Measuring de facto versus de iure political institutions in the long-run: a multivariate statistical approach

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Abstract

In this paper we use the components of the PolityIV project's polity2 and Vanhanen's Index of Democracy indicators to analyse the relationship between de iure and de facto political institutions from 1820 until 2000 with a canonical correlation method, and a correction for the sample selection bias, caused by the change in the number of available countries.

We find considerably fluctuation in the relationship between the two measures and that much of the observed correlation is due to the sample selection bias. The relationship becomes strong and positive only in the second half of the 20th century.

JEL-codes: N40, O17

keywords: democratization, de facto and de iure institutions, canonical correlation, Polity IV, Vanhanen's Index of Democracy

1. De iure versus de facto political institutions

The distinction between de iure and de facto institutions, or to be more precise, between de iure institutional setting versus de facto situation is a crucial element in explaining observed divergence in socio-economic outcomes (the distinction is introduced by Pande and Udry (2006)). North (1991) defines institutions as a set of rules that constraint individual behaviour. The reason d'etre for institutions is the reduction of transaction costs that increase as the potential market size and the degree of the division of labour grows. Without institutions, more complex structure of interdependent relations would be undermined by the potential gains from individual misbehaviour leading to distrust. The government, as principal, hence plays a fundamental role in shaping the fundamental rules of interactions, which takes the form of laws and practices. Yet, this crucial role of the state gives a special importance to political rights inasmuch as those who make the laws, may also use them to their own advantage. Acemoglu and Robinson (2012) introduce the concept of inclusive versus extractive political institutions, the latter supporting the extractive economic institutions that are in place to channel resources from the society toward the elite. But the concept of elite that shape the laws is not a stationary one, as pointed out in their earlier work on the dynamics of regime changes (Acemoglu and Robinson, 2006). Whenever another interest group is growing up in a society, the ruling elite will face the choice of allowing them political rights leading to reforms or to resist them at the risk of revolution or a coup d'état. The process is not automatic, though, as there is an underlying non-linearity in this process: Acemoglu and Robinson find that regime changes are more likely to occur at intermediate levels of income inequality. The important consequence of this finding is that some societies can stuck in an extractive institutional setting in the long-run, which is a primary candidate to explain observed cross-country income differences. But written rules may also arrive from outside, such as happened historically in the case of colonization. Here we refer not as much to the celebrated reversal of fortune thesis of Acemoglu et al (2002) as to legacy of colonial legislation of the European powers in Sub-Saharan Africa, which does not seem to have lasted long or, if they did, they led to inefficient outcomes. As Pande and Udry (2006) observes, the French and British rules regarding land ownership in their African colonies were different, yet, the pre-colonial customary laws still play a prominent role in many ex British and French colonies, independently of their colonial legal origin. Similarly, Blewet (1995) finds that the British laws in Kenya, introducing private property of lands actually destroyed a well-working land-management system leading to a relatively less efficient use of lands. Another example on an obvious difference in de iure and de facto institutions, is the Soviet Constitution of 1936, which, even though clearly stated the Communist Party's leading position, also granted the freedom of consciousness and the equality under the law to all citizens, rights that remained pure words in one of the world's most dictatorial police state of the period.

One explanation for such deviation between the de iure and de facto political institutions is by Boettke et al (2008) who distinguish among foreign-introduced exogenous, indigenously introduced exogenous and indigenously introduced endogenous institutions. Exogenous institutions are constructed and forced from above, either by an indigenous group or by a foreign power (colonizer or an international organization). Endogenous institutions are the result of some spontaneous process. In the historical process of the evolution of institutions, indigenously introduced endogenous institutions predated all other type, being followed by endogenously introduced exogenous institutions, which were created by the ruling elite. Boettke et al. claim that these different institution types exhibit different degree of hysteresis or stickiness, a concept closely related to path dependence[1]. Endogenous institutions are the stickiest of all, that will resist the effect of any new rules efficiently, and for a very long time. The least sticky institutions are the foreign-induced ones, which do not necessarily serve the interest of the population or the ruling elite. These may take the form of laws (such as Western type constitutions, introduction of general suffrage or a system of education) but will be inefficient, and once the external pressure ceases, they disappear. Hence, we can expect that the difference between de iure and de facto political institutions has grown with the globalization as non-European countries were increasingly subjected to the expectations of Western powers either directly (via colonization) or indirectly (by conditioning aid on political or economic reforms). There are historical examples, however, when foreign-induced institutions managed to replace indigenous institutions, such as democratization in Japan and Germany after World War 2, since these externally designed and forced changes were brought in conformity with certain indigenous traditions. Still the majority of the historical examples reflect the lack of success such as the fall of many democratic African regimes in the 1960s attests. Altogether, the distinction between de facto and de iure political institutions is of crucial importance for understanding the obvious differences one can find among the degree of democratization of countries when measured by different indicators, and it also offers an explanation why empirical research, using traditional methods such as regression analysis, on the relationship between democratization and aggregate socio-economic outcomes has limitations.

2. Measuring democracy: limitations and possibilities

[1] See Mahoney(2000) on the different theoretical explanaton behind path dependence observed in social structures.

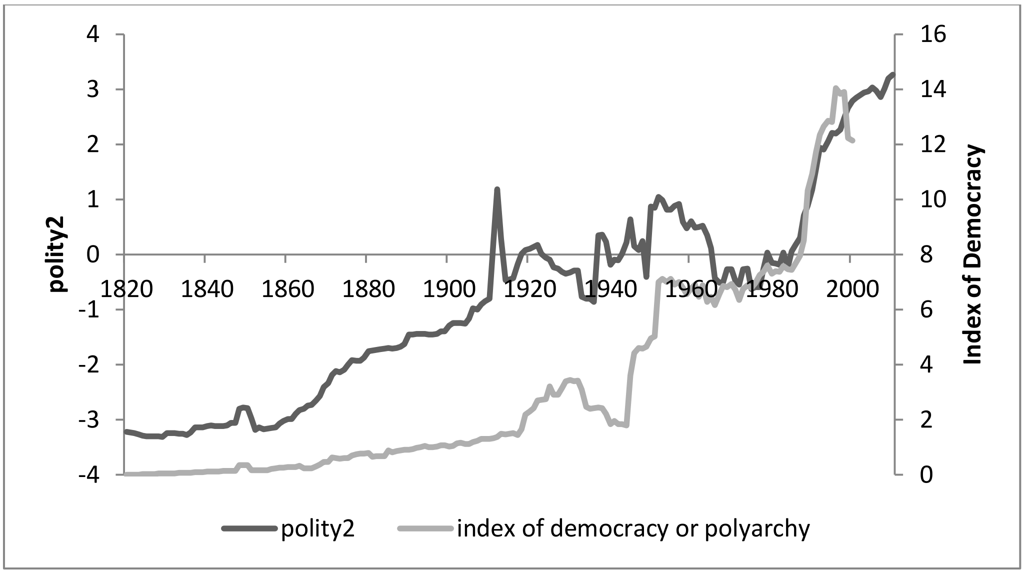
To our knowledge no current empirical measures of democratization are explicitly concerned about the distinction between de iure and de facto institutions. They can all be placed into an underlying theoretical framework as suggested in the critical review article by Coppedge et al. (2011), based on different concepts of democracy. The most important theoretical point of departure is Dahl (1972) who introduced the concept of polyarchy, with competition and participation (or contestation and inclusiveness in his terminology) as two basic aspects of democracy. The identification of these two, theoretically measurable, component of democracy is a common factor behind both the PolityIV (polity) project (Marshall et al, 2012) and Vanhanen's Index of Democracy (ID) (Vanhanen 2000, 2003), that are still the most popular datasets stretching over the last two centuries (the polity project is constantly updated, currently having data on 167 countries for 1800-2012 while the ID includes 187 countries for 1820-2000) and which we also use in this paper.[2] Coppedge et al. (2008) show that the role of the factors competition and participation are predominant in all datasets and account for about three-quarter of the total variation. In this paper we rely on the fundamental assumption that even if both the ID and the polity attempt to capture the same dimensions of democracy, the latter is more successful in measuring actual outcomes through directly using statistics on voter turnout and the composition of parliaments, while polity is more measuring the formal rules and practices that shape political processes, being a product of secondary literature research and expert opinion. In other words, the ID reflects the de facto situation while the polity score (and its five components) is more about the de iure institutional framework. This is observed by Munck and Verkuilen (2002) who notes that the polity indicator is more concerned about the regulatory aspects of participation (if the elections are competitive or not), but it does not reflect the actual magnitude of participation at all.

