Instrumental Variables in the Long Run

Casey, Gregory and Klemp, Marc

Brown University, Brown University and University of Copenhagen

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Gregory Casey Marc Klemp

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Abstract

In the field of long-run economic growth, it is common to use historical or geographical variables as instruments for contemporary endogenous regressors. We study the interpretation of these conventional instrumental variable (IV) regressions in a simple, but general, framework. We are interested in estimating the long-run causal effect of changes in historical conditions. For this purpose, we develop an augmented IV estimator that accounts for the degree of persistence in the endogenous regressor. We apply our results to estimate the long-run effect of institutions on economic performance. Using panel data, we find that institutional characteristics are imperfectly persistent, implying that conventional IV regressions overestimate the long-run causal effect of institutions. When applying our augmented estimator, we find that increasing constraints on executive power from the lowest to the highest level on the standard index increases national income per capita three centuries later by 1.2 standard deviations.

Keywords Long-Run Economic Growth, Instrumental Variable Regression

JEL Classification Codes C10, C30, O10, O40

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1 Introduction

A growing literature examines the determinants of economic development in the long run.[1] In this literature, it is common to use historical or geographic instruments for contemporary endogenous regressors in instrumental variables (IV) regressions (e.g., Acemoglu et al., 2001; Easterly, 2007; Tabellini, 2010).[2] In this paper, we study the interpretation of these conventional IV regressions, develop an augmented estimator for long-run causal effects, and apply our findings to estimate the long-run causal effect of changes in historical institutions.

Despite the prominence of instrumental variable regressions with historical instruments and contemporary endogenous regressors, specific interpretations are rarely attached to coefficient estimates. We provide a simple, but general, framework for interpreting these regressions that is consistent with existing literature. Our parameter of interest is the 'long-run effect' of the endogenous variable, which we define as the causal effect of historical values of the endogenous variable on the contemporary dependent variable. This is the parameter that would be estimated by standard IV analysis if the endogenous variable was measured at the time of the initial impact of the instrument. This is also the parameter which provides information about the long-run consequences of policy interventions or historical events. We find that IV regressions where the endogenous variable is measured later in time estimate the long-run effect divided by the persistence of the endogenous variable. We define 'persistence' as the causal effect of historical levels of the endogenous variable on its current level. Our analysis, therefore, shows that accounting for the persistence in the endogenous variable is crucial for estimating long-run causal effects when the endogenous variable is observed after the effect of the instrument.

Using the intuition from our analytic results, we develop an augmented estimator for the long-run causal effect of the endogenous variable under common data availability constraints. Specifically, we consider the case where the endogenous variable is not measured at the time of the original impact of the instrument. Our new approach corrects the bias of the conventional IV analysis by accounting for the persistence of the endogenous variable. Our updated estimator uses multiple equation Generalized Method of Moments (GMM) with a single instrument. One equation estimates the usual regression, while the other directly estimates persistence using observations of the endogenous variable at two intermediate points in time. Together, these equations allow us to extract an estimate of the long-run causal effect of the endogenous variable.

We show that our results hold even under certain violations of the exclusion restriction, which we argue are often empirically relevant in the field of long-run growth. In the presence of these violations, the long-run effect is the only causal parameter that can be recovered from the regression. Thus, a key aspect of our study is to demonstrate how to extract interesting economic parameters under violations of the exclusion restriction.

[1] For an overview of the literature, see Spolaore and Wacziarg (2013) and Nunn (2014).

[2] This technique is still popular in the literature (e.g., Becker and Woessmann, 2009; Becker et al., 2010; Naritomi et al., 2012; Auer, 2013; Acemoglu et al., 2014; Gorodnichenko and Roland, 2011, 2013).

We use our new results to estimate the long-run effect of institutions on economic performance. We choose this application for several reasons. First, the estimation of the effect of institutions on economic development by Acemoglu et al. (2001) is likely the most prominent paper using historical instruments for contemporary endogenous regressors and many important papers in the institutions literature followed suit (e.g., Easterly and Levine, 2003; Rodrik et al., 2004; Acemoglu and Johnson, 2005). Moreover, unlike many papers using this empirical technique, Acemoglu et al. (2001) provide an explicit set of equations for interpreting their results and a discussion about the role of past values of institutions. Our framework is consistent with their equations and discussion, making our new results immediately applicable in this context. Finally, given the prominence of the institutions literature, much effort has gone into collecting measures of institutional characteristics at different points in time. These data are essential in both steps of our empirical application.

Our analytic results demonstrate the importance of measuring persistence in the endogenous variable when estimating long-run effects. Before applying our augmented estimator, we first estimate the persistence of institutional characteristics using panel data. Employing panel data allows us to utilize large amounts of data and measure persistence with considerable statistical power. This serves as a helpful complement and validation exercise for our augmented estimator, which estimates persistence using cross-sectional data and IV. Panel data suggest that a change in constraints on executive power in 1850 from the lowest observed score to the highest observed score are associated with a change in current institutional quality by less than 1% of a standard deviation. This indicates that large conventional IV regression coefficients may be due to low institutional persistence rather than a high long-run causal effect of institutions on economic growth.

We then apply our augmented estimator to measure the long-run effect of institutions on economic performance. In our preferred specification, a change in constraints on executive power in 1700 from the lowest to the highest possible score on the standard index leads to a 1.2 standard deviation change in 1990 income per capita. While sizable, this effect is less than half as large as the coefficient generated by the conventional IV regressions, indicating that our updated estimator is quantitatively important.

Our results have important implications for the field of long-run economic growth. First, we provide an interpretation for IV regressions with historical instruments and contemporary endogenous regressors. We then provide a new procedure that enables researchers to estimate the long-run effect of potential determinants of economic performance or other outcomes. Finally, using our new analytic results and empirical technique, we generate estimates of the impact of institutions on long-run economic growth (see, e.g., Acemoglu et al., 2005; Banerjee and Iyer, 2005; Dell, 2010; Bruhn and Gallego, 2012). While our approach is applied to the effect of institutions on economic development, it is relevant for any empirical investigation using historical or geographical instrumental variables with contemporary endogenous regressors.

In section 2, we present our framework and main analytic results. Section 3 presents our empirical application, and section 4 concludes.

2 Analytic Results

Problems of omitted variables and reverse causality are severe in the growing literature on the fundamental determinants of long-run economic growth. As a result, historical or geographic variables are often used as instruments for contemporary determinants of economic development in order to overcome these issues and estimate causal effects. The time lag between the instrument and the endogenous variable, however, complicates the interpretation of the regression coefficient. Indeed, specific interpretations are rarely attached to the coefficients from these regressions.

In section 2.1, we provide a general framework for interpreting instrumental variable regressions when the instrument precedes the endogenous regressor in time. Our parameter of interest is the 'long-run effect' of the endogenous variable, which we define as the causal effect of historical values of the endogenous variable on the contemporary dependent variable. This parameter tells us about the long-run implications of a given policy or historical event, which are of fundamental importance in this literature. We use our framework to derive the relationship between our parameter of interest and the coefficient from a conventional IV regression. The different between the two is due to the persistence in the endogenous variable, which we define as the causal effect of historical levels of the endogenous variable on its current level.

Our framework explicitly accounts for certain violations of the exclusion restriction that are empirically relevant in the field of long-run growth. The inclusion of these violations does not affect our core results. Indeed, in the presence of these violations, the long-run effect is the only causal parameter that can be recovered from the regression. Thus, a key aspect of our study is to demonstrate how to extract interesting economic parameters under violations of the exclusion restriction.

Section 2.2 builds on the results from section 2.1 to demonstrate how to augment conventional IV regressions to recover our parameter of interest. Our augmented estimator extracts the long-run causal effect of the endogenous variable by explicitly estimating the persistence of the endogenous variable using observations at two intermediate points in time. Our method uses multiple equation GMM with a single instrument.

2.1 Interpreting IV regressions in the long-run growth literature

Figure 1 provides a simple representation of our framework. We start by just considering the top row of the figure (i.e. we ignore A). There are two periods, H for historical and C for contemporary, while X is the endogeneous variable of interest and Y is the dependent variable. We assume that Z would be a valid instrument for X_H, but that X_H is unobserved. This is a common data availability constraint in the long-run growth literature. We are interested in examining the causal effect of X_H on Y_C, which we refer to as the long-run effect of X on Y.

At this point, we have described the basic data generating process usually underlying regressions of this type. Without A, Z is a valid instrument for X_C, and we can estimate the causal effect of X_C on Y_C with a 2SLS regression. All of our key results will hold in this setting. However, we

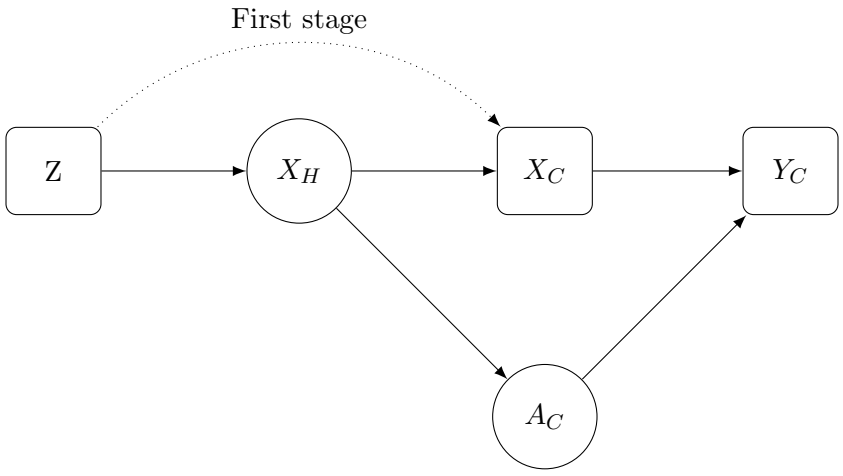

Figure 1: Causal diagram of equations (1)–(4) and the first stage in a conventional 2SLS regression. Rectangular nodes represent observed variables and circular nodes represent unobserved variables. The dotted line represent the first stage in a conventional 2SLS estimation.

think the top row of Figure 1 provides an incomplete picture of the underlying dynamics in most cases. Our reasoning is all follows: if there are good reasons to expect that X_C affects Y_C, then X_H should also affect Y_H. Then, if there is persistence in Y or if the mechanisms through which X_H affects Y_H are persistent, then there will a causal affect of X_H on Y_C that is not intermediated by X_C. We represent this link using the variable A. At first, this appears to be a negative result, because the existence A violates the usual exclusion restriction. It will not, however, inhibit our ability to estimate our parameter of interest. Indeed, a key implication of including A is that our parameter of interest becomes the only mechanism through which we can learn about the causal effect of X on Y. We focus on analyzing the case with A since it is more realistic, though we note again that its inclusion does not affect our main results.[3] We model these alternate channels in a simple reduced form manner, but a wide range of alternate specifications can be re-written in this form.

To fix ideas, it is helpful to consider a particular example. Our system is a simple generalization of the data generating process presented in Acemoglu et al. (2001). In their framework, Z would be settler mortality, Y is income per capita and X is institutional quality. Compared to their formal presentation of the underlying model, we add the existence of the A variable, which is consistent with the empirical findings and interpretation presented in their paper.[4] The A variable could be

[3] Appendix section A.1 analyzes the case without A.

[4] In particular, Acemoglu et al. (2001) find that historical institutions exert an impact on contemporary income independently of contemporary institutions. Their interpretation of these results is in line with our equations: "In some specifications, the overidentification tests using measures of early institutions reject at that 10-percent level (but not at the 5-percent level). There are in fact good reasons to expect institutions circa 1900 to have a direct effect on income today (and hence the overidentifying tests to reject our restrictions): these institutions should affect physical and human capital investments at the beginning of the century, and have some effect on current income levels through this channel" (fn 31, p. 1393).

physical or human capital, technology or culture, which would be affected by historical institutions and persist over time, eventually impacting contemporary income per capita.

Equations (1)–(4) represent the data generating process algebraically:

$$\begin{aligned} X_{H,i} &= \delta_{0,H} + \psi Z_i + \varepsilon_{H,i} && (1) \\ X_{C,i} &= \delta_{0,C} + \delta_1 X_{H,i} + \varepsilon_{C,i} && (2) \\ A_{C,i} &= \gamma_0 + \gamma_1 X_{H,i} + \mu_i && (3) \\ Y_{C,i} &= \beta_0 + \beta_1 X_{C,i} + \beta_2 A_{C,i} + \upsilon_i. && (4) \end{aligned}$$

In standard settings, instrumental variables are used to estimate the contemporaneous causal effect of X, $\frac{\partial Y_C}{\partial X_C} = \beta_1$. Our parameter of interest is the long-run causal effect of X, $\eta \equiv \frac{\partial Y_C}{\partial X_H}$. The other key parameter in this set-up is $\frac{\partial X_C}{\partial X_H} = \delta_1$, which measures the persistence of historical changes in X. If $\delta_1 > 1$, then the endogenous variable diverges from its original path following a shock. If $\delta_1 < 1$, then converges back to its original path, and shocks eventually die out. We refer to δ_1 as a a measure of 'persistence.'

Some algebra shows that $\eta = (\beta_1\delta_1 + \beta_2\gamma_1)$. The simple 2SLS regression of Y_C on X_C with Z as an instrument yields:

$$\operatorname{plim} \hat{\beta}_1^{IV} = \beta_1 + \frac{\beta_2\gamma_1}{\delta_1} = \frac{\eta}{\delta_1}. \quad (5)$$

Thus, the resulting coefficient is consistent for the parameter of interest divided by the persistence term, δ_1. This has an intuitive interpretation in that a one unit change in X_C is associated with a $\frac{1}{\delta_1}$ unit change in X_H. The 2SLS coefficient overestimates η when X converges to its original path after a shock, i.e. $\delta_1 < 1$, and underestimates the effect when institutional quality diverges over time following a shock, i.e. $\delta_1 > 1$. The two are equal only in the knife-edge case where $\delta_1 = 1$. We refer to this condition as X being 'perfectly persistent.'

