also, it appears that the coefficients to the two initial variables log y and Π are fairly constant, but the implied steady state value of the effect of income is not very stable.

Table 3. OLS cross country estimates for each 20-year period – and stacked

Explaining avr polity Π_t^{20}	(1)	(2)	(3)	(4)	(5)	(7)
	Cross country estimate for 20 year periods					Stacked
	1900-20	1921-40	1941-60	1961-80	1981-00	
Constant	-10.16	-14.28	-23.01	**-12.92**	**-10.20**	**-12.75**
	(-1.1)	(-1.0)	(-1.5)	(-3.2)	(-3.7)	(-6.3)
y_{t-1}, income init	1.43	1.80	3.12	**1.51**	**1.64**	**1.75**
	(1.1)	(1.0)	(1.5)	(2.9)	(4.7)	(6.6)
Π_{t-1}, initial	**0.67**	**0.65**	**0.47**	**0.66**	**0.54**	**0.56**
	(9.0)	(5.0)	(4.2)	(13.0)	(10.9)	(17.4)
Oil	-2.37	-0.54	-2.22	-1.78	**-5.11**	**-3.70**
	(-1.0)	(-0.2)	(-0.5)	(-1.7)	(-4.8)	(-4.9)
OW, Old West	1.62	2.01	2.06	**2.65**	-1.01	**1.63**
	(1.2)	(1.1)	(0.9)	(2.2)	(-0.8)	(2.7)
Mu, Muslim	n.a.	n.a.	5.72[a]	0.71	**-2.09**	-0.81
			(1.4)	(0.9)	(-2.8)	(-1.5)
R^2 adjusted	0.85	0.77	0.64	0.82	0.76	0.75
N	31	34	41	99	124	329
	Implied steady state value of the effect of income					
y, long run	4.33	5.14	5.89	4.44	3.57	3.98

Note: See note to table 2. a. Based on one observation only.

When the full model is estimated – in table 3 – we get rather much the same picture, and now the implied steady state effects of income are reasonably stable, around 4 Polity-points. In the stacked regressions all coefficients are forces to be the same. Table 4 shows a set of such stacked regressions, with experiments for the three dummies.

When we repeat table 4 without either income or initial Polity (as done in table 5), all story variables obtain significant coefficients with the signs mentioned. So there are slightly too many variables in the model. When initial Polity, Π_{it-1}, is excluded in table 5 the fit of all other variables increases as it should, and the increase in the constant variables is largest. However, the fall in the R^2 is substantial.

Table 4. Stacked OLS cross country estimates

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Constant	**-12.14**	**-14.73**	**-10.28**	**-11.71**	**-13.15**	**-14.34**	**-9.94**	**-12.75**
	(-6.1)	(-7.6)	(-5.1)	(-5.9)	(-6.5)	(-7.3)	(-4.9)	(-6.3)
y_{t-1}, income	**1.66**	**2.04**	**1.37**	**1.64**	**1.79**	**2.00**	**1.36**	**1.75**
	(6.5)	(8.2)	(5.2)	(6.6)	(6.8)	(8.0	(5.2)	(6.6)
Π_{t-1}, initial	**0.65**	**0.60**	**0.60**	**0.62**	**0.57**	**0.59**	**0.58**	**0.56**
	(21.6)	(20.3)	(18.8)	(19.8)	(18.29	(19.3)	(17.5)	(17.4)
Oil		**-4.33**			**-4.02**	**-4.01**		**-3.70**
		(-6.0)			(-5.5)	(-5.3)		(-4.9)
OW, Old West			**2.16**		**1.62**		**2.08**	**1.63**
			(3.5)		(2.7)		(3.4)	(2.7)
Mu, Muslim				**-1.64**		-0.80	**-1.56**	-0.81
				(-3.0)		(-1.5)	(-2.9)	(-1.5)
R^2 adjusted	0.72	0.74	0.72	0.72	0.75	0.74	0.73	0.75
N	329	329	329	329	329	329	329	329
Implied steady state value of the effect of income								
y, long run	4.74	5.10	3.43	4.32	4.16	4.88	3.24	3.98

Note see table 2. If the 5 periods are allowed different coefficients the coefficient to income falls by 0.25, and the coefficient to Old West rises correspondingly. The R^2 of the regression increases by 0.02