The above difference in the two indicators gives rise to different conclusions regarding the historical process of democratization (Figure 1) and the ranking of countries depending on which indicator is used. The polity 2 suggests that the global democratization process began in the mid-19th century, while Vanhanen's ID dates the begin of the process at the mid-20th century. The two aggregate indicators seem to converge only after the 1950s. This has serious implication on the theory of democratization as well. Huntington (2001, 2003) speaks of three waves of democratization, which is clearly visible on the polity2 score, while it is much less apparent in the ID.

Figure 1

[2] Our choice was primarily motivated by our goal to use comparable data for the longest possible period. This is the reason why we do not use datasets that are available for shorter periods, such as the Freedom in the World by Freedom House which is available for only after 1972, the Democracy-Dictatorship data (Alvarez et al 1996, Przeworksy et al 2000) beginning in 1948 and the Democracy Index by the Economist Intelligence Unit starting from 2006. We also exclude datasets that may have the historical dimension but are binary and hence do not exhibit enough variation for any meaningful multivariate analysis such as Boix et al. (2012) or the Democracy-Dictatorship data which also has this feature.

World average scores in different measures of the degree of democracy of political institutions, 1820-2010, Polity2 score of the Polity IV project (-10/+10) and the Index of Democracy (%)

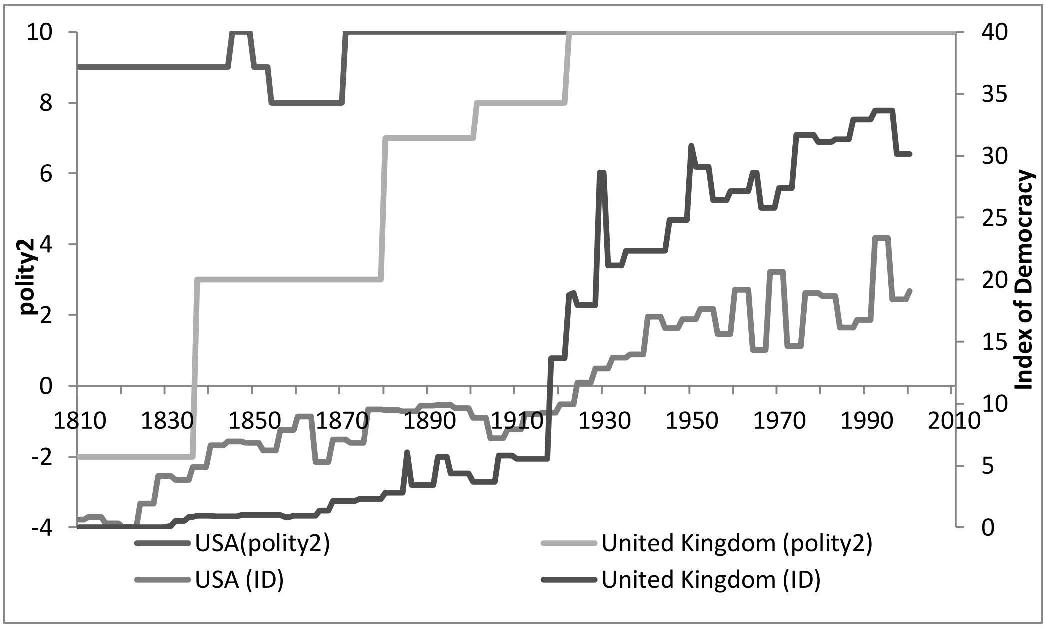


Sources: the polity IV dataset by Marshall et al (2012) and the polyarchy data by Vanhanen (2000, 2003)

The most striking difference can be observed for the United States and the United Kingdom, though. Figure 2 reflect a significant difference between the order of the United States and the United-Kingdom in the democratization process. The polity IV project assigns very high score to the USA in the first half of the 19th century, even though a considerable percentage of the population was still disfranchised. After the Civil War, the USA constantly has a maximum score of 10, which is only achieved by the UK after World War 1. The Index of Democracy exhibits a fundamentally different picture: both countries have a clear trend of increasing democracy, and the USA is overtaken by the UK around 1920, with the significant extension of political rights that results in more participation and competition. Similar differences between the two measures can be observed for most Western European democracies after World War 2, for example in France, Switzerland and the Netherlands.

Figure 2

The polity2 and ID scores for the United States and the United Kingdom, 1810-2010, Polity2 score of the Polity IV project (-10/+10) and the Index of Democracy (%)



Sources: the polity IV dataset by Marshall et al (2012) and the polyarchy data by Vanhanen (2000, 2003)

Table 1
Components of the polity2 index and coding rules

variable	possible outcomes	values	weight in polity2	implied order
XRCOMP Competitiveness of Executive Recruitment	Election	3	2	4
	Transitional	2	1	3
	Selection	1	-2	1
	Unregulated	0	0	2
XROPEN Openness of Executive Recruitment	Open (“Election”)	4	1	6
	Dual: hereditary and election	3	1	5
	Dual: hereditary and designation	2	-1	2
	Closed	1	-1	1
	Unregulated	0	0	4
	Open(“No election”	4	0	3
XCONST Constraint on Chief Executive	Parity or subordination	7	4	7
	Intermediate 1	6	3	6
	Substantial limitation	5	2	5
	Intermediate 2	4	1	4
	Slight moderation	3	-1	3
	Intermediate 3	2	-2	2
	Unlimited Authority	1	-3	1
PARCOMP Competitiveness of Political Participation	Competitive	5	3	6
	Transitional	4	2	5
	Factional	3	1	4
	Restricted	2	-1	2
	Suppressed	1	-2	1
	Not applicable	0	0	3
PARREG	Regulated	5	0	3

Regulation of participation	Multiple identity	2	0	3
	Sectarian	3	-1	2
	Restricted	4	-2	1
	Unregulated	1	0	3

Source: Table 1 in Treier and Jackman (2008: 204), and Marshall et al (2013)

But conceptual limitations are not the only challenges a quantitative research has to cope with. Munck and Verkuilen (2002) discuss some important technical issues that have potentially highly significant consequences on the choice of statistical techniques and the results. The first important issue is the level of measurement. Most institutional indicators are measured on nominal scale (like the components of the polity2 score), which can usually be concerted to an ordinal scale based on some theoretical expectations as done by Treier and Jackman (2008). On nominal scale one can measure if a country's political system fulfils certain qualitative condition, but no further arithmetic operation makes sense. The only information conveyed by such variables is the difference among countries from a certain aspect. On an ordinal scale at least an order is established, e.g., one can state that a country where the chief executives are given authority by hereditary succession (XRCOMP=1 in the polity IV dataset) has a lower rank compared to the situation when they are elected (XRCOMP=3) from the perspective of democratization, but again, even the most fundamental operations like addition are pointless: one could assign any arbitrary numbers to the different outcomes as long as they preserve the order. In other words, assigning the number 0 to the XRCOMP=1 case, and 100 to the XRCOMP=3 case would still convey the same information on the order of possible outcomes, but it would change the mean from 1.5 to 99.5. Most statistical methods are designed for variables measurable by at least interval scale, where the operations summation and subtraction makes sense, and basic statistics, like the mean or the standard deviation can be defined.

The polity project addresses this problem by assigning arbitrary numbers (weights) to different outcomes and sum them up to an aggregate measure labelled as polity2 in Polity IV (see Table 1).[3] Numerous studies use this aggregate measure as an explanatory variable even though, unless the arbitrary weighting accidently coincides with the theoretically correct one, this practice leads to an omitted variable problem and biased coefficient estimates (see Appendix 1 for a proof).

Another issue is the inclusion of redundant variables as a result of arbitrary aggregation methods. The polity2 score the sum of the weighted components, which completely neglects the effect and importance of covariance among the components: components are correlated simply because, to a different extent, they contain the same information (see Table 2 and 3). Hence, they are partly redundant, since we could extract the same information from them. Adding these components up is

[3] Marshall et al (2013) warns about the possible shortcomings of their aggregation method in their manual.

consequently a form of double counting, resulting in an aggregate component that has more variance, than it should have if it were correctly representing the underlying latent democracy. The same applies to the multiplicative aggregation adopted by Vanhanen who creates his aggregate Index of Democracy by multiplying observed data on participation (voter turnout) and competition (one minus the share of the winning party in the parliament). This method assures that only countries that have a balanced performance in both aspects will have a high ID score, but there is no further reason to prefer it above the additive aggregation.