In light of these results, it is apparent that a large 2SLS coefficient does not imply a large long-run effect of X on Y. The regression measures the long-term impact of improving X_H enough to raise X_C by one unit. Thus, a large regressions coefficient may indicate an important impact of X_H or that the regression is picking up a very large change in X_H. The algebra also indicates that, in the presence of an A variable, it is not possible to recover the contemporaneous relationship between institutions and income per capita, β_1.[5]

These results suggest that we could recover η by multiplying the IV coefficient by δ_1 or by including X_H, rather than X_C, in the regression. In most applications in long-run economic growth, X_H cannot be observed. Thus, we need to combine the cross-sectional regression with an estimate of δ_1. In the next subsection, we demonstrate how to use GMM to estimate η.

[5] As demonstrated in appendix section A.1, the relationship between the regression coefficient and η is unchanged if the A variable is excluded from the system.

2.2 Estimating η

In this section, we demonstrate how to estimate η when X_H is not observed. This is often the case when using historical or geographic instruments. In order to estimate δ_1 without X_H, we make use of measures of X at intermediate points in time. Thus, our framework here extends that of the previous section by allowing for more than two time periods:

$$\begin{aligned} X_{t,i} &= \delta_{0,t} + \delta_1 X_{t-1} + \epsilon_{t,i},\ \forall\ t = 1 \dots C,\ t \neq H && (6)\\ X_{H,i} &= \delta_{0,H} + \delta_1 X_{H-1,i} + \psi Z_i + \epsilon_{H,i} && (7)\\ A_{C,i} &= \gamma_0 + \gamma_1 X_{H,i} + \mu_i, && (8)\\ Y_{C,i} &= \beta_0 + \beta_1 X_{C,i} + \beta_2 A_C + \upsilon_i. && (9) \end{aligned}$$

Now, X follows a simple law of motion given by (6). Then, in some year H, X is shocked by Z. After the shock, X continues to follow the original law of motion. Our key assumption is that δ_1 is constant over time. This allows us to infer the relationship between X_C and X_H even when the latter is not observable.[6]

We start by solving for the relationship between values of X_T and X_{T-Q}. This will be important because we will use the relationship between X_T and X_{T-Q} to estimate $\frac{\partial X_C}{\partial X_H}$. To do so, we simply apply (6) recursively:

$$\begin{aligned} X_{T,i} &= \delta_{0,T} + \delta_1 X_{T-1,i} + \epsilon_{T,i} && (10)\\ &= \Big(\sum_{k=0}^{Q-1} \delta_1^k \delta_{0,T-k}\Big) + \delta_1^Q X_{T-Q,i} + \Big(\sum_{k=0}^{Q-1} \delta_1^k \epsilon_{T-k,i}\Big). && (11) \end{aligned}$$

Now consider the IV regression:

$$X_{T,i} = a_0 + a_1 X_{T-Q,i} + a_{2,i}, \tag{12}$$

where i denotes a country and Z_i is an instrument for $X_{T-Q,i}$. There is no violation of the exclusion restriction in this case and, according to (11), the estimation yields:

$$\operatorname{plim} \hat{a}_1 = \delta_1^Q. \tag{13}$$

Now we turn to the relationship between X and Y. A little algebra yields:

$$Y_{C,i} = \tilde{\beta}_0 + (\beta_1 \delta_1^{C-H} + \beta_2 \gamma_1) X_{H,i} + \tilde{\epsilon}_i, \tag{14}$$

[6] This result can be generalized to any known functional form for the evolution of δ_1.

where $\tilde{\beta}_0 = \beta_{0,C} + \left(\beta_1 \sum_{k=0}^{C-H-1} \delta_1^k \delta_{0,T-k}\right) + \beta_2\gamma_0$ and $\tilde{\epsilon}_i = \left(\beta_1 \sum_{k=0}^{Q-1} \delta_1^k \epsilon_{X,T-k}\right) + \upsilon_{C,i} + \beta_2\mu_i$. It is immediate that $\eta_H \equiv \frac{\partial Y_C}{\partial X_H} = (\beta_1\delta_1^{C-H} + \beta_2\gamma_1)$. Now, consider the conventional IV regression:

$$Y_{C,i} = b_0 + b_1 X_{C,i} + b_{2,i}, \tag{15}$$

where i denotes a country and Z_i is an instrument for X_C. Similar to our results from section 2, this regression yields:

$$\operatorname{plim} \hat{b}_1 = \frac{\beta_1\delta_1^{C-H} + \beta_2\gamma_1}{\delta_1^{C-H}} = \frac{\eta_H}{\delta_1^{C-H}}. \tag{16}$$

To solve for η_H, we simply combine the results from estimating equations (12) and (15) :

$$\hat{a}_1 = \delta_1^Q \Rightarrow \tag{17}$$

$$\delta_1 = \hat{a}_1^{\frac{1}{Q}} \tag{18}$$

and

$$\hat{b}_1 = \frac{\eta_H}{\delta_1^{C-H}} \Rightarrow \tag{19}$$

$$\eta_H = \hat{b}_1 * \delta_1^{C-H} \tag{20}$$

$$= \hat{b}_1 * \hat{a}_1^{\frac{C-H}{Q}}. \tag{21}$$

Our new estimator is given by equation (21). To construct confidence intervals around our estimates of η_H, we estimate equations (12) and (15) jointly via GMM and apply the delta method to generate point estimates and standard errors for the nonlinear transformation yielding the expression for η_H in equation (21).

3 Application: Institutions and Long-Run Growth

In section 2.1, we provided a simple, but general, framework for interpreting IV regression coefficients with historical instruments and contemporary endogenous regressors. We found that the regression coefficient is equal to the long-run impact of changing historical conditions multiplied by the persistence of the endogenous variable. This is true even under certain violations of the exclusion restriction. In section 2.2, we provided an augmented estimator that uses multiple equation GMM to estimate the long-run impact of changing historical conditions.

In this section, we apply our findings to estimate the long-run impact of improving institutional quality. We do so using two different approaches. First, we estimate the persistence of institutions in panel data. Our analytic results from section 2.1 demonstrate that these estimates give us the bias in the standard regression coefficient when trying to estimate our parameter of interest. The panel data results suggest very low persistence in institutions, indicating the regression coefficients overestimate the long-run impact of changing institutions. We then apply our new estimator to directly estimate

the long-run impact of improving institutions using the settler mortality instrument from Acemoglu et al. (2001). Compared to our panel data estimates, we find a much larger effect of changing historical institutions with this approach. In our preferred specification, increasing institutional quality – as measured by the standard 'constraints on the executive' index – in 1700 from the lowest to highest possible value of institutional quality increases 1990 income per capita by 1.2 standard deviations. While sizable, this result is significantly lower than the coefficient from the un-augmented regression, indicating that our updated approach is quantitatively important.

3.1 Data

Our main measure of institutional quality, 'Constraints on the Executive,' comes from the Polity IV dataset, which is standard in the literature. We use this measure in both the panel and GMM pieces of our application. Constraints on the Executive measures the limits to executive power and is measured on a 7 point scale that increases in the level of constraints. This is the preferred measure of institutional quality identified in the IV literature (Glaeser et al., 2004; Acemoglu et al., 2005).[7] We use this measure in both the panel and GMM applications. A major advantage of this dataset is the length of the time series. In particular, for a set of 25 countries, we have institutional data from 1000–2013. The cross section increases to 125 countries in later years. To supplement the panel data analysis, we also use the Political Rights Index (PRI) from Freedom House and the Vanhanen Index of Democratization, which measures democracy in independent countries from 1810-1998 (Vanhanen, 2000).

Following recommendations by Albouy (2012) and Acemoglu et al. (2012), we use the log of potential settler mortality capped at 250 per 1000 as the instrument in the GMM regressions.[8] Unfortunately, it is not clear exactly when settler mortality should first affect institutions. We use 1700. Since these are cross-sectional estimates, we cannot include country fixed-effects. As a result, we may have a violation of the exclusion restriction if settler mortality is correlated with other country-specific factors such as disease environment or geography. To mitigate these concerns, we include controls for the log of the absolute value of latitude and World Bank region fixed effects.[9] The measure of economic development is the natural logarithm of the gross domestic product per capita in 1990, again from Acemoglu et al. (2001). Summary statistics are provided in table 5.

[7] In the appendix, we also use the 'Democracy' and 'Autocracy' measures. Democracy captures constraints on the executive and the ability of citizens to express preferences about leaders. It is measured on an 11 point scale. Autocracy captures constraints on the executive and several measures of openness of political participation. It is also measured on an 11 point scale.

[8] The uncapped settler mortality variable is obtained directly from AJR (2001).

[9] The latitude variable is the latitude of a country's approximate geodesic centroid obtained from CIA's World Factbook. The regional dummies indicate the Sub-Saharan Africa, Middle East & North Africa, South Asia, East Asia and Pacific, and the North America regions, as defined by the World Bank. There are no observations from the Europe & Central Asia region and the Latin America & Caribbean region is the background region.

3.2 Measuring Institutional Persistence in Panel Data

Before applying our new estimator, we measure the persistence of institutions in panel data. Our analytic results from section 2.1 demonstrate how to combine these estimates with the usual IV regression to extract an estimate of the long-run impact of improving institutional quality. This analysis complements the application of our new estimator by allowing us to estimate the persistence of institutions with much greater precision.

To measure the persistence of institutions, we employ the time-series of analog of equation (2):

$$\text{INST}_{c,t} = \alpha_c + \nu_t + \delta_1 \text{INST}_{c,t-1} + \epsilon_{c,t}, \tag{22}$$

where INST is a measure of institutional quality, ν_t is a time fixed effect, and α_c is a country fixed-effect. As demonstrated in section 2.1, the relevant measure of institutional persistence is δ_1. This simple specification is consistent with the growing literature that examines the determinants of institutional quality (e.g., Acemoglu et al, 2008, 2009). We use the three main measures of institutions discussed in the previous section. In the appendix, we show that the results are unchanged if we use the components of the Vanhanen Index of Democracy or the Democracy/Autocracy variables from Polity IV. In each specification, we report the p-value of the simple t-test for $\delta_1 = 1$.[10]

We do not include any country-specific time-varying control variables for two reasons. First, we are interested in the persistence of institutions through any intervening channel. For example, if institutions increase income and higher income leads to better institutions in the next period, then we want to capture this effect in our measure of persistence.[11] Of course, not controlling for other factors may create a problem of omitted variables. Omitted variables, however, are likely to affect past and current institutions in the same direction, biasing our estimate of δ_1 upward. Without a more complete theory of institutional persistence, it is not possible to decide *a priori* which variables are channels of institutional persistence and which are omitted variables. Moreover, as discussed below, the existing literature estimates related panel regressions with control variables and always finds that $\delta_1 < 1$.

For our main analysis, we use the data at 10 year intervals and run regressions on the entire unbalanced sample. We take single observations instead of aggregating across years to follow the existing literature (Acemoglu et al., 2008, 2009). We use the Arellano-Bong GMM estimator to correct for Nickell bias and show that the results hold in the Vanhanen Index of Democracy to mitigate concerns about censoring in the more common measures of institutions (Benhabib et al., 2013). In the appendix, we demonstrate that our qualitative findings hold across across a number of alternate scenarios. Specifically, we use data in 1, 5, 30, and 100 year intervals and restrict the sample to former colonies and the sample of the 25 countries for which we have data from 1800-2013.

[10] We also report the results of the Phillips-Perron unit root test which is testing the null hypothesis that a variable is perfectly persistent, i.e., that it has a unit root. This unit root test is robust to general forms of heteroskedasticity in the error term, and does not require a specified lag length for the test regression.

[11] This result is shown formally in section A.3 of the appendix.

Table 1: Institutional Persistence — 10-Year Data

	Constraint on Executive			Freedom House Measure of Democracy			Vanhanen Index of Democracy		
	OLS (1)	OLS (2)	GMM (3)	OLS (4)	OLS (5)	GMM (6)	OLS (7)	OLS (8)	GMM (9)
First Lag of Constraint on the Executive	0.596*** (0.048)	0.454*** (0.052)	0.344*** (0.070)						
First Lag of Freedom House Measure of Democracy				0.162* (0.088)	0.144 (0.088)	0.297 (0.201)			
First Lag of Vanhanen Index of Democratization							0.807*** (0.038)	0.563*** (0.056)	0.459*** (0.107)
Year FE	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Number of Observations	1,258	1,258	1,057	337	337	138	1,113	1,113	958
Number of Countries	157	157	137	142	142	138	144	144	139
Adjusted R^2	0.333	0.437		0.026	0.083		0.557	0.653	
Signif. of main coeff.=1 test	.00	.00	.00	.00	.00	.00	.00	.00	.00
Signif. of unit root test (P-P)	.00			.00			.00		

This table establishes that the degree of persistence of institutions is below one, accounting for year fixed effects. The estimation is performed with both OLS as well as the GMM estimator by Arellano and Bond (1991) where institutions are instrumented using a double lag. Robust standard errors are shown in the parentheses. *** Significant at the 1 percent level. ** Significant at the 5 percent level. * Significant at the 10 percent level.

Table 1 presents our baseline persistence results. In all cases, the coefficient is significantly less than 1 at the 1% level. To quantify these effects in terms relevant for long-run economic growth, we derive $\frac{\partial X_C}{\partial X_H}$ from the panel regressions. Our analytic results from section 2.1 demonstrate that this will be bias from an IV regression of current income on current institutions. It is easiest to interpret the Vanhanen index because it does not have an upper bound. In 1850, the first year in the data, the range in the Vanhanen index was 7.38. With our estimates of δ_1, we can calculate the long-run impact on current institutions of positive shock that improved a country's 1850 institutions from 0 to 7.38 on the Vanhanen scale. Let j denote the country without the shock and j' denote the country with the shock. We take 2000 as current data because that is the most recent year available in the Vanhanen dataset. Using the results from column (8) – which account for year fixed effects, and are more conservative than the corresponding GMM estimate in column (9), we get:

$$INST_{j',2000} - INST_{j,2000} = 7.38 * .563^{\frac{2000-1850}{10}} = 7.38 * .563^{15} = .001. \tag{23}$$

Thus, this shock only raises institutions by .001 on the Vanhanen scale in the long run, and $\frac{\partial X_C}{\partial X_H} = .001/7.38$ is the bias in an IV regression. For comparison, the standard deviation in the Vanhanen scale for 2000 is 12.18.