Table 5. As table 4, but with no initial level for the Polity index

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Constant	**-32.47**	**-34.57**	**-22.38**	**-28.27**	**-25.98**	**-31.31**	**-20.01**	**-23.51**
	(-11.9)	(-13.7)	(-8.0)	(-10.7)	(-9.7)	(-12.2)	(-7.5)	(-8.7)
y_{t-1}, income ini	**4.24**	**4.60**	**2.79**	**3.83**	**3.35**	**4.24**	**2.60**	**3.10**
	(12.2)	(14.3)	(7.7)	(11.5)	(9.5)	(13.1)	(7.5)	(8.8)
Oil		**-8.27**			**-6.58**	**-6.60**		**-5.18**
		(-7.9)			(-6.5)	(-6.1)		(-5.0)
OW, Old West			**6.76**		**5.47**		**6.01**	**5.21**
			(8.1)		(6.8)		(7.5)	(6.6)
Mu, Muslim				**-5.05**		**-3.41**	**-4.19**	**-3.02**
				(-6.6)		(-4.4)	(-5.9)	(-4.1)
R^2 adjusted	0.31	0.42	0.43	0.39	0.49	0.45	0.48	0.51
N	329	329	329	329	329	329	329	329
Equation (1)	The excess size of the implied steady state coefficients from table 4							
$(\gamma^\infty - \mu^{20})/\gamma^\infty$	11%	10%	19%	11%	20%	13%	20%	22%

Note that the long run effects of income are quite stable. If it is estimated as in table 5 forces the full the adjustment to happen in one period (of 20 years) it is only 10-20% lower.

The conclusions so far are: Income has an effect which is always positive and normally significant. Its size is $\gamma^{20} \approx 1.6$. The initial Polity index is always positive, significant and stable at about $\beta^{20} \approx 0.6$. This implies a long run income effect $\gamma^{\infty} \approx 4.0$. The scale of y is in (natural) logs to gdp, and it is "translated" into ratios in table 6. Very poor and very rich countries differ by 50 times. This gives 15.6 points on the Polity-scale in the long run. For countries that only differ 2 or 10 times it is 2.8 and 9.2 points on the Polity scale in the long run – note how long the long run is in this field. The effect of income on the political system is thus substantial, but it takes some time for the full effect to set through.

The three story variables do tell a story: Oil is always negative, and as soon as there are more than one observation also significant and stable. Old West is mostly significant and then always positive and reasonably stable. The most dubious of the three variables is Muslim. It applies to the last 2 periods only, where it is negative and mostly significant.

Table 6. Converting the effects to income into Polity-points, and speed of adjustment

	Coef-ficient	Income gaps between countries in times					
		1.5	2	3	5	10	50
		Polity points					
Medium term	1.6	0.6	1.1	1.8	2.6	3.7	6.3
Long run	4.0	1.6	2.8	4.4	6.4	9.2	15.6
		Speed of adjustment					
Years		20	40	60	80	100	120
Adjustment	0.6	60%	84%	94%	97%	99%	100%

Note: The relation between the variables is: $4 = \gamma^{\infty} = \gamma^{20}/(1-\beta^{20}) = 1.6/(1-0.6)$

5.   Corrections of potential problems and a replication

Models can suffer from many potential problems, but estimators have been developed to deal with many of these. A handful of these estimators are applied in tables 7 and 8.

One such problem is residual autocorrelation – i.e. the countries differ to the same side from one period to the next, by more than is removed by initial Polity. This is taken into account by the GLS-estimate termed SURE. When tables 3 and 6 are compared it appears that nearly all t-ratios increase in table 7 as they should, and this causes two more coefficients to become significant, but the basic picture is unchanged.