Table 2
Spearman rank correlation coefficients between components of the polity2 score in 2000

	XRCOMP	XROPEN	XCONST	PARREG	PARCOM
XRCOMP	1				
XROPEN	0.884	1			
XCONST	0.840	0.691	1		
PARREG	0.801	0.629	0.808	1	
PARCOM	0.790	0.691	0.839	0.784	1

N=151, note: we adopted the same ranking as Table 1 in Treier and Jackman (2008)

Table 3
Spearman rank correlation coefficients between components of the polity2 score in 1900

	XRCOMP	XROPEN	XCONST	PARREG	PARCOM
XRCOMP	1				
XROPEN	0.853	1			
XCONST	0.533	0.498	1		
PARREG	0.560	0.463	0.513	1	
PARCOM	0.578	0.575	0.502	0.719	1

N=51, note: we adopted the same ranking as Table 1 in Treier and Jackman (2008)

But Tables 2 and 3 have an additional inconvenient message about usual weighting methods: the degree of correlation changes over time, and hence the weights applied for aggregation cannot remain constant either.

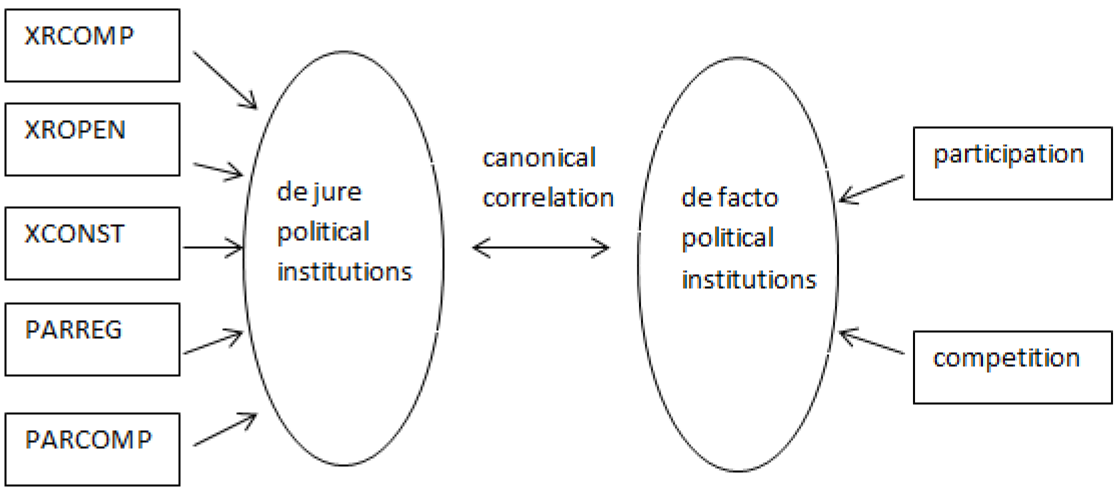
3. Methodology

It may be tempting at first sight to apply a simple dimension reducing method, such as Principal Component Analysis (PCA) or an Exploratory Factor Analysis on the components of democracy to arrive at some less arbitrary weighting scheme. Unfortunately, there is no guarantee that any of the principal components (or factors) would be the latent democracy variable even if we use a rotation to arrive at easier interpretable factors. In a PCA (which is usually the first step in a factor analysis) the component loadings are identified so that the resulting principal components explain most of the variance observed in the data, and the sum of squared loadings is one. But the observed correlation among different components may include measurement errors or the effect of other external factors that are not related to democratization and should be treated as noise rather than signal. It is hence advisable either to rely on methods that introduce additional, theoretically formulated restrictions on the estimated weights, such as Canonical Correlation (CC), Structural Equation Modelling (SEM), or other latent variables methods such as Pemstein et al (2010). Yet one should be aware that the resulting estimates for the latent democracy variable depend on a set of assumptions. Pemstein et al (2010), for example, rely on the assumption that different democracy measures actually measure the same latent variable and any observed difference are due to methodological differences and random measurement errors. These effects are then filtered out to arrive at a unified measure. In this paper however, our main assumption that we demonstrate in the next section, is that the Polity project and Vanhanen's dataset do not measure the same process, even though they are correlated.

We therefore use a canonical correlation approach to find out how the relationship between de iure and de facto political institutions changed over time. With canonical correlation we look for those weights (or coefficients) that maximize the correlation between two component variables (or canonical variates) that contain the components of polity2 and ID respectively. The underlying theory can be summarized as a block diagram (Figure 3).

Figure 3

The theoretical outline of the canonical correlation model



The components of the polity2 score and the Index of Democracy are used to arrive at an estimate for the two latent variables de iure and de facto political institutions. The crucial theoretical assumption that identifies the coefficients of the observed variables is that two latent variables are correlated. If the majority of political systems in the World exhibit a strong internal consistency between de iure and de facto institutions, we should obtain a high canonical correlation coefficient. In the case the two are not related, the canonical correlation should approach zero. Unfortunately, using canonical correlation has a price too. Since the five components of the polity2 indicator are strongly correlated, we cannot use them as dummy variables for the canonical correlation analysis, since they are usually perfectly collinear. As an intermediary solution, we adopt the arbitrary weighting scheme by Marshal et all (column 4 of Table 1), but we allow each component to have their own weight.[4] While an imperfect solution, this still allows a room for a reweighing of the components, and redundant variables will still yield a close to zero coefficient. Also, exceptional events, denoted by codes -66, -77 and -88 in the polity dataset are treated as missing values. We used modern countries, hence the data on historical states that has no obvious equivalent today are omitted either.

Finally, since we use long-term historical data we also need to cope with the problem of sample selection bias. Namely, the probability that a country is included in the data is not random and may be correlated with the value of the components included in the analysis. Initially we have observations on the developed Western nations such as the USA, the United Kingdom and France, while from the last decades of the 19th century we will have data on the periphery to an increasing extent. Also the number of countries increased steadily in the sample period. One should not underestimate the importance of selection problems in cross-country analyses. Since countries with endogenously developed more efficient institutions will have a higher chance of being observed (with probably less noise than latecomers), the estimated correlation may easily be biased upward. The problem has been described by Heckman (1979) who showed that this selection problem can be interpreted and treated as a form of omitted variable bias. We follow his first, two-step procedure for the canonical correlation. In the first step we estimate the probability if the components of the polity2 and the ID were observed for a particular year conditioned on the subcontinent it is situated on with a probit model.[5] The results of the first step are reported as Table 4 and Table 5 in Appendix 2. In the second step we use the two Inverse

[4] Unfortunately there is no canonical correlation method designed for ordinal variables. If one were to design such a method, the choice of weights would matter only as much as they affect the order of the possible values of the components. Yet, the established order should be primarily theory driven, hence it is questionable if a "canonical rank correlation" would make practical sense.

[5] The subcontinents loosely follows the Clio-Infra project's adopted geographical categorization. The regions are: Western and Northern Europe, Eastern Europe (including the USSR and later its successors west of the Ural), Southern Europe, North America, Central America and the Caribbean, South America, Australia and Oceania, East-, West-, South-, Southeast- and Central-Asia, North Africa, and Sub-Saharan Africa.

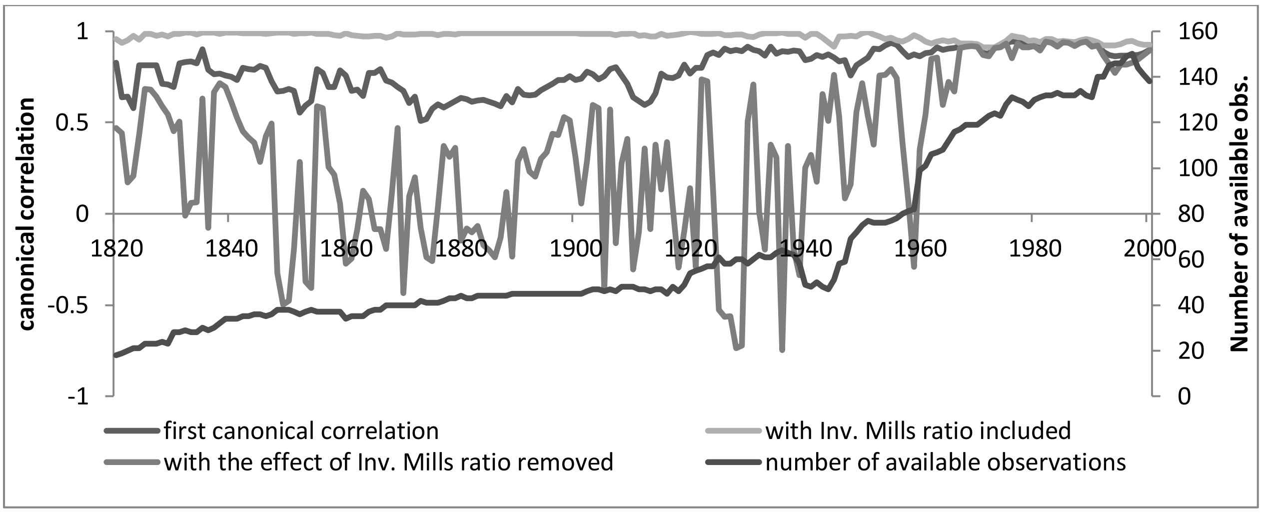
Mills ratios[6] estimated form the first step, as additional variables in the canonical correlation analysis. These should correct for the effect of selection bias in the coefficients, and once we use these corrected coefficients to estimate the latent de facto and de iure political institution indices, we can estimate the linear correlation coefficient between them as a canonical correlation coefficient corrected for selection bias.