We can perform the same analysis for 'constraints on the executive'. The maximum difference in this measure is 6. Using the same logic and the results from column 2, we get:

$$INST_{j',2013} - INST_{j,2013} = 6 * .454^{\frac{2013-1850}{10}} = 6 * .454^{16.3} = 1.53\text{x}10^{-5}. \tag{24}$$

The standard deviation for constraints on the executive in 2013 is 1.95. Thus, the data suggest that improving institutions in 1850 has a very small effect on institutions today, and that IV regression will substantially overestimate long-run causal effects.

Appendix tables A.1 – A.4 present the results at 1, 5, 10, 100 year intervals. In our GMM application, we will focus on the sub-sample of former colonies in order to use settler mortality as an instrument for institutional quality. Thus, appendix tables A.7 – A.10 in the appendix present results for this subsample. Tables A.11 – A.14 in the appendix presents our results using the balanced panel from 1800-2013. We only have data on 25 countries in this setting. The results are qualitatively unchanged in all of these scenarios.

We also examine whether institutional persistence in constant over time by running rolling regressions (Figures 5 and 6) for the two of the main dependent variables of interest that are available for more than 50 years, (i.e., Constraint on the Executive and the Vanhanen Index of Democracy). We run the 10-year regressions on 50-year rolling sample windows. In particular, we run a regression starting in each year between 1850 and 1963 and plot the estimate and its 95 percent confidence interval against the initial year of the rolling window. The coefficient on lagged institutions appears relatively stable in each case. Moreover, the 95% confidence interval almost always excludes 1, confirming the robustness of the finding that the persistence of these measures of institutions is below 1. Tables A.15 – A.18 provide evidence of a structural break in the persistence of institutions in 1965. We account for this in our GMM application.

Though our results show surprisingly little institutional persistence, they are consistent with the existing literature. As described above, we do not include any control variables because we want to capture the full degree of persistence in institutions. A growing literature, however, looks at the determinants of institutions, mostly focusing on whether increase in income can lead to more democracy (the 'Modernization Hypothesis'). While it is not the goal of these papers to measure institutional persistence, the lag of institutions is always included as a control. In every case we have found in the literature, the coefficient is significantly less than one (Acemoglu et al., 2008, 2009; Heid et al., 2012; Benhabib et al., 2013; Cervellati et al., 2014).

3.3 Direct Estimation of η

In this section, we apply our new estimator from 2.2 to measure the long-run effect of institutions on economic development. To do so, we simultaneously estimate two equations via GMM. First, we estimate the cross-sectional relationship between contemporary institutions and contemporary income per capita via equation (12). Second, we estimate the persistence of institutions via equation (15). Then, we combine the results of these equations to extract the long-run effect of improving institutions using equation (21). Both equations are estimated using settler mortality as an instrument, following Acemoglu et al. (2001). Several studies have suggested that settler mortality is correlated with other contemporary variables, such as education or trade (e.g., Dollar and Kraay, 2003; Glaeser et al., 2004). For our results to be valid, we need only assume that settler mortality

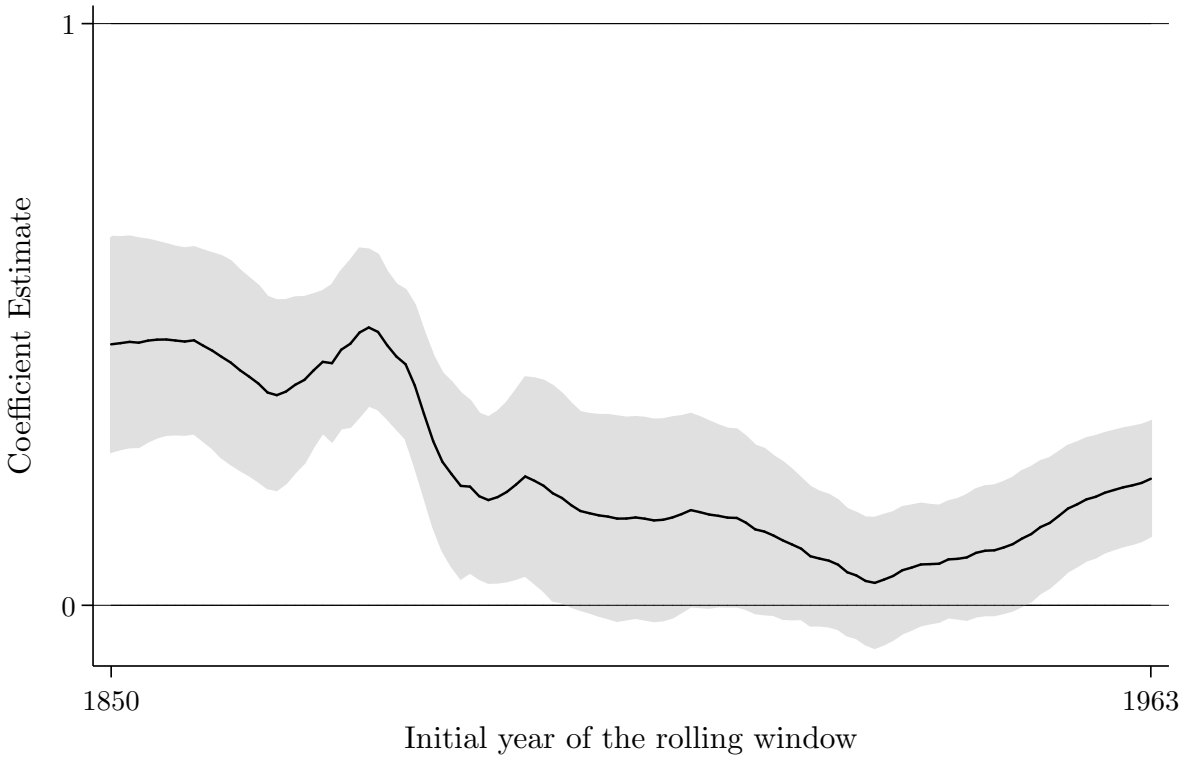

Figure 2: This figure depicts the coefficient from panel regressions of Constraint on the Executive on its 10-year lagged value in over period 1850–2013 with a 50-year regression window and a step size of 1 years, estimated with OLS. The regressions account for year fixed effects. Robust standard errors are used for the calculation of the confidence band.

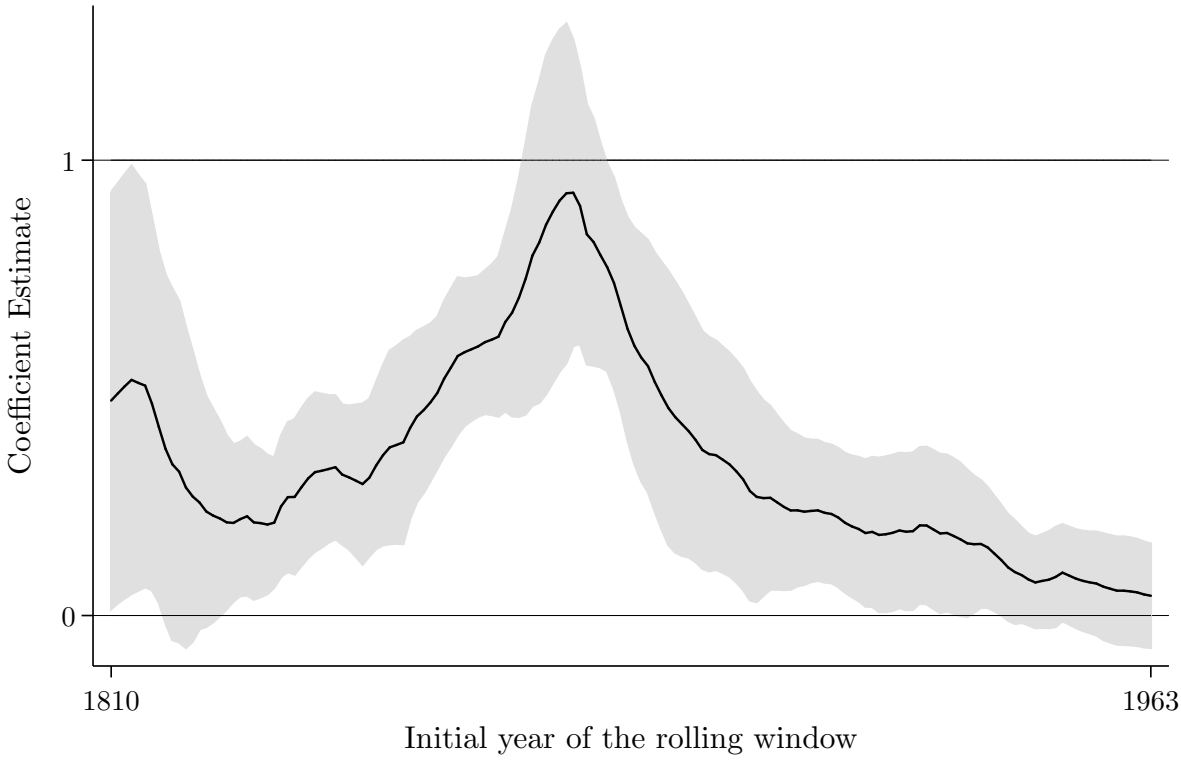

Figure 3: This figure depicts the coefficient from panel regressions of the Vanhanen Index of Democracy on its 10-year lagged value in over period 1810–2013 with a 50-year regression window and a step size of 1 years, estimated with OLS. The regressions account for year fixed effects. Robust standard errors are used for the calculation of the confidence band.

Table 2: Summary Statistics

	Average	P25	P50	P75	S.D.
Log GDP per capita in 1990s	8.11	7.29	8.21	8.82	1.06
Constraint on Executive in 1990s	4.52	2.95	4.45	6.30	1.90
Constraint on Executive in 1960s	3.78	2.37	3.15	5.24	2.06
Constraint on Executive in 1900	2.30	1	1	3	2.17
Log Capped European Settler Mortality	4.47	4.24	4.36	5.50	0.94
Log Absolute Latitude	2.39	2.08	2.61	3.07	1.00
Observations	56				

affected these other variables through historical institutions. Using the notation from section 2.1, education or trade could serve as the A variable in our framework.

The second of our two regressions will give us a new estimate of institutional persistence. Compared with the estimates from panel data, the use of instrumental variables also allows us to correct for issues of measurement error and omitted variables. The trade-off is that we have many fewer observations, which severely limits our statistical power, and we cannot control for all geographic covariates via fixed effects.[12]

Columns 1, 4, and 7 present results from estimating equation (15) with different sets of geographic controls. For each of these income regressions, we provide two separate estimates of δ_1 via equation (12). In columns 2, 5, and 8, we use the estimated persistence of institutions between 1900 and 1960. In the remaining columns, we use the persistence of institutions between 1900 and 1990.[13] Panel 1 presents the regression results. Panel 2 presents the implied estimates of η assuming that settler mortality first affects institutions in 1700. It also presents tests of the null hypothesis that $\delta_1 < 1$.

Columns 1-3 present results without using any controls. The first stage F-statistics indicate that we have strong instruments in all regressions. The point estimates in column 2 and 3 once again indicate that $\delta_1 < 1$, though we do not have enough statistical power to reject the null hypothesis of $\delta_1 = 1$ at conventional levels. Given that this result is consistent with panel data, where we have considerably more power, we take this as further evidence for our earlier findings. The point estimates here indicate higher persistence than those found in section 3.2.[14]

[12] In Section A.3 of the appendix, we demonstrate how using IV allows us to separate channels through which institutions might persist from omitted variables that are correlated with both past and future institutions. In Section A.2 of the appendix, we also discuss the degree to which historical IV's 'correct for' reverse causality.

[13] Appendix tables A.15 – A.18 present evidence of a structural break in the persistence of institutions in 1965.

[14] Given the small number of observations and low statistical power, it is possible to construct specifications with $\delta_1 > 1$, especially when including many covariates. In parsimonious specifications and those including World Bank region fixed effects, we consistently find $\delta_1 < 1$. Given the evidence presented in section 3.2, our interpretation is that the data strongly suggest that $\delta_1 < 1$.

Table 3: Estimating the long-run effect of Institutions

	Log GDP per cap. in	Constraint on Executive in		Log GDP per cap. in	Constraint on Executive in		Log GDP per cap. in	Constraint on Executive in	
	1990s	1960s	1990s	1990s	1960s	1990s	1990s	1960s	1990s
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Panel 1: Conventional Estimates and Estimates of the Degree of Persistence									
Constraint on Executive in 1990s	0.712***			0.508**			0.639***		
	(0.169)			(0.199)			(0.197)		
Constraint on Executive in 1900		0.835***	0.761***		0.720*	0.545*		0.791	0.500*
		(0.216)	(0.170)		(0.432)	(0.301)		(0.483)	(0.285)
Log Absolute Latitude							-0.477**	-0.469	0.301
							(0.214)	(0.295)	(0.185)
Region FE	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Number of Observations	56	56	56	56	56	56	56	56	56
Wald Test of $\hat{\delta}_0 = 1$ p-value		.444	.159		.518	.13		.665	.079
AR Test of $\hat{\delta}_0 = 1$ p-value		0.497	0.274		0.577	0.238		0.696	0.213
First Stage F-Statistic (K-P)	27.064	26.217	26.217	5.292	12.522	12.522	5.349	11.152	11.152
Panel 2: Estimates of η_{1700}									
Based on institutional	.313			.114			.220		
persistence 1900–1960s	(.387)			(.334)			(.643)		
Based on institutional	.305			.077			.074		
persistence 1900–1990s	(.196)			(.136)			(.135)		

This table presents estimates of the effect of institutions on economic development. The first panel presents estimates from conventional 2SLS analyses, accounting for the natural logarithm of absolute latitude and world region fixed effects. Furthermore, the panel presents estimates of the degree of persistence of institutions from 1900 to the 1960s as well as from 1900 to the 1990s. The second panel presents estimates based on the augmented estimator, based on GMM estimation, that accounts for the degree of persistence of institutions, accounting for the natural logarithm of absolute latitude and world region fixed effects. Robust standard errors are shown in the parentheses. *** Significant at the 1 percent level. ** Significant at the 5 percent level. * Significant at the 10 percent level.

Comparing the estimates of η_{1700} in column 1 to the the regression coefficient indicates that accounting for persistence can have a meaningful impact on the estimate of the long-run effect of institutions. Using the more conservative estimates from column 2, increasing institutional quality from 1 (the worst possible value) to 7 (this highest possible value) in 1700 leads to a 1.88 log point change in 1900 income per capita, which is 1.7 standard deviations. The long-run effect decreases if we use estimates of persistence from column 3.