Table 7. SURE-estimates for each 20-year period and tests for one coefficient tie

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Cross country estimate for 20 year periods					One coefficient tied	
	1900-20	1921-40	1941-60	1961-80	1981-00	Estimate	Wald-test
Constant	-11.93	-16.69	**-23.77**	**-13.18**	**-10.43**	**-11.74**	Accept
	(-1.4)	(-1.3)	(-1.7)	(-3.4)	(-3.9)	(-5.56)	
y_{t-1}, income ini	1.68	2.13	**3.22**	**1.54**	**1.67**	**1.66**	Accept
	(1.5)	(1.2)	(1.7)	(3.2)	(4.9)	(6.2)	
Π_{t-1}, initial	**0.66**	**0.63**	**0.43**	**0.65**	**0.53**	**0.59**	Accept
	(9.7)	(5.32)	(4.2)	(13.2)	(10.9)	(20.4)	
Oil	-2.22	-0.69	-2.78	**-1.81**	**-5.13**	**-3.22**	Accept
	(-1.1)	(-0.2)	(-0.7)	(-1.8)	(-4.9)	(-4.7)	
OW, Old West	1.43	1.83	2.19	**2.75**	-0.91	**1.22**	Accept
	(1.2)	(1.7)	(1.0)	(2.3)	(-0.8)	(1.9)	
Mu, Muslim	n.a.	n.a.	5.51	0.66	**-2.13**	-0.73	Reject
			(1.4)	(0.9)	(-3.0)	(-1.4)	
R^2 adjusted	0.87	0.79	0.64	0.81	0.76		
N	31	34	41	99	124		
Implied steady state value of the effect of income							
y, long run	4.94	5.76	5.65	4.40	3.55	4.05	

Note: Columns (1) to (5) allow coefficients to be different. Column (6) shows the key result from 6 regressions with one tied coefficient. The Wald-test examines if the tie is accepted.

The SURE-technique also allows us to test if we are permitted to tie the coefficients to be the same for all 5 periods as we are doing in the stacked regressions. It appears that we are for all variables except Muslim. We have also tied all coefficients at the same time. This tie is accepted, so the deviation of the coefficients to Mu is of little importance in the total picture.

It still changes the results very little, however, when we use the loss in R^2 compared to the untied (independent) regressions for each period the loss is 0.02, 0.04, 0.06, 0.01 and 0.03 respectively. As is also obvious from the changes in the coefficients it is only in Period 3 that the ties matter to the result. This is also here that one observation for one Muslim country gives a strange result in table 3.

Table 8 demonstrates that we can correct the estimates for several additional problems. In order not to drown the paper in very similar results we only report re-estimates of the stacked model with all explanatory variables using various estimators that each corrects the regression for one potential problem. Each column is one such regression:

Table 8. Other estimates: White, Tobit, fixed effects for countries and 2SLS

	(1) White	(2) Tobit	(3a) Fixed effects	(3b)	(4) 2SLS
Constant	**-12.74**	**15.81**	**-28.47**	**-23.66**	**-7.92**
	(-5.8)	(-6.1)	(-9.8)	(-3.2)	(2.7)
y_{t-1}, initial	**1.75**	**2.20**	**3.35**	**2.94**	**1.19**
	(6.1)	(7.0)	(7.8)	(7.7)	(3.1)
Π_{t-1}, initial	**0.56**	**0.63**		**0.25**	**0.56**
	(14.6)	(16.9)		(4.4)	(12.0)
Oil	**-3.70**	**-4.50**	0.26	-1.03	**-3.44**
	(-5.7)	(-5.2)	(0.1)	(-0.4)	(3.9)
OW, Old West	**1.63**	**3.78**	n.a.	n.a.	**1.69**
	(3.2)	(4.8)			(2.6)
Mu, Muslim	-0.81	-0.64	n.a.	n.a.	**-1.14**
	(-1.5)	(-1.1)			(1.8)
R^2 adj	0.76	0.24[a]	0.78	0.81	n/a
N	329	329	293	293	233
		Implied steady state value of the effect of income			
y, long run	3.98	5.95	(3.35)	3.92	2.70

Note a: Pseudo-R^2, not comparable.

Column (1) is White's correction of the error terms of the regression for heteroscedasticity. The results are virtually unchanged, so heteroscedasticity is not a problem. The same correction has been computed for individual periods, but again this has little effect.

Column (2) takes the fact that Polity is truncated to lie between -10 and 10 into account. Table 1 shows that the corner solution (+10) occurs in no less than 61 of the 329 cases. OLS may thus be inappropriate. Therefore, the model is estimated using the Tobit estimator. The results increase the effect of income a little (as it should), but they are otherwise unchanged.