4. Results

The results from the canonical correlation analysis on decadal averages are reported as Table 6 in Appendix 3. The coefficients suggest that redundancy was indeed a significant issue, as usually only one or two components are found to significant at at least 10%, and the rest is usually very close to zero. We also carried out the estimation per year, but since the results are basically the same, for convenience we report only the decadal estimates in Table 6. The figures are created from the annual estimates for the canonical correlation, however, as these reflect a more precise picture. Figure 4 has all estimated canonical correlations and the number of observations in a single graph.

Figure 4

Estimated canonical correlation coefficients per year 1820-2000



6 The Inverse Mills ratio is the ratio of a probability density function of a probability distribution to its cumulative distribution function. $mills_i = \frac{e^{-\frac{1}{2}\hat{p}^2}}{\sqrt{2\pi}\Phi(\hat{p})}$, where $\hat{p}$ is the estimated probability of observing observation i from the probit model, and $\Phi(\hat{p})$ denotes the value of the standard normal CDF at value $\hat{p}$.

Figure 5 reveals a slow increase in the first canonical correlation coefficient[7] ranging between 0.508 in 1873 and 0.947 in 1982. Even though these estimates are still biased by the selection problem, a trend can already be established. Until about the 1860s the relationship between the two group of indicators was relatively strong, which weakened until 1873 and slowly increased until World War I which resulted in a temporary drop. In the 1930s we find a minor setback, followed by World War 2, which had a seemingly smaller effect than World War 1, and the strong correlation gradually restores finally by the 1960s.

Figure 5

The first canonical correlation coefficient (without correction for sample selection)

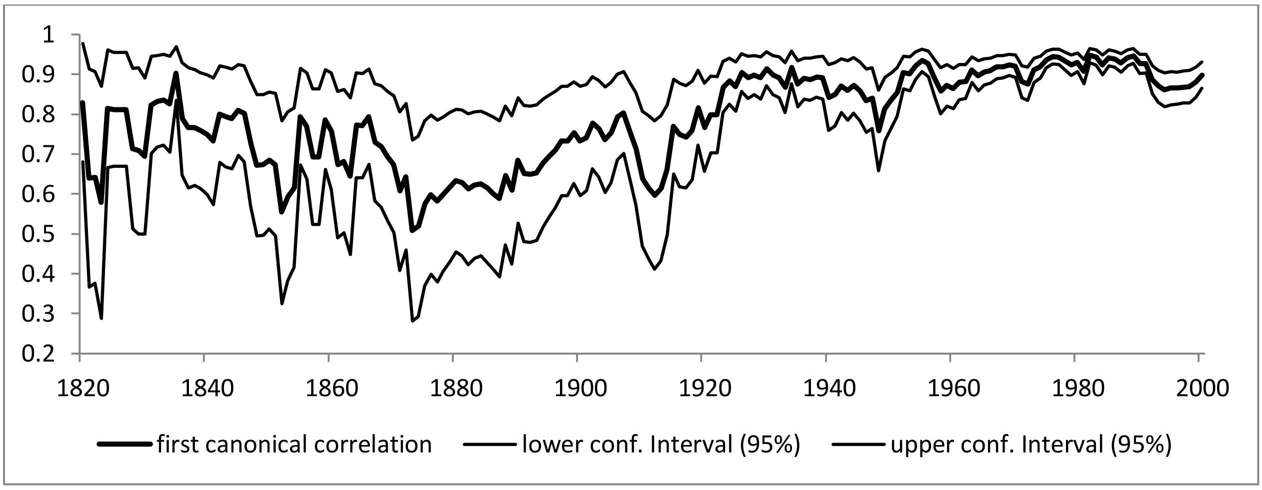


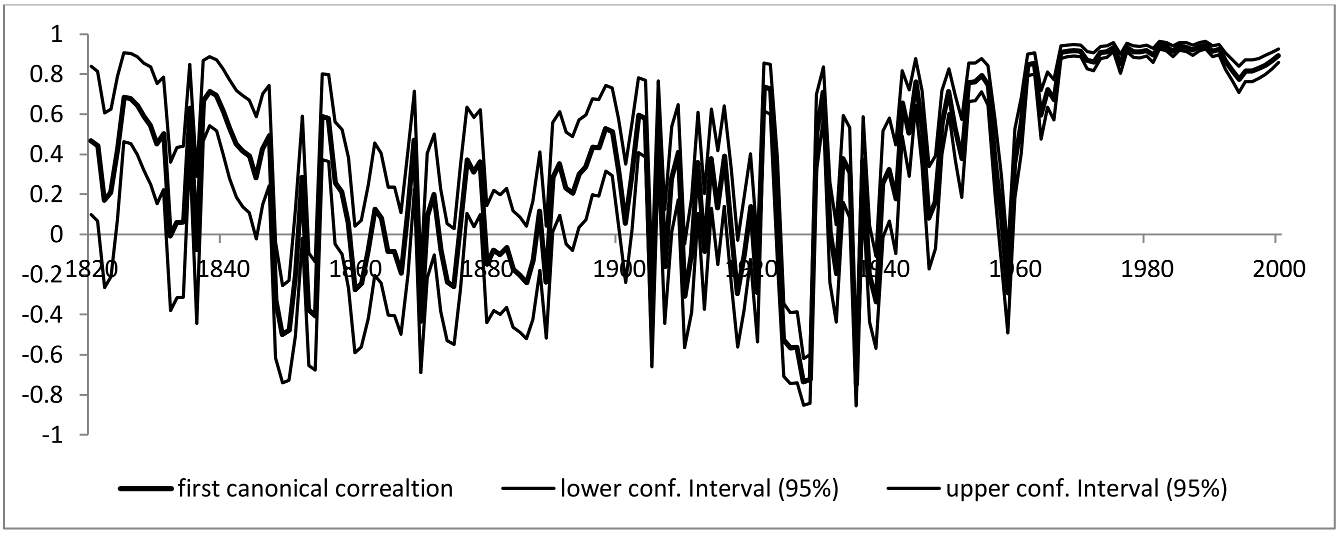
Figure 5 tells us a story which is in accordance with standard knowledge about the historical democratization process. De iure political institutions and de facto practices become less connected in periods of fundamental changes or crises such as World War I and II, the Great Depression.

Once we correct for sample selection biases, the magnitude of the correlation changes fundamentally (Figure 6). As Table 6 attests, the effect of selection bias on the estimated canonical variates as the coefficients are positive and significant. In other words, the omitted selection bias indeed resulted in an overestimation of the relationship between de iure and de facto institutions, and also biased the coefficients. In case of the components of the ID, we even obtain periods when none of the variables yield a significant coefficients, indicating a complete detachment between de iure and de facto institutions.

[7] We use and report the first (highest) canonical correlation.

Figure 6

The first canonical correlation coefficient (with correction for sample selection)



The first obvious difference is that the corrected canonical correlation coefficients have much larger variation and becomes even negative in the 1930s. Yet, one should bear in mind that the probability that a country is included in the sample is also result of an estimation and this introduces additional error. For this reason we apply a Hodrick-Prescot filter (λ=100) on the obtained corrected first canonical correlation coefficients (Figure 7). OF course the filtering method is based on certain assumptions, we decided to follow the original paper (Hodrick and Prescott, 1997) in choosing the main parameter as 100, which results in smoother results than the alternative (6.25) suggested by Ravn and Uhlig (2002) for annual data.