As discussed above, settler mortality may correlated with many other geographic factors that affect income per capita, creating a violation of the exclusion restriction. Thus, the remainder of the table adds latitude and World Bank region fixed effects to the analysis. These are the most important geographic covariates of development in the literature.[15] The qualitative results are similar in all specifications. Columns 7-9 include both controls. In this specification, changing institutions in 1700 from a 1 to a 7 leads to a 1.2 standard deviation change in 1990 income per capita, which is less than half as large as the effect implied by the regression coefficient in column 7. We consider this to be a moderate long-run effect of improving institutional quality.

Appendix table 5 demonstrates that the main results are robust to controlling for temperature and soil quality, which may be correlated with settler mortality rates and directly affect income per capita. Both are insignificant. Appendix table 6 demonstrates that the results are robust to adding the two most prominent 'endogenous controls' in the long-run growth literature, population density in 1500 and the timing of the neolithic transition.

Overall, these results indicate that accounting for institutional persistence is quantitatively important. Unfortunately, the small sample for which we have a good instrument limits the statistical power. In particular, while the point estimates for institutional persistence are below one (over long time periods), we cannot statistically reject that they are less than one. Also, the confidence intervals for η are large. Still, we believe that this exercise, especially in conjunction with the results from section 3.2, provides evidence that estimates of the long-run impact of improving institutions need to account for institutional persistence. When doing so, we find relatively moderate long-run effects of improving institutions. More generally, this new methodology is useful to long-run growth literature by allowing researchers to estimate the long-run impact of improving any potential determinant of income per capita.

4 Conclusion

A growing literature convincingly argues that historical events continue to shape current levels of economic development (Spolaore and Wacziarg, 2013; Nunn, 2014). Currently, however, we do not know how to translate these interesting findings into policy advice that is relevant for developing countries. We take a step in this direction by analyzing a popular methodology, IV regressions where the instrument precedes the endogenous regressor in time, and investigating the interpretation of

[15] Acemoglu et al. (2001) use latitude and continent fixed effects as baseline controls. We use World Bank region fixed effects, which are more appropriate for a modern context and yield stronger first stage F-statistics (Ashraf and Galor, 2013).

the regression coefficients. We then provide an augmented estimator that estimates the long-run effect of changes in historical conditions. Finally, we apply our results to the literature on institutions and economic development. Using panel data, we find a relatively small persistence in institutions, indicating that conventional IV regressions overestimate the long-run impact of changes in institutions. When adjusting for low persistence using our augmented estimator, we find a more moderate effect of institutions on economic outcomes. Our procedure is relevant for a broad range of contexts.

A Further Algebraic Implications

A.1 No Alternative Channels

In this section, we examine the interpretation of the standard IV regression without the presence of an A variable. This is a special case of our more general framework. The simplified system is given by:

$$\begin{aligned} X_{H,i} &= \delta_0 + \psi Z_i + \varepsilon_{H,i} && (25) \\ X_{C,i} &= \delta_0 + \delta_1 X_{C,i} + \varepsilon_{C,i} && (26) \\ Y_{C,i} &= \beta_0 + \beta_1 X_{C,i} + \upsilon_i. && (27) \end{aligned}$$

In this set-up, $\eta = \frac{\partial Y_C}{\partial X_H} = \delta_1 \beta_1$. Since there is no violation of the exclusion restriction, the 2SLS regression yields:

$$\operatorname{plim} \hat{\beta}_1^{IV} = \beta_1. \tag{28}$$

Thus, as in the more general framework, $\eta = \delta_1 \cdot \operatorname{plim} \hat{\beta}_1^{IV}$. So, our results for estimating η hold in this more simple case. A key aspect of our paper is that this simple result still hold under violations of the exclusion restriction that take the form we study in section 2. We believe that this is the empirically relevant case when investigating causes of long-run economic growth.

A.2 Reverse Causality and Historical Instruments

In this section, we discuss the ability of historical instruments to 'overcome' reverse causality. Our paramter of interest, η, actually incorporates reverse causality. To see this, we can add reverse causality to the framework of Section 2.

$$
\begin{aligned}
X_{H,i} &= \delta_0 + \psi Z_i + \varepsilon_{H,i} && (29)\\
Y_{H,i} &= \beta_{0,H} + \beta_1 X_{H,i} + \upsilon_{H,i} && (30)\\
X_C &= \delta_{0,C} + \delta_1 X_{H,i} + \varphi Y_v + \varepsilon_{C,i} && (31)\\
A_{C,i} &= \gamma_0 + \gamma_1 X_{H,i} + \mu_i && (32)\\
Y_{C,i} &= \beta_0 + \beta_1 X_{C,i} + \beta_2 A_{C,i} + \upsilon_{C,i} && (33)
\end{aligned}
$$

Now, $\eta_R = \frac{\partial Y_C}{X_H} = (\beta_1\delta_1 + \beta_2\gamma_1 + \beta_1^2\varphi)$. Again, the 2SLS coefficient yields:

$$\operatorname{plim} \hat{\beta}_1^{IV} = \frac{\eta_R}{\delta_1 + \beta_1\varphi}. \tag{34}$$

where $\frac{\partial X_C}{\partial X_H} = \delta_1 + \beta_1\varphi$. It is apparent that the reverse causality coefficient enters the η_R coefficient. This doesn't change the fact that a 1 unit change in X_0 will increase Y_1 by η_R, but it is necessary to keep in mind the limited ability of the 2SLS coefficient to 'isolate' the effect of one variable on another even if historical data on X in employed.

A.3 Channels versus Omitted Variables

We now consider what the 2SLS regression accomplishes when compared to OLS. So far, we haven't introduced any explicit violations of the exclusion restriction other than causal channels, represented by A. Consider the effect of a variable, for example some geographic characteristic, that is correlated with X_H, but is not causally affected by X_H.

$$
\begin{aligned}
X_{H,i} &= \delta_0 + \psi Z_i + \varepsilon_{H,i} && (35)\\
A_{H,i} &= \gamma_{0,H} + \mu_{H,i} && (36)\\
Y_{H,i} &= \beta_0 + \beta_1 X_{H,i} + \beta_2 A_H + \upsilon_{H,i} && (37)\\
X_{C,i} &= \delta_0 + \delta_1 X_{H,i} + \varepsilon_{X,C} && (38)\\
A_{C,i} &= \gamma_{0,C} + \gamma_1 X_{H,i} + \mu_{C,i} && (39)\\
Y_{C,i} &= \beta_0 + \beta_1 X_{C,i} + \beta_2 A_{C,i} + \beta_3 W_i + \upsilon_{C,i} && (40)
\end{aligned}
$$

where $Cov(W, X_0) = \nu \neq 0$ but $Cov(W, Z) = 0$. We also define $\operatorname{Var}(X_0) = \xi$. In this case, the OLS coefficient picks up the association between W and X_H in the usual omitted variable fashion, but 2SLS does not:

$$\text{plim}\,\hat{\beta}_1^{OLS} = \beta_1 + \frac{\gamma_1\beta_2}{\delta_1} + \frac{\beta_3\nu}{\delta_1\xi} = \frac{\eta}{\delta_1} + \frac{\beta_3\nu}{\delta_1\xi} \quad (41)$$

$$\text{plim}\,\hat{\beta}_1^{IV} = \beta_1 + \frac{\beta_2\gamma_1}{\delta_1} = \frac{\eta}{\delta_1} \quad (42)$$

Indeed, the 2SLS coefficient is the same as in Section 2.2. So, the 2SLS coefficient removes the effect of correlates of X_H but not channels through which X_H affects Y_C.

Finally, we demonstrate that if X_0 affects X_1 through an alternative channel, in this case A_1, we do not want to control for this channel when measuring δ_1. Consider the following extensions of the results from section 2:

$$X_{H,i} = \delta_{0,H} + \psi Z_i + \varepsilon_{H,i} \quad (43)$$

$$A_{C,i} = \gamma_{0,H} + \gamma_1 X_{H,i} + \mu_{C,i} \quad (44)$$

$$X_{C,i} = \delta_{0,C} + \delta_1 X_H + +\xi A_C + \varepsilon_{X,C} \quad (45)$$

$$Y_{C,i} = \beta_0 + \beta_1 X_{C,i} + \beta_2 A_{C,i} + \upsilon_{C,i} \quad (46)$$

Plugging (44) into (45) yields:

$$X_{C,i} = (\delta_{0,C} + \xi\gamma_0) + (\xi\gamma_1 + \delta_1)X_{H,i} + (\xi\varepsilon_{C,i} + \mu_C). \quad (47)$$

Now, defining $\tilde{\delta}_1 = (\xi\gamma_1 + \delta_1)$, we have the exact same system as section 2, except that $\tilde{\delta}_1$ is the persistence of institutions. Thus, we want to measure this 'total' (through all channels) persistence, ξ, not just the partial persistence δ_1.

B Additional Figures

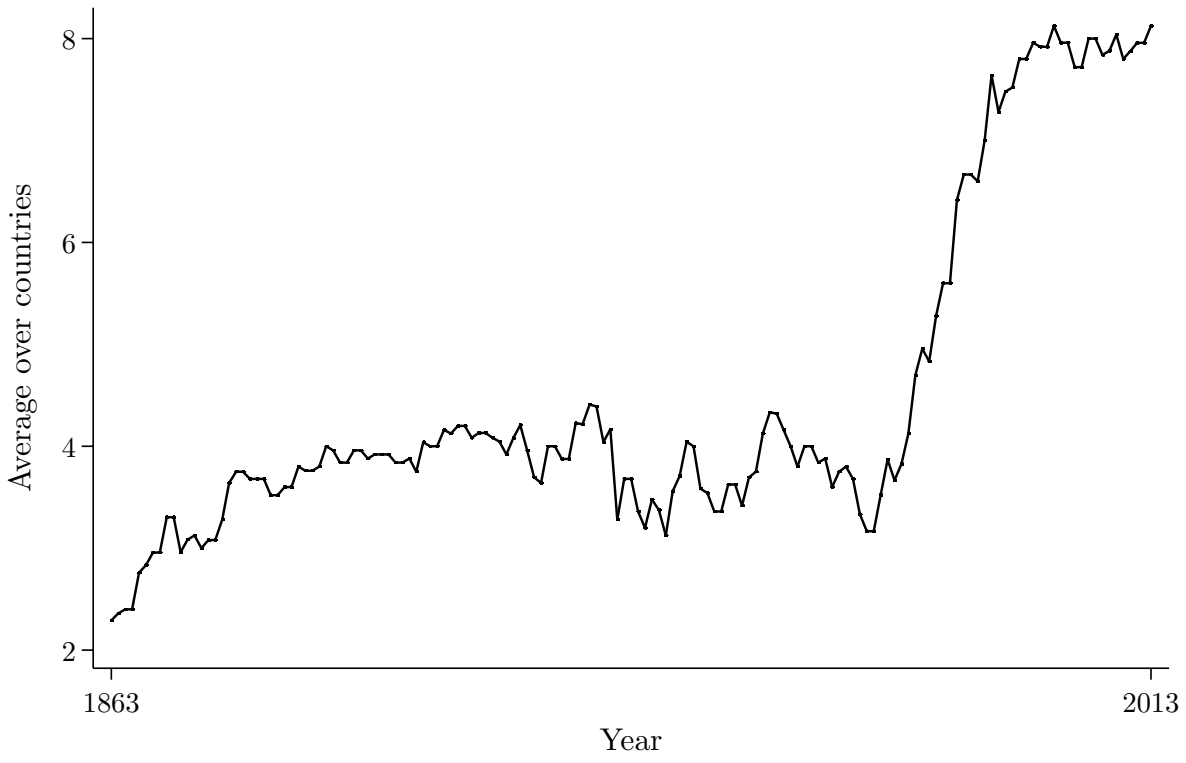

Figure A.1: This figure depicts the average level of Democracy plotted against time for countries with available data for the 150-year period.

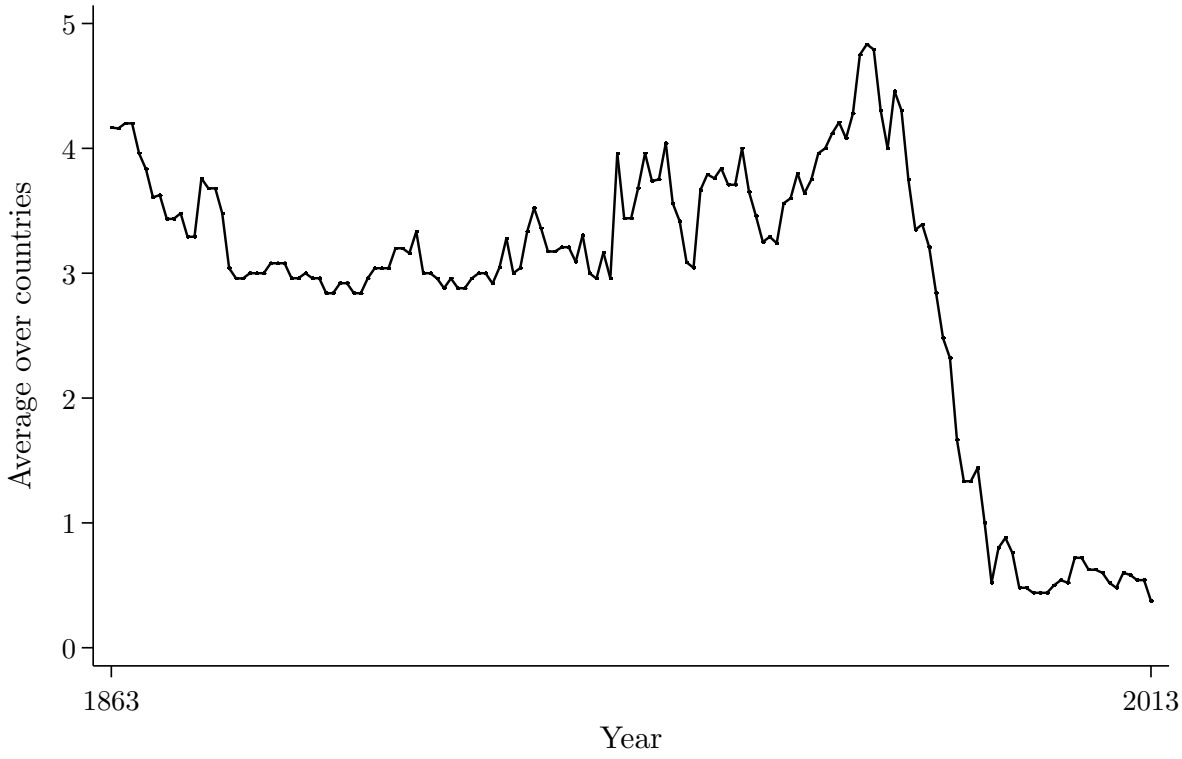

Figure A.2: This figure depicts the average level of Autocracy plotted against time for countries with available data for the 150-year period.