Column (3) allows for country-specific fixed effects. We report panel estimates using the within groups estimator.[3] Again, the conclusions are unaffected, though the persistence of democracy is lower, as is to be expected from the estimator used. Note that column (3) reports two regressions: (3a) includes fixed effects in the model, and (3b) replaces the initial Polity with fixed effects. It is obvious that the collinearity between the two variables that are accounting for path dependency is large. Also, the use of fixed effect for countries does not

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3. The estimator is biased for large N and fixed T for the case of the dynamic model, so our results are at best suggestive.

permit any constant binary dummy in the regression. We can keep in Oil as some countries change from non-Oil to Oil – however it is just a couple, so the variable drops in fit.

Column (4) corrects for the potential endogeneity bias. This implies the loss of one cross-section, and it does reduce the size of the coefficient to log y, from 1.75 to 1.19. We use the lagged value of initial GDP per capita as an instrument for initial GDP per capita. This reduction is almost significant, but it may be due to changed sample. However, it does suggest that there is some reverse causality in the relation. The 2SLS regression has no impact on the remaining conclusions.

Finally it should be mentioned that we have replicated everything on the Gastil index for the available period, i.e., 1972-2004 (see Paldam, 2005b). Fortunately, the Gastil Index has slightly less persistence and for $T = 16$ we get two periods: Per 1 is 1973-1988, with 1972 as the initial year. Per 2 is 1989-2004, with 1988 as the initial year. Data are available for 135 and 154 countries respectively, so N =289. With a conversion of the Gastil scale to the Polity scale (see appendix), all results replicate nicely also as regards size. The only small deviation from the results is that the variable *Oil* gives slightly weaker results in the Gastil data, while the Mu-variable gives considerably stronger results. In the Gastil data all coefficients to Mu are significant.

6.   Interpreting the results

The pattern found is simple and clear, and it is constant across the full 20th century. As we have only 5 variables we shall go through their effects one by one.

The polity index contains strong inertia. Political systems do not change very often. Also, countries have a history that matters in a fairly long time perspective. Two methods can be used to account for path dependency: The first is to use the initial level of the index as an explanatory variable, and the second is to use fixed effects for countries. The two methods try to do almost the same so they have strong collinearity. If the first method is used the Polity average has to span a considerable period to prevent that a near unit root destroys the regression. If the second method is used we are unable to use explanatory variables that are constant, such as culture or "old" history. We have found that in connections with the Polity Index a time unit of 20 years works. This time unit gives a coefficient to initial Polity of about 0.6, so that the model can be estimated with reasonable precision.

Income is significant throughout, and gives a substantial effect, when the full adjustment has taken place. The Grand Transition gives an increase of 30 to 40 times in income.

This increases the Polity index by no less than 12-14 points. Another interesting calculation is based on Maddison's estimates of World gdp for the 20th century: these say that World gdp has increased 4.8 times (i.e. 1.6% per year) during the whole of the 20th century. This corresponds to about 6 points on the index. If the reader consults figure 1 that is precisely what has happened.

However, it is not income as such, but the Grand Transition that matters. The transition to democracy is thus part of the whole process of development, not just an effect of income change. This is visible from the consistently negative sign to the *Oil*-variable, and the substantial size of the estimated coefficient. Oil-countries are 4 points less democratic than other countries. Countries that have been wealthy throughout the century are all *Old West*, and also democracy emerged in the west. We cannot separate the two historical facts, but we find that the *OW*-variable is mostly significant and when significant always positive. It adds 2 points on the Polity scale to be Old West.

We also get a negative effect of Muslim culture, but it is somewhat unstable over time. The variable interacts with both the *Oil*-variable and the income variable. Muslim countries are only rich if they have oil. When we then include a variable accounting for path dependency as the initial Polity score, the relation does contain too much collinearity, and we are unable to sort out the independent effect of religion. However, given that the distribution of religions is exogenous even in the time perspective of a century it is reasonable to argue that Muslim culture is causal, and income is more endogenous.

The fact that the data reject that the coefficient is stable gives us some hope that the present divergence between the political systems in the West and the ones of the Muslim world is transitory only. This brings us back to figure 3, which shows the large divergence that has taken place over the last 50 years. There is, however, an optimistic kink for the last 5 years.