Figure 7

Filtered canonical correlation coefficients (HP filter with λ=100)

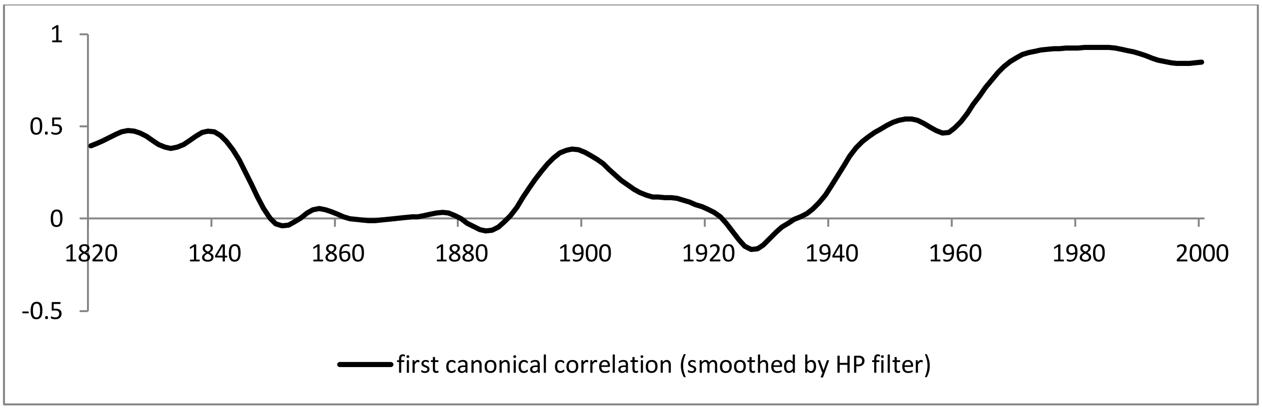


Figure 7 makes the overall picture easier to see: after an initial, moderate, positive relationship, the corrected canonical correlation coefficients approach zero, meaning that the two group of measures become linearly independent, and we see a lasting upward trend only after World War 2.A really strong, positive relationship, that would confirm that the polyarchy dataset by Vanhanen and the Polity IV data by Marshall et al, measures the same underlying process is only found from the 1970s on. Table 6 offers more information on what exactly is responsible for the pattern observed in Figure 6 and 7. The inclusion of the Inverse Mills ratios, that capture the effect of sample selection causes all coefficients to became statistically insignificant from the 1840s until the 1910s and 1920s. Their positive coefficients reflect that basically all observed linear correlation between the de facto and de iure institutional variables was caused by the selection bias.

5. Conclusion

In this paper we claim that the components of the polity2 indicator of Polity IV and the political competition and participation components of Vanhanen's polyarchy dataset (or Index of Democracy), while conceptually related, measure two different aspects of political institutions. The former is more indicative of the de iure, while the latter is more reflecting the de facto institutions. We can use this difference to estimate the relationship between the two group of institutions in the long-run by a canonical correlation analysis. We also find that the selection bias has a strong effect on the outcomes, hence a correction is necessary. The corrected canonical correlation reflects considerable changes in the relationship between de iure and de facto political institutions in time. The relationship becomes even non-existent from the 1840s until the 1920s and it becomes strong only from the 1970s on, altogether giving rise to a trend that reminds of an U-shape, that may arise from the non-linearity of regime changes as suggested by Acemoglu and Robinson (2006), even though with the lack of annual data on within country inequality this is difficult to prove.

These results are indicative that the degree to which formal rules can translate into outcomes is also dependent on some other factors, hence it raises doubts regarding the role of the historical changes in de iure political institutions in the early waves of democratization. It is also noteworthy that the consistency between the two types of political institutions is a recent phenomenon, which coincides with the start of globalization. The conclusion is hence that it is very likely that this high correlation is due to the enforcing power of international markets and organizations, which results in a permanent pressure on indigenous political institutions to adopt foreign-induced, exogenous political institutions using the terminology by Boettke et al (2008).

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Appendix 1

The possible consequence of arbitrary weighting in aggregation of nominal variables in linear regressions

Let us assume that **z** is an aggregate measure of an important factor, that is calculated as a weighted sum of k components. In matrix form: $\mathbf{z} = \mathbf{Zb}$ where, **z** is an nx1 vector if the aggregate measure, **Z** is a nxk matrix of the k components of the aggregate measure z and **b** is a kx1 vector of weights. In a regression one is usually interested in measuring the partial (ceteris paribus) effect of **z** on a dependent variable **y**(an nx1 vector), with p explanatory variables included. We can assume that even if the components of Z are measured on the nominal level, there exists a vector of weights **c** that can be considered as ideal in the sense that $\mathbf{Zc}$ would capture the underlying latent variable while fulfilling the requirement of exogeneity, that is, $E(\mathbf{e}\,|\,\mathbf{Zc}) = 0$. The population regression function is: $\mathbf{Y} = \mathbf{X}\boldsymbol{\beta} + \mathbf{Zc}\boldsymbol{\gamma} + \mathbf{e}$, where **X** is an nxp matrix of explanatory variables, and $\boldsymbol{\beta}$ is a px1 vector of coefficients. The regression equation that one estimates of the sample is, however:

$$\mathbf{y} = \mathbf{X}\hat{\boldsymbol{\beta}} + \mathbf{z}\hat{\boldsymbol{\gamma}} + \mathbf{u} = \mathbf{X}\hat{\boldsymbol{\beta}} + \mathbf{Zb}\hat{\boldsymbol{\gamma}} + \mathbf{u},$$

Since there is no guarantee that **b=c**, the residual **u** will contain the effect of using the wrong weights: $\mathbf{u} = \mathbf{e} - \mathbf{X}\left(\hat{\boldsymbol{\beta}} - \boldsymbol{\beta}\right) - \mathbf{Z}(\mathbf{c}\boldsymbol{\gamma} - \mathbf{b}\hat{\boldsymbol{\gamma}})$, with the OLS estimates of the coefficients being biased as follows:

$E(\hat{\boldsymbol{\beta}}) = \boldsymbol{\beta} + (\mathbf{X}^{\mathbf{T}}\mathbf{X})^{-1}\mathbf{X}^{\mathbf{T}}\mathbf{Z}(\mathbf{b}\hat{\boldsymbol{\gamma}} - \mathbf{c}\boldsymbol{\gamma})$ and $E(\hat{\boldsymbol{\gamma}}) = \boldsymbol{\gamma} - \left(\mathbf{b}^{\mathbf{T}}\mathbf{Z}^{\mathbf{T}}\mathbf{Z}\mathbf{b}\right)^{-1}\mathbf{b}^{\mathbf{T}}\mathbf{Z}^{\mathbf{T}}\mathbf{X}(\hat{\boldsymbol{\beta}} - \boldsymbol{\beta})$.

Appendix 2 Results from the probit models (first step of the Heckman method)

Table 4
Probit estimation for the avaialibaility of polyarchy components per decade 1820s-2000
(t-statistics are reported in parentheses)

	1820s	1830s	1840s	1850s	1860s	1870s
NWEurope	0.788	0.888	1.663***	1.663***	1.755***	1.755***
	(1.37)	(1.55)	(3.52)	(3.52)	(3.72)	(3.72)
SEurope	0.131	0.380	1.059**	1.059**	1.257**	1.257**
	(0.20)	(0.61)	(1.98)	(1.98)	(2.41)	(2.41)
EEurope	-0.000	0.000	0.679	0.679	1.094*	1.387**
	(-0.00)	(0.00)	(1.03)	(1.03)	(1.85)	(2.45)
NAmerica	0.541	0.541	1.220	1.220	1.809***	1.809***
	(0.66)	(0.66)	(1.61)	(1.61)	(2.59)	(2.59)
CAmerica	-0.196	0.434	1.318***	1.318***	1.318***	1.318***
	(-0.32)	(0.75)	(2.80)	(2.80)	(2.80)	(2.80)
SAmerica	1.563**	1.949***	2.628***	2.628***	2.628***	2.628***
	(2.52)	(3.09)	(4.86)	(4.86)	(4.86)	(4.86)
AustOc						
EAsia	0.709	0.709	1.387**	1.387**	1.387**	1.387**
	(1.00)	(1.00)	(2.20)	(2.20)	(2.20)	(2.20)
WAsia	-0.262	-0.262	0.417	0.417	0.417	0.417
	(-0.37)	(-0.37)	(0.67)	(0.67)	(0.67)	(0.67)
SAsia	0.541	0.541	1.220**	1.220**	1.220**	1.220**
	(0.79)	(0.79)	(2.01)	(2.01)	(2.01)	(2.01)
SEAsia			0.679	0.679	0.679	0.679
			(1.03)	(1.03)	(1.03)	(1.03)
CAsia						
NAfrica						
SubSahAfrica						
Constant	-1.383***	-1.383***	-2.062***	-2.062***	-2.062***	-2.062***
	(-2.66)	(-2.66)	(-5.06)	(-5.06)	(-5.06)	(-5.06)
pseudo R^2	0.152	0.148	0.207	0.207	0.203	0.201
N	164	164	215	215	215	215