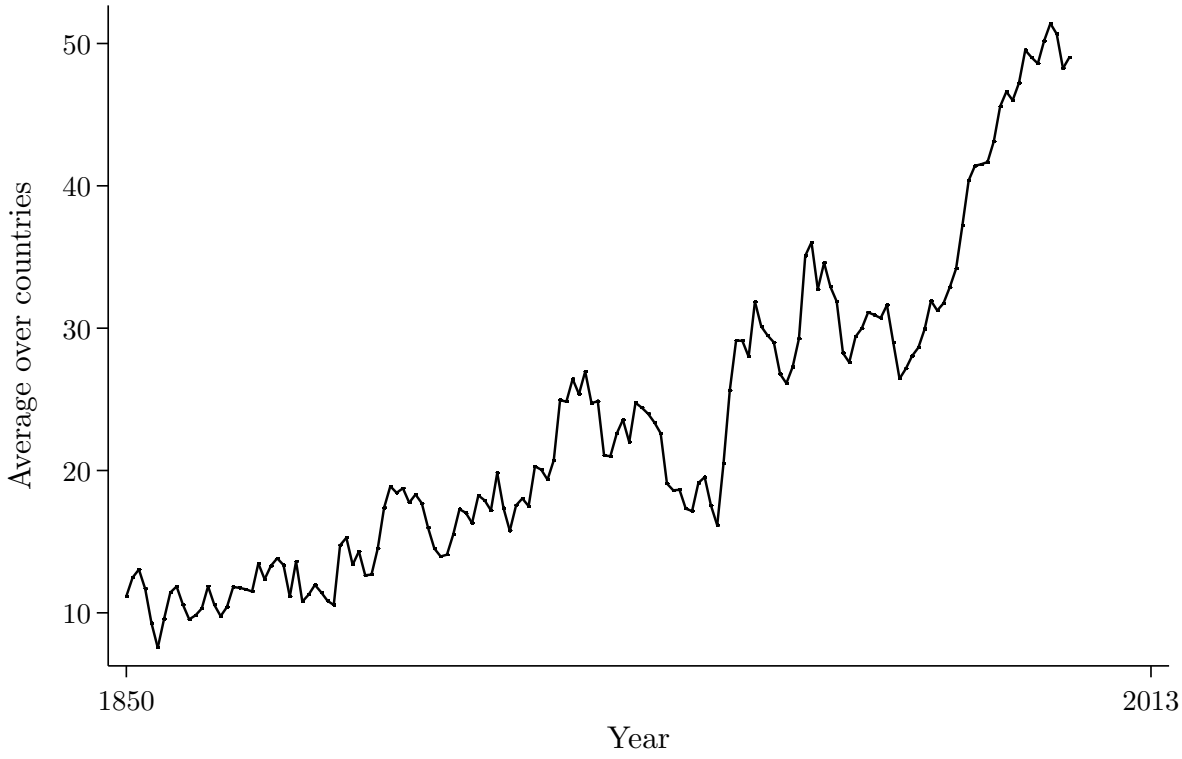

Figure A.3: This figure depicts the average level of the Vanhanen Index of Competition plotted against time for countries with available data for the 150-year period.

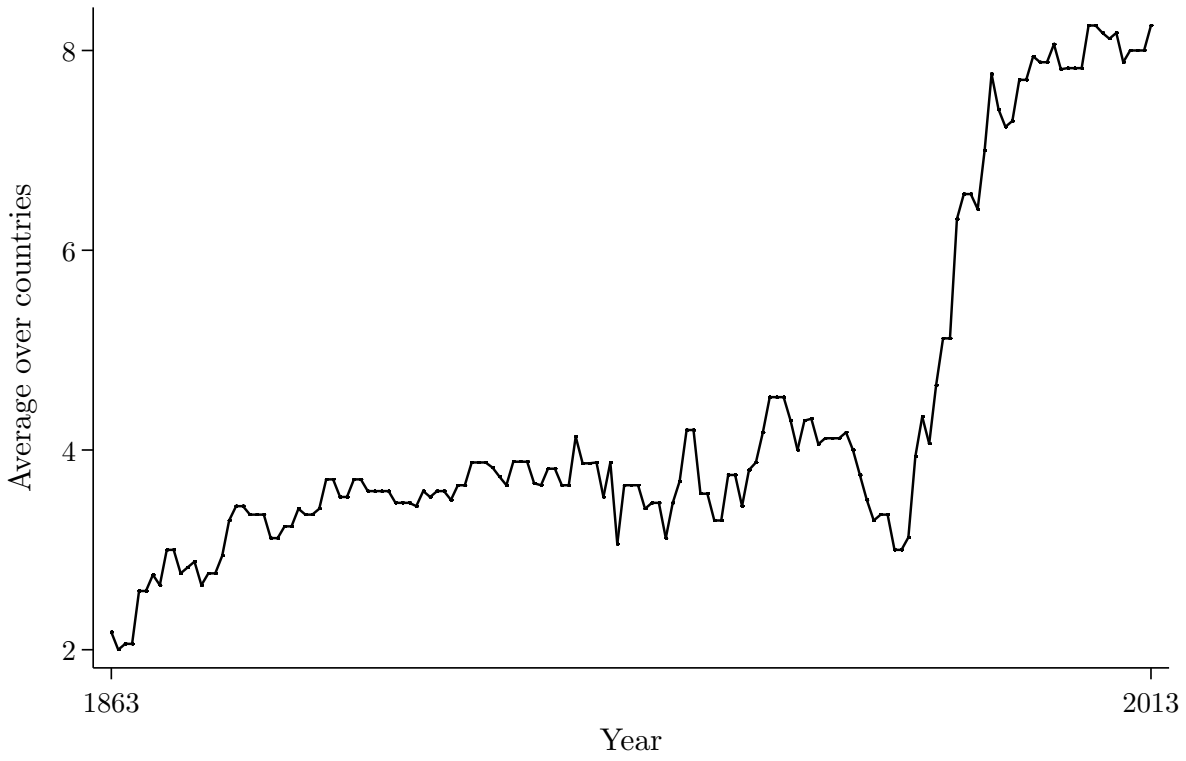

Figure A.4: This figure depicts the average level of Democracy plotted against time for for colonized countries with available data for the 150-year period.

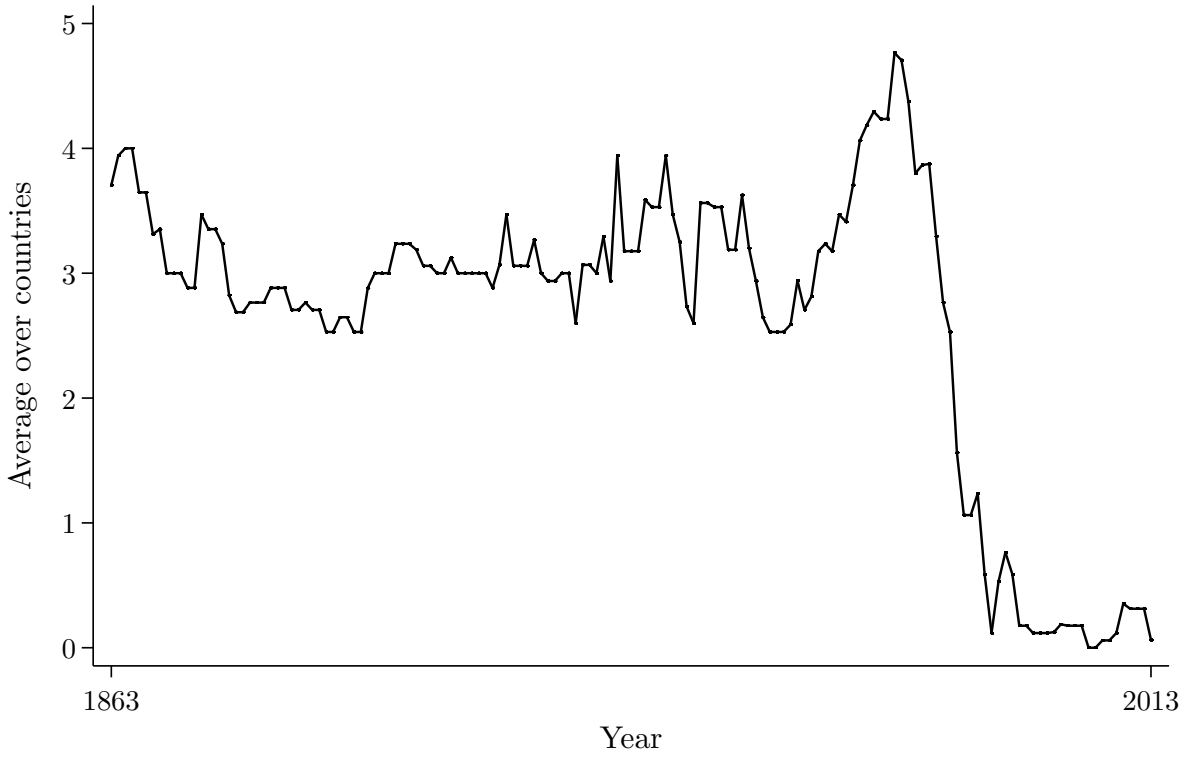

Figure A.5: This figure depicts the average level of Autocracy plotted against time for colonized countries with available data for the 150-year period.

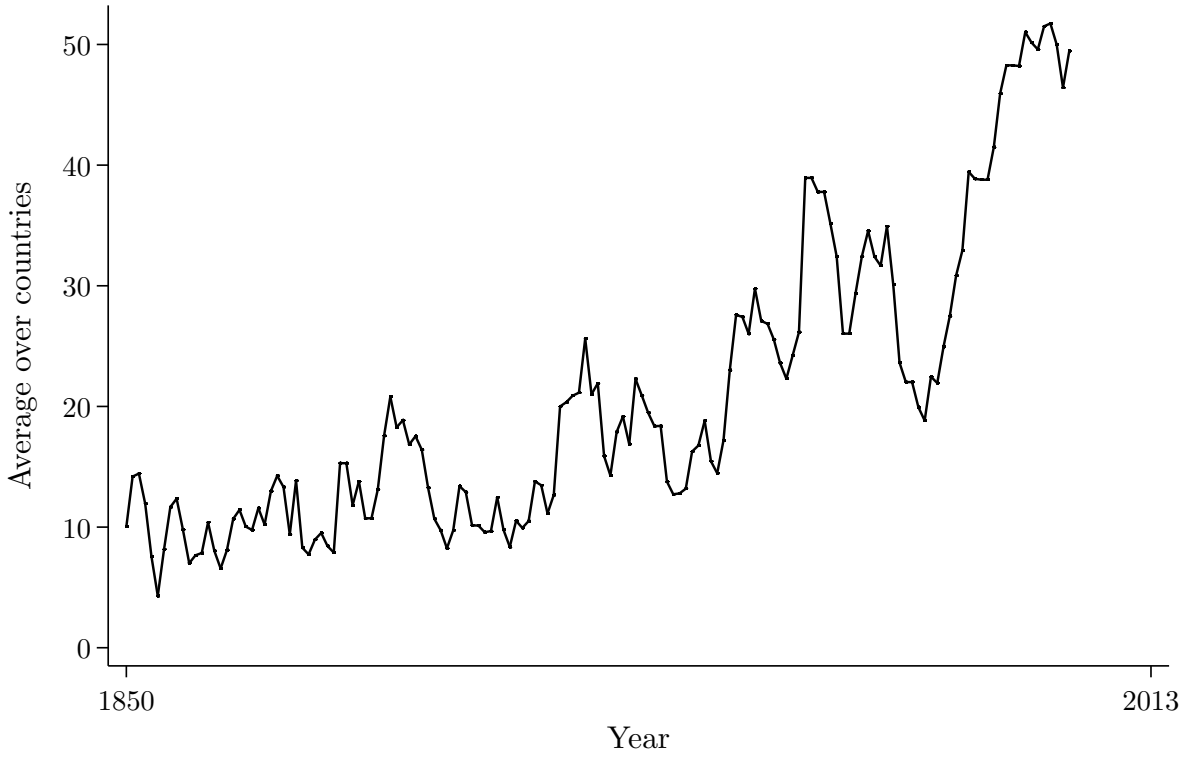

Figure A.6: This figure depicts the average level of the Vanhanen Index of Competition plotted against time for colonized countries with available data for the 150-year period.