Appendix: The relation between the Gastil and the Polity indices

The Gastil index from the *Freedom House* is the index for the political system that is used by most economists, so it is worth spending a few pages comparing the two indices. The Gastil index goes from 1972 to 2003, and it is reversely scaled so that it rather measures an absence of democracy. Table A1 gives the scales and an endpoint consistent conversion of the two. The present paper uses the Polity scale throughout, also for the Gastil index.

Table A1. Comparing the scales of the two indices

Fix points	Polity, P	Gastil, G	Conversions
Full democracy	10	1	$P = (40 – 10G)/3$
Midway	0	4	
Full dictatorship	-10	7	$G = 4 – 3P/10$

While this conversion is fine at the endpoints, it is concave in-between, as the Polity-index is more optimistic than the Gastil index, see figure A3 and table A2.

Figure A1 compares the average path for the period 1972 to 2003 for the two indices, when the Gastil index is converted to the Polity scale. The figure shows that the two indices are closely related, though Polity index is a bit more "optimistic" than the Gastil index.

Figure A1. Comparing the path of the averages of Gastil and the Polity indices
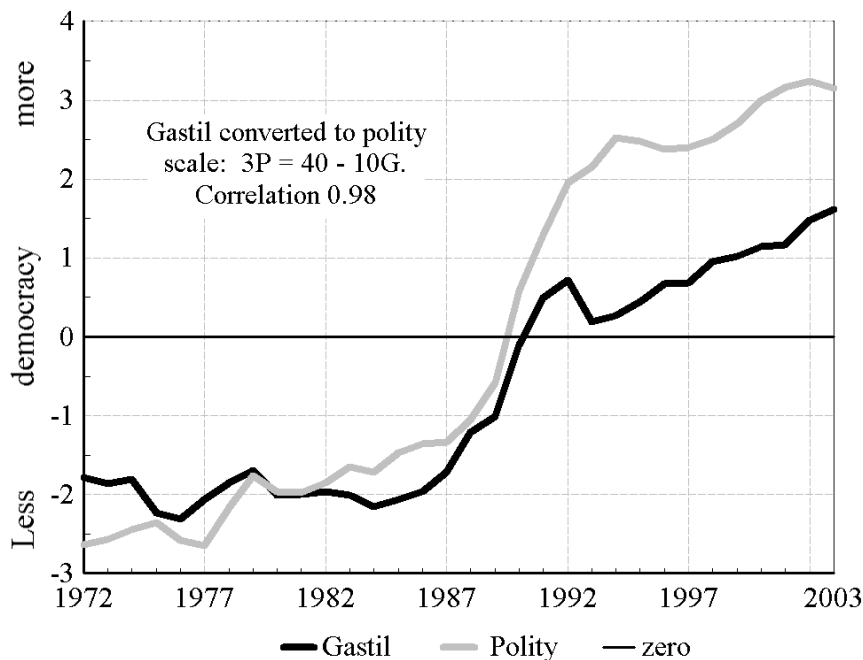
Also as regards the individual countries the two indices are reasonably well correlated. This is demonstrated on figure A2, which covers the period 1994-2003. It is hence the period after the breakup of USSR where the number of countries covered by both indices is 152. It is at least 25 less for any other decade.

Figure A2 shows that over most of the range Polity-scores are more optimistic, so that even when the end points are the same the Polity index is in average 2.24 points higher.

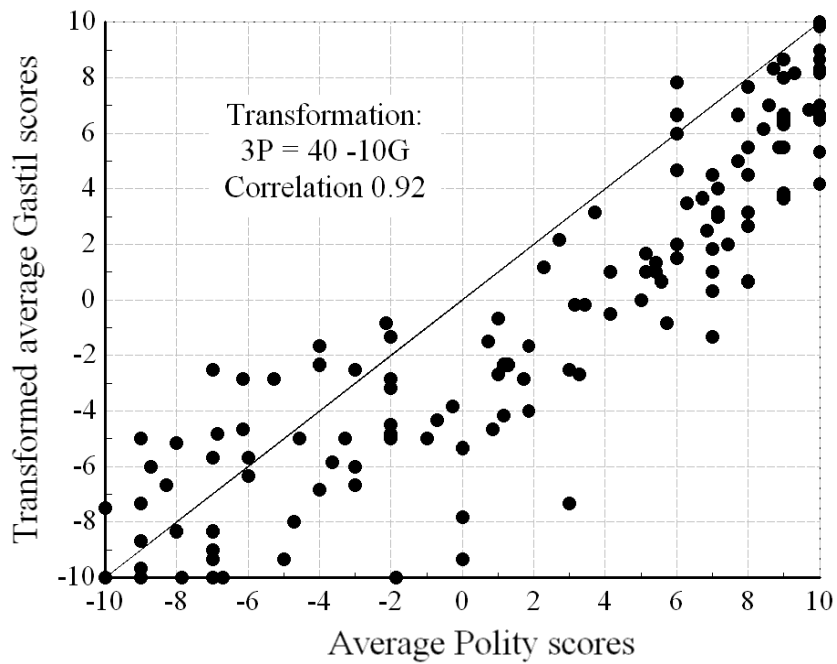Figure A2. The scatter of observations for the Gastil and the Polity indices 1994-2003