* p<0.1, ** p<0.05, *** p<0.01

	1880s	1890s	1900s	1910s	1920s	1930s
NWEurope	1.453***	1.453***	1.453***	1.608***	1.695***	1.695***
	(3.65)	(3.65)	(3.65)	(4.41)	(4.64)	(4.64)
SEurope	0.955**	0.955**	0.955**	0.931**	0.931**	0.931**
	(2.10)	(2.10)	(2.10)	(2.23)	(2.23)	(2.23)
EEurope	1.085**	1.085**	1.329***	1.775***	1.565***	1.565***
	(2.14)	(2.14)	(2.70)	(3.86)	(3.42)	(3.42)
NAmerica	1.507**	1.507**	1.507**	1.311**	1.311**	1.311**
	(2.31)	(2.31)	(2.31)	(2.07)	(2.07)	(2.07)
CAmerica	1.016**	1.016**	1.194***	0.999***	0.913**	0.999***
	(2.56)	(2.56)	(3.05)	(2.78)	(2.52)	(2.78)
SAmerica	2.326***	2.326***	2.326***	2.131***	2.131***	2.131***
	(4.86)	(4.86)	(4.86)	(4.70)	(4.70)	(4.70)
AustOc			0.314	0.119	0.119	0.119
			(0.65)	(0.26)	(0.26)	(0.26)
EAsia	1.085*	1.085*	1.085*	0.890	1.246**	1.246**
	(1.88)	(1.88)	(1.88)	(1.60)	(2.34)	(2.34)
WAsia	0.115	0.115	0.115	-0.080	0.283	0.723*
	(0.20)	(0.20)	(0.20)	(-0.15)	(0.60)	(1.70)
SAsia	0.918*	0.918*	0.918*	1.040**	1.040**	1.040**
	(1.66)	(1.66)	(1.66)	(2.07)	(2.07)	(2.07)
SEAsia	0.377	0.377	0.377	0.182	0.182	0.182
	(0.62)	(0.62)	(0.62)	(0.31)	(0.31)	(0.31)
CAsia						
NAfrica					0.344	0.344
					(0.55)	(0.55)
SubSahAfrica						
Constant	-1.760***	-1.760***	-1.760***	-1.565***	-1.565***	-1.565***
	(-5.49)	(-5.49)	(-5.49)	(-5.57)	(-5.57)	(-5.57)
pseudo R^2	0.179	0.179	0.183	0.206	0.194	0.181
N	215	215	242	242	251	251

* p<0.1, ** p<0.05, *** p<0.01

	1940s	1950s	1960s	1970s	1980s	1990s	2000
NWEurope	1.695***	1.336***	-0.498*	-0.964***	-1.050***	-1.075***	-0.875***
	(4.64)	(3.99)	(-1.67)	(-3.06)	(-3.28)	(-3.20)	(-2.72)
SEurope	0.931**	0.659*	-1.021***	-1.487***	-1.572***	-0.957**	-1.159***
	(2.23)	(1.68)	(-2.90)	(-4.05)	(-4.23)	(-2.52)	(-3.20)
EEurope	1.565***	1.293***	-0.541	-1.007**	-1.093***		-0.125
	(3.42)	(2.97)	(-1.33)	(-2.40)	(-2.58)		(-0.26)
NAmerica	1.311**	1.039*	-0.795	-1.261**	-1.346**	-1.546**	-1.346**
	(2.07)	(1.69)	(-1.33)	(-2.08)	(-2.21)	(-2.51)	(-2.21)
CAmerica	0.999***	0.727**	-0.946***	-1.043***	-0.913***	-1.113***	-1.057***
	(2.78)	(2.21)	(-3.31)	(-3.48)	(-2.98)	(-3.46)	(-3.46)
SAmerica	2.131***	1.859***	0.250	0.060	-0.025	-0.225	-0.527
	(4.70)	(4.33)	(0.60)	(0.13)	(-0.05)	(-0.47)	(-1.26)
AustOc	0.119	-0.153	-1.586***	-1.772***	-1.738***	-1.724***	-1.523***
	(0.26)	(-0.35)	(-4.55)	(-5.18)	(-5.11)	(-4.97)	(-4.58)
EAsia	1.883***	1.611***	-0.223	-0.689	-0.774	-0.974*	-1.093**
	(3.54)	(3.15)	(-0.46)	(-1.38)	(-1.54)	(-1.90)	(-2.21)
WAsia	1.311***	1.167***	-0.416	-0.483	-0.568	-0.451	-0.418
	(3.29)	(3.15)	(-1.24)	(-1.33)	(-1.55)	(-1.13)	(-1.11)
SAsia	2.089***	1.817***	-0.017	-0.166	-0.251	-0.451	-0.251
	(4.16)	(3.78)	(-0.04)	(-0.33)	(-0.50)	(-0.88)	(-0.50)
SEAsia	1.134**	1.724***	0.426	-0.040	-0.125	-0.325	-0.125
	(2.42)	(3.87)	(0.91)	(-0.08)	(-0.26)	(-0.66)	(-0.26)
CAsia							
NAfrica	0.344	1.433***	-0.111	-0.577	-0.662	-0.862*	-0.662
	(0.55)	(2.96)	(-0.24)	(-1.20)	(-1.37)	(-1.74)	(-1.37)
SubSahAfrica							
EEurope							
Constant	-1.565***	-1.293***	0.541***	1.007***	1.093***	1.293***	1.093***
	(-5.57)	(-5.37)	(2.92)	(4.75)	(4.98)	(5.37)	(4.98)
pseudo R^2	0.194	0.176	0.126	0.150	0.145	0.129	0.113
N	251	251	251	251	251	239	251

* p<0.1, ** p<0.05, *** p<0.01

Table 5
Probit estimation for the avaialibaility of polity2 components per decade 1820s-2000s
(t-statistics are reported in parentheses)

	1820s	1830s	1840s	1850s	1860s	1870s
NWEurope	0.519	0.625	1.567***	1.265***	1.361***	1.453***
	(0.85)	(1.03)	(3.30)	(3.14)	(3.40)	(3.65)
SEurope	0.217	0.416	1.257**	0.955**	1.126**	1.126**
	(0.33)	(0.65)	(2.41)	(2.10)	(2.53)	(2.53)
EEurope	-0.162	-0.162	0.679	0.792	1.085**	1.329***
	(-0.21)	(-0.21)	(1.03)	(1.48)	(2.14)	(2.70)
NAmerica	0.379	0.379	1.220	0.918	1.507**	1.507**
	(0.45)	(0.45)	(1.61)	(1.28)	(2.31)	(2.31)
CAmerica	-0.359	0.272	1.318***	1.016**	1.016**	1.016**
	(-0.55)	(0.45)	(2.80)	(2.56)	(2.56)	(2.56)
SAmerica	1.041	1.787***	2.628***	2.326***	2.326***	2.326***
	(1.61)	(2.72)	(4.86)	(4.86)	(4.86)	(4.86)
AustOc				-0.026	-0.026	-0.026
				(-0.05)	(-0.05)	(-0.05)
EAsia	0.546	0.546	1.387**	1.085*	1.085*	1.085*
	(0.74)	(0.74)	(2.20)	(1.88)	(1.88)	(1.88)
WAsia	-0.061	-0.061	0.780	0.478	0.478	0.478
	(-0.09)	(-0.09)	(1.40)	(0.96)	(0.96)	(0.96)
SAsia	0.379	0.379	1.220**	0.918*	0.918*	0.918*
	(0.53)	(0.53)	(2.01)	(1.66)	(1.66)	(1.66)
SEAsia	-0.162	-0.162	0.679	0.377	0.377	0.377
	(-0.21)	(-0.21)	(1.03)	(0.62)	(0.62)	(0.62)
CAsia						
NAfrica			0.841	0.539	0.539	0.539
			(1.22)	(0.84)	(0.84)	(0.84)
SubSahAfrica						
Constant	-1.221**	-1.221**	-2.062***	-1.760***	-1.760***	-1.760***
	(-2.21)	(-2.21)	(-5.06)	(-5.49)	(-5.49)	(-5.49)
pseudo R^2	0.085	0.124	0.182	0.169	0.175	0.182
N	173	173	224	251	251	251