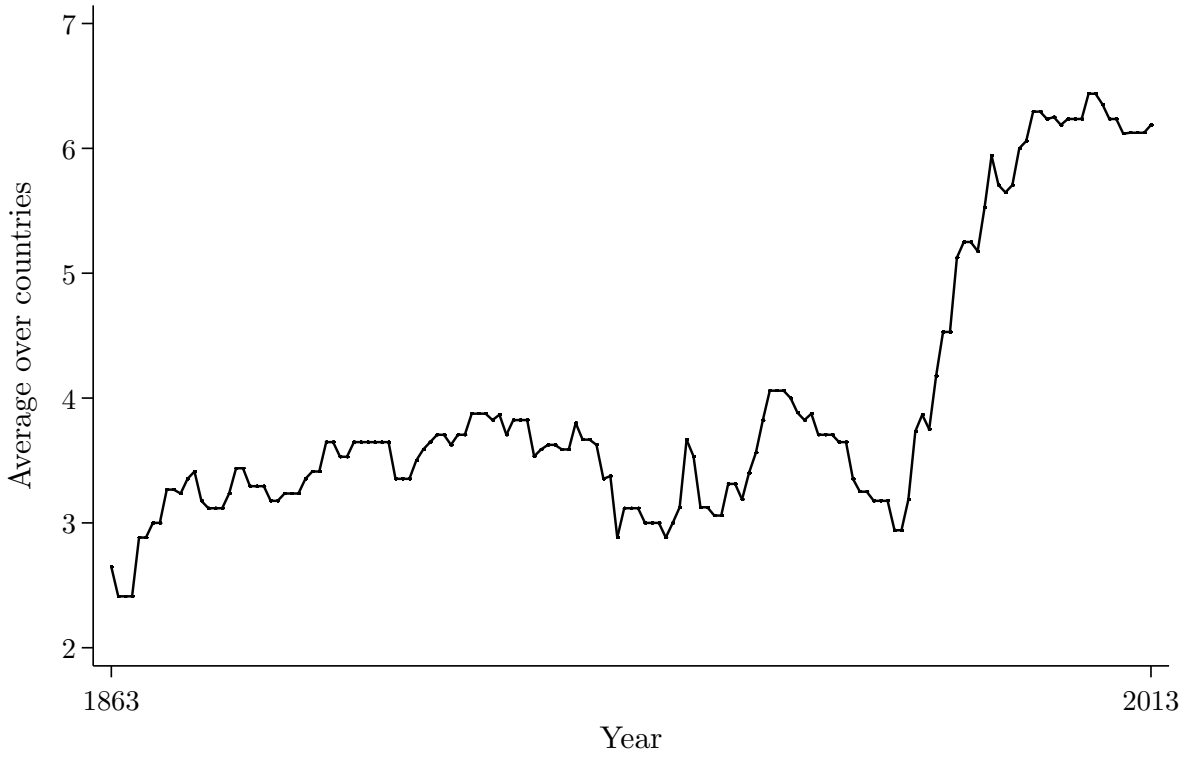

Figure A.7: This figure depicts the average level of Constraint on the Executive plotted against time for colonized countries with available data for the 150-year period.

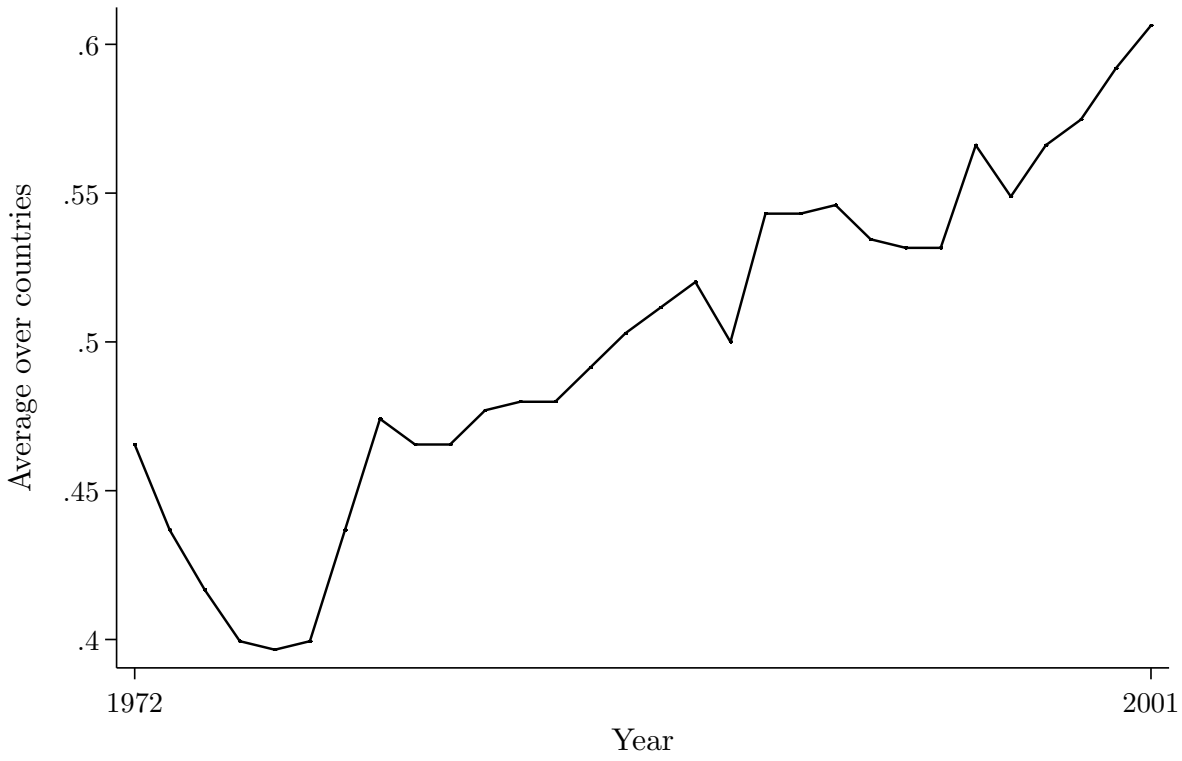

Figure A.8: This figure depicts the average level of the Freedom House PRI plotted against time for colonized countries with available data for the 30-year period.

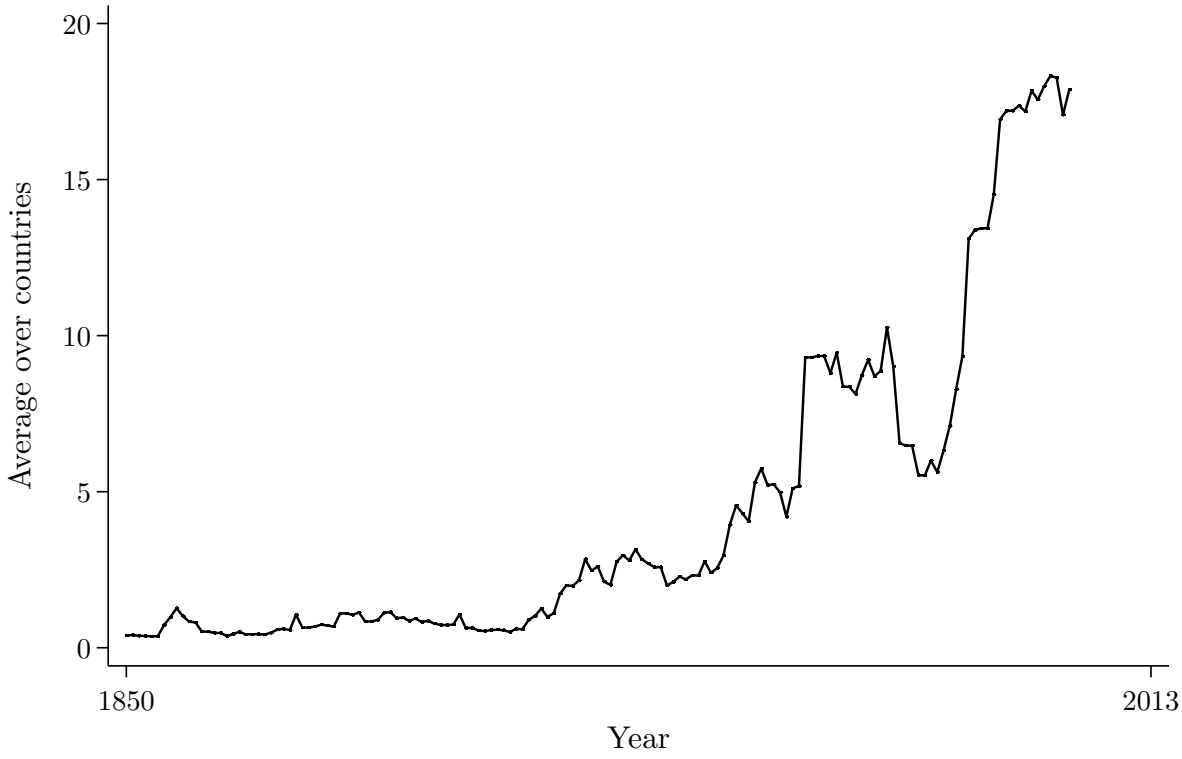

Figure A.9: This figure depicts the average level of the Vanhanen Index plotted against time for colonized countries with available data for the 150-year period.

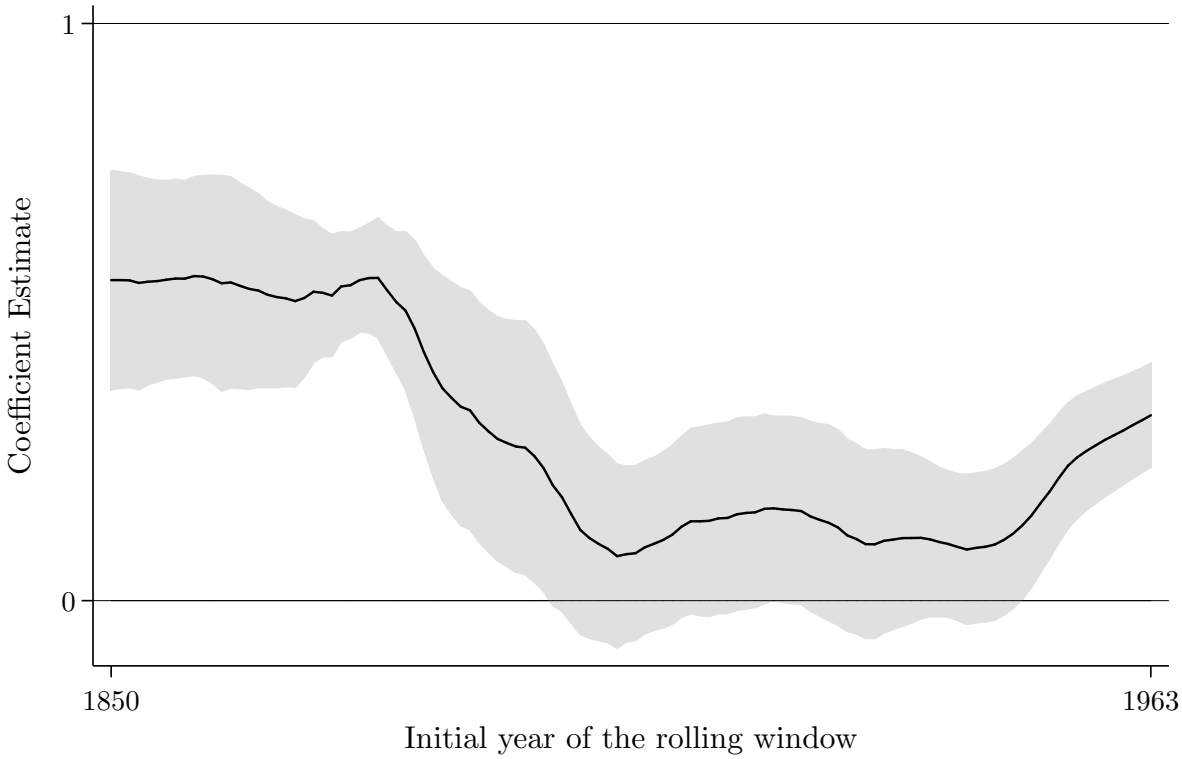

Figure A.10: This figure depicts the coefficient from panel regressions of Democracy on its 10-year lagged value in over period 1850–2013 with a 50-year regression window and a step size of 1 years, estimated with OLS. The regressions account for year fixed effects. Robust standard errors are used for the calculation of the confidence band.

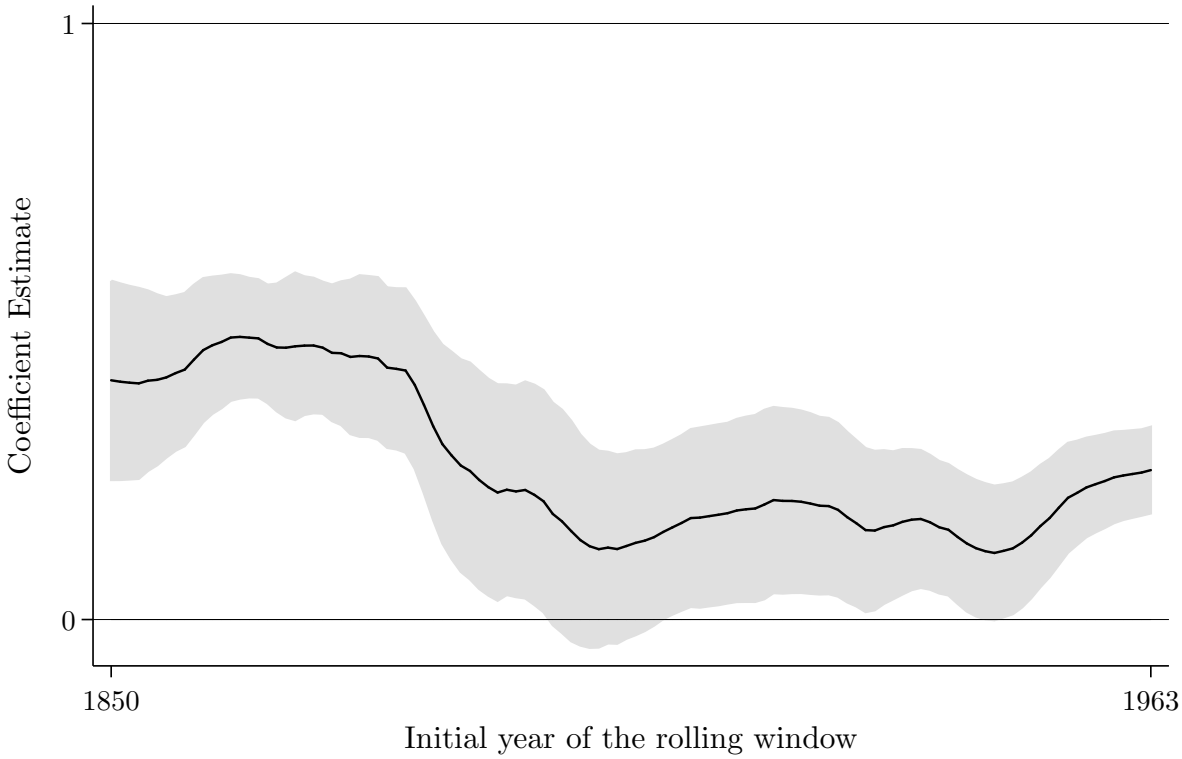

Figure A.11: This figure depicts the coefficient from panel regressions of Autocracy on its 10-year lagged value in over period 1850–2013 with a 50-year regression window and a step size of 1 years, estimated with OLS. The regressions account for year fixed effects. Robust standard errors are used for the calculation of the confidence band.