Transformation:
3P = 40 -10G
Correlation 0.92

Transformed average Gastil scores (y-axis)

Average Polity scores (x-axis)

Figure A3. The deviations between the two indices, 1994-2003

Number of cases in intervals of one point (y-axis)

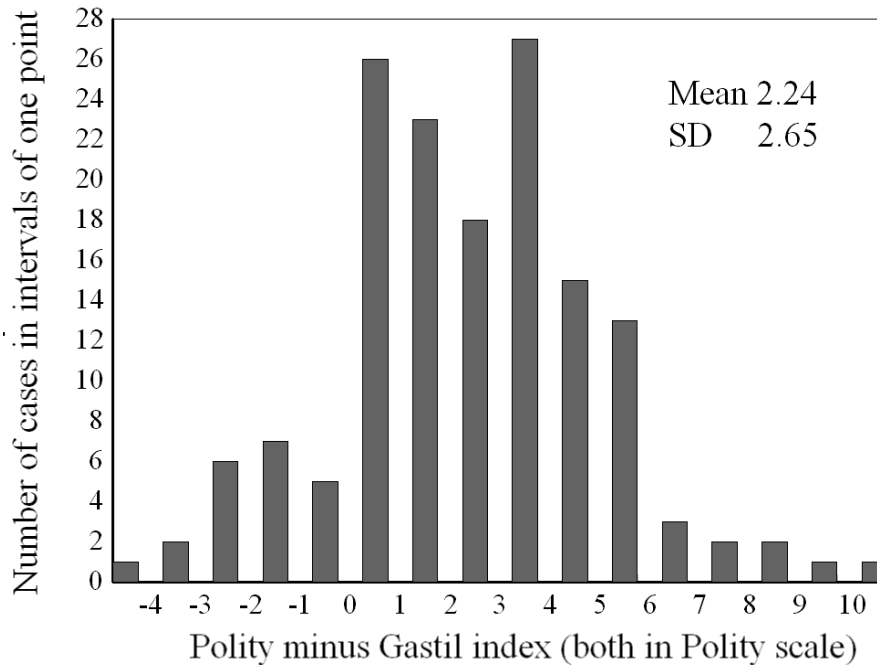Polity minus Gastil index (both in Polity scale) (x-axis)

Mean 2.24
SD   2.65

Figure A3 shows how the deviations between the two indices are distributed. The distribution is reasonably normal, but some countries deviate considerably.

It is interesting to note the most extreme outliers. Table A2 gives the 10 most extreme deviations. It is unfortunate that large deviations are found for rather substantial countries where the facts are well known. Perhaps it is understandable that a unique theocratic system as Iran can generate a large difference in judgment, but it is puzzling that differences which are almost as large appears for Russia, Indonesia and Turkey.

Table A2. The most extreme deviations – based on averages 1994-2003

	Polity	Gastil	Difference	In % of range
Indonesia	3.29	-2.67	5.95	30%
Ukraine	7.00	1.00	6.00	30%
Russia	5.71	-0.83	6.55	33%
Colombia	7.00	0.33	6.67	33%
Guatemala	8.00	0.67	7.33	37%
Congo Kinshasa	0.00	-7.83	7.83	39%
Turkmenistan	-1.86	-10.00	8.14	41%
Turkey	7.00	-1.33	8.33	42%
Somalia	0.00	-9.33	9.33	47%
Iran	3.00	-7.33	10.33	52%

Note: the range is the 20 points between perfect democracy (+10) and prefect dictatorship of (-10).

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