* p<0.1, ** p<0.05, *** p<0.01

	1880s	1890s	1900s	1910s	1920s	1930s
NWEurope	1.453***	1.453***	1.453***	1.521***	1.695***	1.695***
	(3.65)	(3.65)	(3.65)	(4.17)	(4.64)	(4.64)
SEurope	1.126**	1.126**	1.126**	1.085***	1.085***	1.085***
	(2.53)	(2.53)	(2.53)	(2.64)	(2.64)	(2.64)
EEurope	1.329***	1.329***	1.329***	1.565***	1.775***	1.565***
	(2.70)	(2.70)	(2.70)	(3.42)	(3.86)	(3.42)
NAmerica	1.507**	1.507**	1.507**	1.311**	1.311**	1.311**
	(2.31)	(2.31)	(2.31)	(2.07)	(2.07)	(2.07)
CAmerica	1.016**	1.016**	1.194***	0.999***	0.999***	0.999***
	(2.56)	(2.56)	(3.05)	(2.78)	(2.78)	(2.78)
SAmerica	2.326***	2.326***	2.326***	2.131***	2.131***	2.131***
	(4.86)	(4.86)	(4.86)	(4.70)	(4.70)	(4.70)
AustOc	-0.026	-0.026	0.314	0.119	0.119	0.119
	(-0.05)	(-0.05)	(0.65)	(0.26)	(0.26)	(0.26)
EAsia	1.085*	1.085*	1.085*	0.890	1.246**	1.246**
	(1.88)	(1.88)	(1.88)	(1.60)	(2.34)	(2.34)
WAsia	0.478	0.478	0.478	0.528	0.890**	0.890**
	(0.96)	(0.96)	(0.96)	(1.19)	(2.15)	(2.15)
SAsia	0.918*	0.918*	1.235**	1.040**	1.040**	1.040**
	(1.66)	(1.66)	(2.35)	(2.07)	(2.07)	(2.07)
SEAsia	0.377	0.377	0.377	0.182	0.182	0.597
	(0.62)	(0.62)	(0.62)	(0.31)	(0.31)	(1.16)
CAsia						
NAfrica	0.539	0.539	0.539	0.344	0.344	0.344
	(0.84)	(0.84)	(0.84)	(0.55)	(0.55)	(0.55)
SubSahAfrica						
Constant	-1.760***	-1.760***	-1.760***	-1.565***	-1.565***	-1.565***
	(-5.49)	(-5.49)	(-5.49)	(-5.57)	(-5.57)	(-5.57)
pseudo R^2	0.182	0.182	0.168	0.172	0.184	0.170
N	251	251	251	251	251	251

* p<0.1, ** p<0.05, *** p<0.01

	1940s	1950s	1960s	1970s	1980s	1990s	2000s
NWEurope	1.872***	1.372***	-0.585**	-1.051***	-1.051***	-0.969***	-0.963***
	(5.10)	(3.96)	(-1.97)	(-3.34)	(-3.34)	(-2.96)	(-3.00)
SEurope	1.085***	0.936**	-1.021***	-1.487***	-1.487***	-1.253***	-0.613*
	(2.64)	(2.37)	(-2.90)	(-4.05)	(-4.05)	(-3.41)	(-1.65)
EEurope	1.565***	1.416***	-0.541	-1.007**	-1.007**		-0.125
	(3.42)	(3.19)	(-1.33)	(-2.40)	(-2.40)		(-0.26)
NAmerica	1.311**	1.162*	-0.795	-1.261**	-1.261**	-1.440**	-1.346**
	(2.07)	(1.87)	(-1.33)	(-2.08)	(-2.08)	(-2.36)	(-2.21)
CAmerica	0.999***	0.850**	-1.025***	-1.491***	-1.491***	-1.671***	-1.576***
	(2.78)	(2.49)	(-3.55)	(-4.87)	(-4.87)	(-5.25)	(-5.06)
SAmerica	2.131***	1.982***	0.250	0.060	0.060	-0.119	-0.025
	(4.70)	(4.52)	(0.60)	(0.13)	(0.13)	(-0.25)	(-0.05)
AustOc	0.119	-0.030	-1.987***	-1.903***	-1.903***	-2.083***	-1.989***
	(0.26)	(-0.07)	(-4.92)	(-5.42)	(-5.42)	(-5.76)	(-5.59)
EAsia	2.239***	2.090***	0.133	-0.333	-0.333	-0.512	-0.418
	(4.02)	(3.83)	(0.26)	(-0.63)	(-0.63)	(-0.96)	(-0.79)
WAsia	1.439***	1.290***	-0.288	-0.333	-0.483	0.095	-0.056
	(3.62)	(3.39)	(-0.85)	(-0.90)	(-1.33)	(0.21)	(-0.14)
SAsia	1.565***	1.669***	-0.288	-0.483	-0.483	-0.662	-0.568
	(3.22)	(3.50)	(-0.65)	(-1.03)	(-1.03)	(-1.39)	(-1.21)
SEAsia	1.134**	1.846***	-0.111	-0.333	-0.577	-0.512	-0.125
	(2.42)	(4.07)	(-0.27)	(-0.75)	(-1.34)	(-1.13)	(-0.26)
CAsia							
NAfrica	0.344	1.276***	-0.402	-0.868*	-0.868*	-1.047**	-0.953**
	(0.55)	(2.59)	(-0.88)	(-1.85)	(-1.85)	(-2.19)	(-2.01)
SubSahAfrica							
EEurope							
Constant	-1.565***	-1.416***	0.541***	1.007***	1.007***	1.187***	1.093***
	(-5.57)	(-5.51)	(2.92)	(4.75)	(4.75)	(5.19)	(4.98)
pseudo R^2	0.202	0.180	0.142	0.180	0.172	0.216	0.202
N	251	251	251	251	251	239	251

* p<0.1, ** p<0.05, *** p<0.01

Appendix 3 Results form the canonical correlation analysis on decadal averages

Table 6
Canonical correlation between components of polity2 and polyarchy per decade with and without correction for sample selection bias 1820s-2000 (t-statistics are reported in parentheses)

	1820s		1830s		1840s	
xrcomp	0.445	-0.003	-0.033	0.016	0.093	0.009
	(1.24)	(-0.02)	(-0.20)	(0.11)	(0.38)	(0.21)
xropen	-0.069	-0.075	-0.247	-0.120	-0.408	-0.068
	(-0.13)	(-0.24)	(-0.72)	(-0.39)	(-0.80)	(-0.73)
xconst	0.352***	-0.097	0.493***	0.068	0.444***	0.003
	(3.08)	(-1.44)	(7.52)	(1.19)	(4.53)	(0.14)
parreg	0.346	-0.461	-0.038	-0.022	0.158	0.011
	(0.44)	(-0.97)	(-0.12)	(-0.07)	(0.33)	(0.13)
parcomp	-0.178	0.135	-0.190	-0.079	-0.063	-0.040
	(-0.61)	(0.74)	(-1.26)	(-0.55)	(-0.25)	(-0.87)
polmills		0.239***		0.399***		0.108***
		(7.11)		(7.53)		(24.97)
competition	0.005	0.005	0.081***	0.019*	0.060***	0.004
	(0.21)	(0.37)	(7.38)	(2.01)	(3.63)	(1.50)
participation	1.336***	-0.369*	-0.117	-0.064	0.080	-0.023
	(3.72)	(-1.81)	(-1.27)	(-0.80)	(0.83)	(-1.37)
polymills		0.181***		0.287***		0.106***
		(9.38)		(9.88)		(32.82)
cancor	0.780	0.913	0.840	0.875	0.700	0.985
N	24	24	34	34	38	38