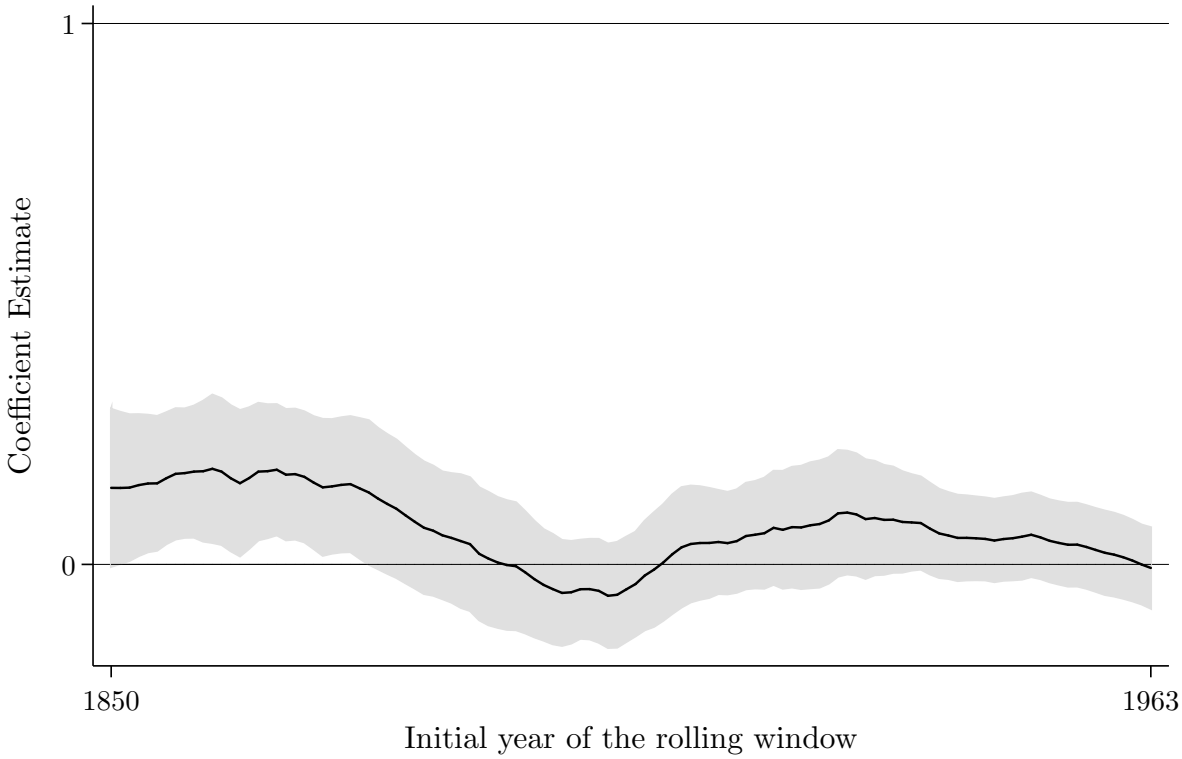

Figure A.12: This figure depicts the coefficient from panel regressions of the Vanhanen Index of Competition on its 10-year lagged value in over period 1850–2013 with a 50-year regression window and a step size of 1 years, estimated with OLS. The regressions account for year fixed effects. Robust standard errors are used for the calculation of the confidence band.

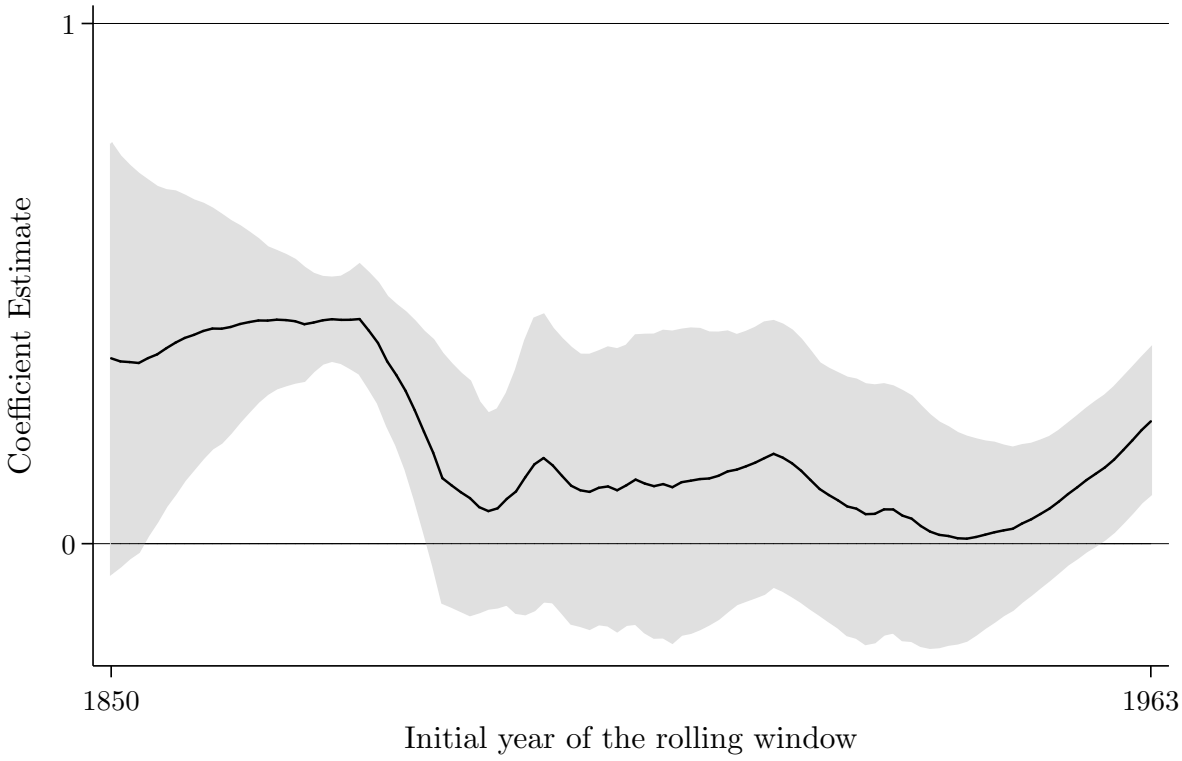

Figure A.13: Colonies only. This figure depicts the coefficient from panel regressions of Democracy on its 10-year lagged value in over period 1850–2013 with a 50-year regression window and a step size of 1 years, estimated with OLS. The regressions account for year fixed effects. Robust standard errors are used for the calculation of the confidence band.

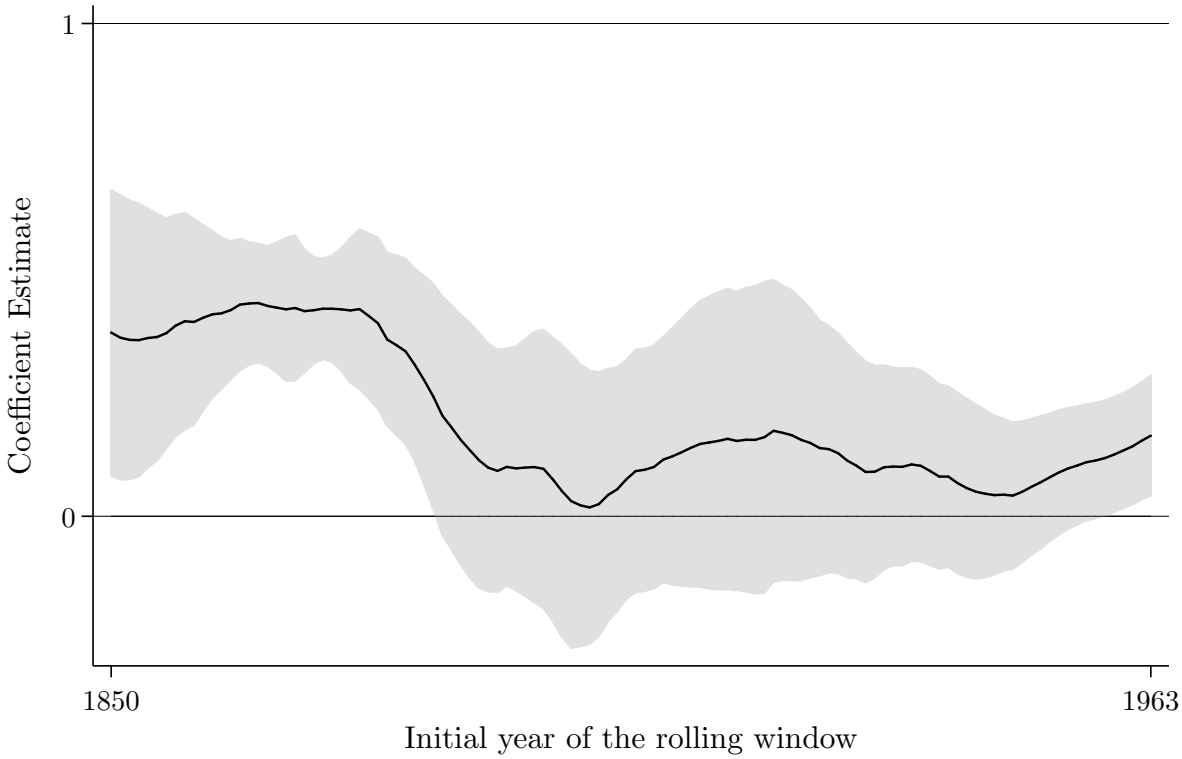

Figure A.14: Colonies only. This figure depicts the coefficient from panel regressions of Autocracy on its 10-year lagged value in over period 1850–2013 with a 50-year regression window and a step size of 1 years, estimated with OLS. The regressions account for year fixed effects. Robust standard errors are used for the calculation of the confidence band.

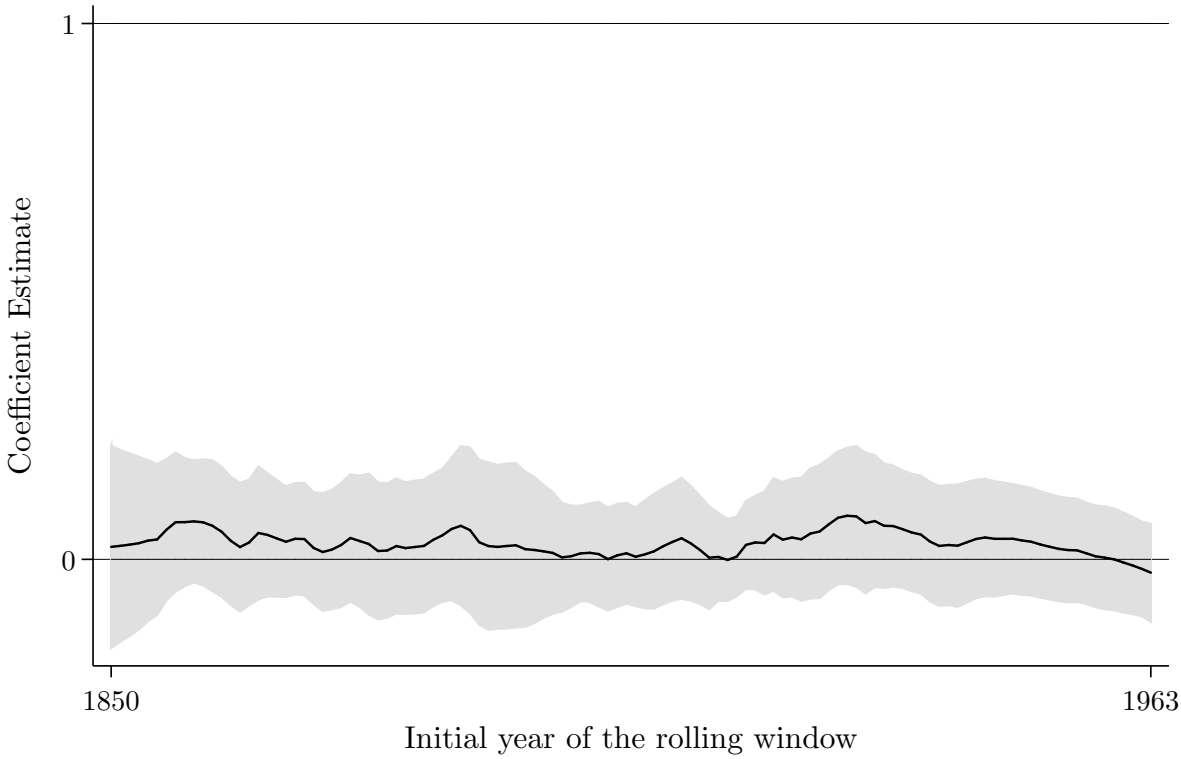

Figure A.15: Colonies only. This figure depicts the coefficient from panel regressions of the Vanhanen Index of Competition on its 10-year lagged value in over period 1850–2013 with a 50-year regression window and a step size of 1 years, estimated with OLS. The regressions account for year fixed effects. Robust standard errors are used for the calculation of the confidence band.