* p<0.1, ** p<0.05, *** p<0.01

	1850s		1860s		1870s	
xrcomp	0.027	0.000	-0.037	0.020	-0.160	0.024
	(0.13)	(0.01)	(-0.19)	(0.47)	(-0.68)	(0.56)
xropen	-0.172	0.078	0.170	0.042	0.413	-0.004
	(-0.37)	(0.73)	(0.47)	(0.51)	(0.90)	(-0.05)
xconst	0.416***	0.011	0.362***	0.007	0.339***	0.003
	(5.00)	(0.58)	(4.68)	(0.39)	(3.63)	(0.16)
parreg	-0.330	-0.107	-0.532	-0.121	0.243	-0.078
	(-0.76)	(-1.06)	(-1.17)	(-1.19)	(0.52)	(-0.91)
parcomp	0.155	0.029	0.296	0.049	0.046	0.041
	(0.68)	(0.53)	(1.31)	(0.98)	(0.17)	(0.84)
polmills		0.240***		0.253***		0.260***
		(20.63)		(24.27)		(25.06)
competition	0.066***	0.002	0.053***	0.001	0.036***	-0.002
	(5.66)	(0.82)	(5.36)	(0.41)	(2.72)	(-0.90)
participation	-0.014	0.004	0.045	0.001	0.118**	0.001
	(-0.29)	(0.37)	(1.06)	(0.07)	(2.20)	(0.08)
polymills		0.107***		0.112***		0.113***
		(25.48)		(27.67)		(28.02)
cancor						
N	38	38	42	42	44	44

* p<0.1, ** p<0.05, *** p<0.01

	1880s		1890s		1900s	
xrcomp	0.074	0.011	0.279	0.028	0.274*	0.057
	(0.32)	(0.23)	(1.58)	(0.53)	(1.82)	(1.13)
xropen	0.044	-0.063	-0.247	-0.113	-0.746**	-0.125
	(0.09)	(-0.59)	(-0.64)	(-0.97)	(-2.37)	(-1.19)
xconst	0.306***	-0.029	0.272***	-0.026	0.302***	-0.010
	(3.44)	(-1.52)	(4.47)	(-1.38)	(5.26)	(-0.49)
parreg	-0.122	0.063	0.458	0.006	0.317	0.007
	(-0.23)	(0.56)	(1.14)	(0.05)	(1.08)	(0.07)
parcomp	0.239	-0.077	-0.143	-0.050	-0.011	-0.037
	(0.85)	(-1.32)	(-0.69)	(-0.80)	(-0.07)	(-0.74)
polmills		0.197***		0.195***		0.197***
		(20.47)		(20.33)		(22.41)
competition	0.046***	-0.003	0.033***	-0.001	0.045***	-0.000
	(3.03)	(-1.05)	(3.14)	(-0.28)	(5.90)	(-0.11)
participation	0.058	-0.003	0.088**	-0.012	0.007	0.002
	(1.06)	(-0.26)	(2.29)	(-1.05)	(0.33)	(0.31)
polymills		0.179***		0.179***		0.183***
		(21.38)		(20.99)		(23.86)
cancor	0.593	0.964	0.732	0.964	0.770	0.965
N	45	45	45	45	50	50

* p<0.1, ** p<0.05, *** p<0.01

	1910s		1920s		1930s	
xrcomp	0.259	0.057	0.046	0.033	-0.044	-0.016
	(1.64)	(0.75)	(0.45)	(0.75)	(-0.57)	(-0.41)
xropen	-0.355	-0.302*	0.414	-0.150	0.332*	-0.017
	(-0.96)	(-1.70)	(1.65)	(-1.35)	(1.88)	(-0.19)
xconst	0.197***	0.065**	0.172***	-0.002	0.312***	0.022
	(3.18)	(2.13)	(3.94)	(-0.12)	(9.92)	(1.37)
parreg	0.333	0.045	0.636***	-0.114	0.244	-0.006
	(1.13)	(0.31)	(3.05)	(-1.19)	(1.57)	(-0.08)
parcomp	0.144	0.030	-0.112	-0.016	-0.072	0.008
	(0.98)	(0.42)	(-1.19)	(-0.40)	(-0.98)	(0.22)
polmills		0.265***		0.266***		0.291***
		(14.90)		(26.90)		(36.26)
competition	0.029***	0.005	0.026***	-0.000	0.034***	0.003*
	(4.27)	(1.49)	(4.88)	(-0.03)	(10.55)	(1.71)
participation	0.043**	0.010	0.025***	-0.003	0.012**	0.001
	(2.52)	(1.20)	(2.85)	(-0.86)	(2.58)	(0.29)
polymills		0.234***		0.266***		0.284***
		(16.63)		(30.93)		(38.42)
cancor	0.741	0.920	0.876	0.972	0.928	0.980
N	58	58	62	62	65	65

* p<0.1, ** p<0.05, *** p<0.01

	1940s		1950s		1960s	
xrcomp	0.211**	-0.007	0.249***	0.042	0.058	-0.016
	(2.22)	(-0.84)	(2.97)	(1.38)	(1.09)	(-0.34)
xropen	0.071	0.028	0.337*	-0.050	0.505***	0.206*
	(0.30)	(1.45)	(1.88)	(-0.77)	(3.70)	(1.78)
xconst	0.105**	0.005	0.062	-0.027*	0.143***	0.039
	(2.57)	(1.34)	(1.39)	(-1.70)	(4.62)	(1.50)
parreg	-0.142	-0.034**	-0.066	0.037	0.072	0.005
	(-0.70)	(-2.04)	(-0.34)	(0.52)	(0.50)	(0.04)
parcomp	0.283***	0.002	0.138	0.011	0.132**	0.057
	(3.06)	(0.26)	(1.62)	(0.35)	(2.14)	(1.08)
polmills		0.309***		0.395***		0.647***
		(161.29)		(50.25)		(25.49)
competition	0.039***	-0.000	0.039***	0.001	0.040***	0.012***
	(10.43)	(-0.73)	(17.22)	(0.95)	(22.23)	(7.61)
participation	0.006	-0.000	0.003	-0.003***	0.005**	0.001
	(1.31)	(-0.44)	(1.04)	(-3.44)	(2.46)	(0.46)
polymills		0.312***		0.460***		1.466***
		(173.25)		(52.54)		(26.13)
cancor	0.886	0.999	0.902	0.986	0.918	0.940
N	76	76	84	84	122	122

* p<0.1, ** p<0.05, *** p<0.01

	1970s		1980s		1990s	
xrcomp	0.011	0.058	0.098***	0.079**	0.052	-0.058
	(0.27)	(1.58)	(3.01)	(2.54)	(1.06)	(-1.27)
xropen	0.154	0.041	-0.053	-0.056	0.029	0.011
	(1.39)	(0.43)	(-0.57)	(-0.63)	(0.25)	(0.11)
xconst	0.102***	0.073***	0.110***	0.109***	0.205***	0.210***
	(3.49)	(2.89)	(4.26)	(4.43)	(5.64)	(6.09)
parreg	0.160	0.108	0.319***	0.173*	0.058	-0.305***
	(1.08)	(0.84)	(3.18)	(1.74)	(0.50)	(-2.80)
parcomp	0.287***	0.131**	0.167***	0.185***	0.229***	0.260***
	(4.68)	(2.46)	(3.46)	(3.98)	(4.16)	(4.87)
polmills		1.015***		0.379***		0.972***
		(20.86)		(8.49)		(17.07)
competition	0.040***	0.025***	0.041***	0.036***	0.041***	0.022***
	(27.72)	(19.68)	(33.43)	(29.49)	(20.24)	(11.19)
participation	0.004***	-0.002	0.001	-0.001	0.004*	0.004
	(2.73)	(-1.14)	(0.60)	(-0.69)	(1.68)	(1.62)
polymills		1.409***		0.588***		2.417***
		(20.94)		(8.20)		(17.08)
cancor	0.958	0.957	0.916	0.962	0.822	0.936
N	135	135	135	135	158	141

* p<0.1, ** p<0.05, *** p<0.01

	2000	
xrcomp	0.138	-0.031
	(1.36)	(-0.34)
xropen	0.228	0.027
	(1.15)	(0.16)
xconst	0.210***	0.227***
	(3.10)	(4.01)
parreg	-0.074	-0.146
	(-0.40)	(-0.93)
parcomp	0.161*	0.085
	(1.90)	(1.18)
polmills		1.194***
		(13.86)
competition	0.039***	0.018***
	(11.13)	(5.75)
participation	0.006	0.001
	(1.37)	(0.18)
polymills		2.774***
		(14.09)
cancor	0.821	0.868
N	144	139

* p<0.1, ** p<0.05, *** p<0.01