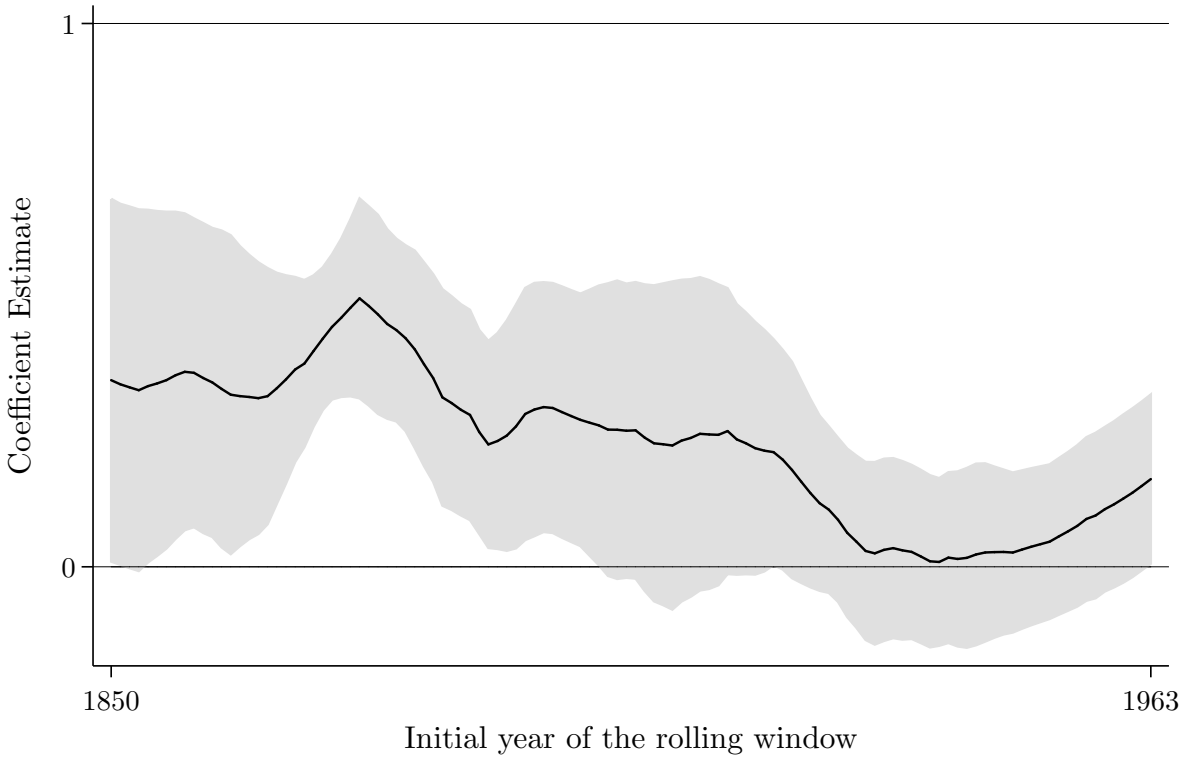

Figure A.16: Colonies only. This figure depicts the coefficient from panel regressions of Constraint on the Executive on its 10-year lagged value in over period 1850–2013 with a 50-year regression window and a step size of 1 years, estimated with OLS. The regressions account for year fixed effects. Robust standard errors are used for the calculation of the confidence band.

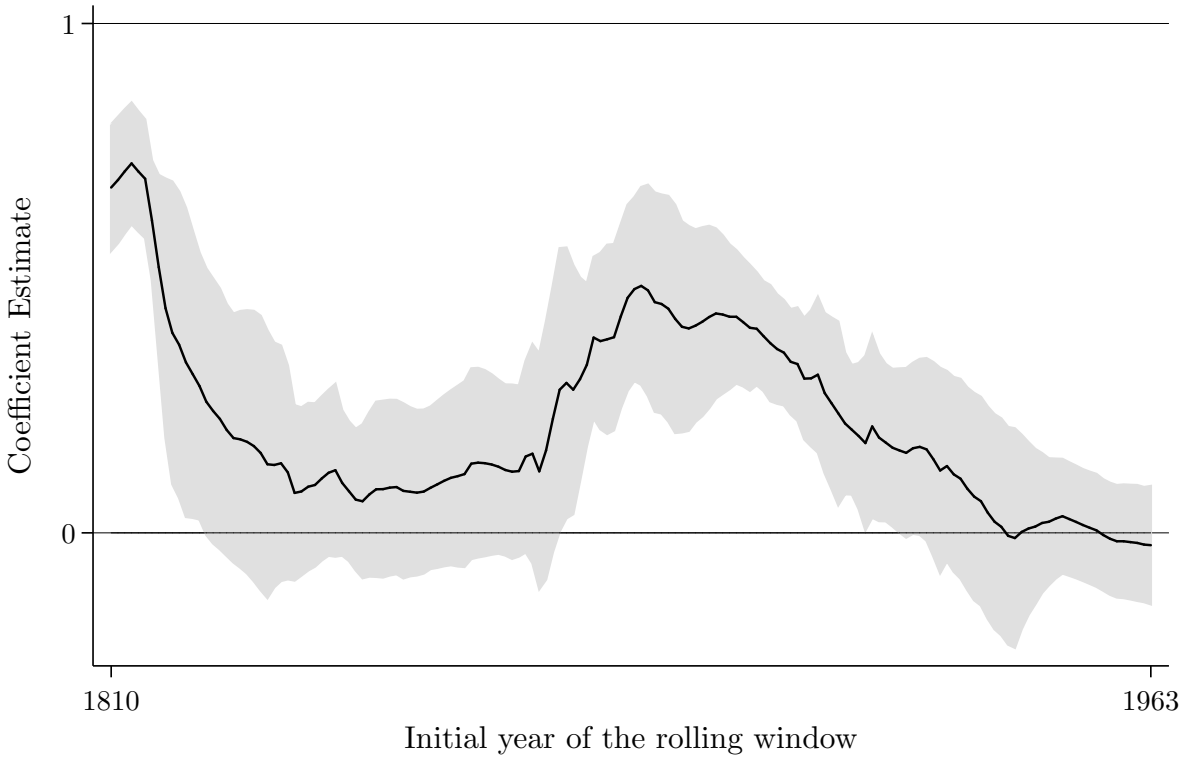

Figure A.17: Colonies only. This figure depicts the coefficient from panel regressions of the Vanhanen Index of Democracy on its 10-year lagged value in over period 1850–2013 with a 50-year regression window and a step size of 1 years, estimated with OLS. The regressions account for year fixed effects. Robust standard errors are used for the calculation of the confidence band.

C Additional Tables

Table A.1: Institutional Persistence — 1-Year Data

	Constraint on Executive		Freedom House Measure of Democracy		Vanhanen Index of Democracy	
	OLS (1)	OLS (2)	OLS (3)	OLS (4)	OLS (5)	OLS (6)
First Lag of Constraint on the Executive	0.957***	0.936***				
	(0.005)	(0.007)				
First Lag of Freedom House Measure of Democracy			0.836***	0.821***		
			(0.016)	(0.016)		
First Lag of Vanhanen Index of Democratization					0.961***	0.919***
					(0.007)	(0.011)
Year FE	No	Yes	No	Yes	No	Yes
Number of Observations	14,117	14,117	4,245	4,245	12,012	12,012
Number of Countries	158	158	166	166	163	163
Adjusted R^2	0.912	0.913	0.705	0.710	0.912	0.915
Signif. of main coeff.=1 test	.00	.00	.00	.00	.00	.00
Signif. of unit root test (P-P)	.01		.00		.00	

This table establishes that the degree of persistence of institutions is below one, accounting for year fixed effects. The estimation is performed with both OLS as well as the GMM estimator by Arellano and Bond (1991) where institutions are instrumented using a double lag. Robust standard errors are shown in the parentheses. *** Significant at the 1 percent level. ** Significant at the 5 percent level. * Significant at the 10 percent level.

Table A.2: Institutional Persistence — 5-Year Data

	Constraint on Executive			Freedom House Measure of Democracy			Vanhanen Index of Democracy		
	OLS (1)	OLS (2)	GMM (3)	OLS (4)	OLS (5)	GMM (6)	OLS (7)	OLS (8)	GMM (9)
First Lag of Constraint on the Executive	0.779***	0.694***	0.509***						
	(0.027)	(0.033)	(0.044)						
First Lag of Freedom House Measure of Democracy				0.492***	0.481***	0.428***			
				(0.049)	(0.052)	(0.107)			
First Lag of Vanhanen Index of Democratization							0.871***	0.714***	0.632***
							(0.024)	(0.036)	(0.045)
Year FE	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Number of Observations	2,625	2,625	2,388	936	936	670	2,324	2,324	2,145
Number of Countries	158	158	158	166	166	142	162	162	144
Adjusted R^2	0.585	0.619		0.255	0.268		0.694	0.733	
Signif. of main coeff.=1 test	.00	.00	.00	.00	.00	.00	.00	.00	.00
Signif. of unit root test (P-P)	.14			.00			.00		

This table establishes that the degree of persistence of institutions is below one, accounting for year fixed effects. The estimation is performed with both OLS as well as the GMM estimator by Arellano and Bond (1991) where institutions are instrumented using a double lag. Robust standard errors are shown in the parentheses. *** Significant at the 1 percent level. ** Significant at the 5 percent level. * Significant at the 10 percent level.

Table A.3: Institutional Persistence — 30-Year Data

	Constraint on Executive			Vanhanen Index of Democracy		
	OLS (1)	OLS (2)	GMM (3)	OLS (4)	OLS (5)	GMM (6)
First Lag of Constraint on the Executive	0.223***	0.063	0.443***			
	(0.077)	(0.072)	(0.162)			
First Lag of Vanhanen Index of Democratization				0.818***	0.605***	0.406*
				(0.089)	(0.109)	(0.223)
Year FE	No	Yes	Yes	No	Yes	Yes
Number of Observations	374	374	236	232	232	160
Number of Countries	131	131	73	71	71	54
Adjusted R^2	0.042	0.354		0.410	0.521	
Signif. of main coeff.=1 test	.00	.00	.00	.04	.00	.010
Signif. of unit root test (P-P)	.25			.90		

This table establishes that the degree of persistence of institutions is below one, accounting for year fixed effects. The estimation is performed with both OLS as well as the GMM estimator by Arellano and Bond (1991) where institutions are instrumented using a double lag. Robust standard errors are shown in the parentheses. *** Significant at the 1 percent level. ** Significant at the 5 percent level. * Significant at the 10 percent level.

Table A.4: Institutional Persistence — 100-Year Data

	Constraint on Executive		
	(1) OLS	(2) OLS	(3) GMM
First Lag of Constraint on the Executive (AJR 2005)	0.712***	0.679***	0.622**
	(0.144)	(0.142)	(0.304)
Year FE	No	Yes	Yes
Number of Observations	200	200	175
Number of Countries	25	25	25
Adjusted R^2	.311	.339	
Signif. of unit root test	1		
Signif. of main coeff.=1 test	.06	.033	.21

Table A.5: Robustness to Accounting for Temperatures and Soil Productivity

	Log GDP per cap. in	Constraint on Executive in		Log GDP per cap. in	Constraint on Executive in	
	1990s	1960s	1990s	1990s	1960s	1990s
	(1)	(2)	(3)	(4)	(5)	(6)
Constraint on Executive in 1990s	0.736**			0.628***		
	(0.295)			(0.191)		
Constraint on Executive in 1900		0.992	0.486		0.867*	0.531*
		(0.708)	(0.354)		(0.508)	(0.289)
Log Absolute Latitude	-0.468**	-0.486*	0.246	-0.473**	-0.512	0.342*
	(0.220)	(0.273)	(0.171)	(0.230)	(0.345)	(0.202)
Temperature	0.041	0.088	-0.032			
	(0.049)	(0.130)	(0.071)			
Soil Fertility				0.135	-0.745	-1.584
				(0.694)	(2.473)	(1.018)
Region FE	Yes	Yes	Yes	Yes	Yes	Yes
Number of Observations	55	55	55	55	55	55
Wald Test of $\hat{\delta}_0 = 1$ p-value		.991	.146		.793	.105
AR Test of $\hat{\delta}_0 = 1$ p-value		0.991	0.335		0.806	0.247
First Stage F-Statistic (K-P)	3.386	5.724	5.724	6.222	10.016	10.016

This table presents estimates of the effect of institutions on economic development. The first panel presents estimates from conventional 2SLS analyses, accounting for the natural logarithm of absolute latitude and world region fixed effects. Furthermore, the panel presents estimates of the degree of persistence of institutions from 1900 to the 1960s as well as from 1900 to the 1990s. The second panel presents estimates based on the augmented estimator, based on GMM estimation, that accounts for the degree of persistence of institutions, accounting for the natural logarithm of absolute latitude and world region fixed effects. Robust standard errors are shown in the parentheses. *** Significant at the 1 percent level. ** Significant at the 5 percent level. * Significant at the 10 percent level.

Table A.6: Robustness to Accounting for Potential Soil Productivity

	Log GDP per cap. in	Constraint on Executive in		Log GDP per cap. in	Constraint on Executive in	
	1990s	1960s	1990s	1990s	1960s	1990s
	(1)	(2)	(3)	(4)	(5)	(6)
Constraint on Executive in 1990s	0.651***			0.578**		
	(0.223)			(0.272)		
Constraint on Executive in 1900		0.747*	0.471*		0.700	0.416
		(0.450)	(0.254)		(0.474)	(0.280)
Log Absolute Latitude	-0.465**	-0.582**	0.226	-0.447*	-0.436	0.331*
	(0.212)	(0.282)	(0.179)	(0.232)	(0.294)	(0.185)
Neolithic Transition Timing	0.000	-0.000**	-0.000**			
	(0.000)	(0.000)	(0.000)			
Population Density in 1500 CE				-0.042	-0.125	-0.115
				(0.083)	(0.107)	(0.094)
Region FE	Yes	Yes	Yes	Yes	Yes	Yes
Number of Observations	56	56	56	56	56	56
Wald Test of $\hat{\delta}_0 = 1$ p-value		.57400	.037		.526	.037
AR Test of $\hat{\delta}_0 = 1$ p-value		0.629	0.184		0.591	0.174
First Stage F-Statistic (K-P)	6.457	10.712	10.712	3.337	10.462	10.462

This table presents estimates of the effect of institutions on economic development. The first panel presents estimates from conventional 2SLS analyses, accounting for the natural logarithm of absolute latitude and world region fixed effects. Furthermore, the panel presents estimates of the degree of persistence of institutions from 1900 to the 1960s as well as from 1900 to the 1990s. The second panel presents estimates based on the augmented estimator, based on GMM estimation, that accounts for the degree of persistence of institutions, accounting for the natural logarithm of absolute latitude and world region fixed effects. Robust standard errors are shown in the parentheses. *** Significant at the 1 percent level. ** Significant at the 5 percent level. * Significant at the 10 percent level.

Table A.7: Institutional Persistence — 1-Year Data — Sample Restricted to Colonies

	Constraint on Executive		Freedom House Measure of Democracy		Vanhanen Index of Democracy	
	OLS (1)	OLS (2)	OLS (3)	OLS (4)	OLS (5)	OLS (6)
First Lag of Constraint on the Executive	0.946***	0.925***				
	(0.010)	(0.013)				
First Lag of Freedom House Measure of Democracy			0.811***	0.795***		
			(0.019)	(0.019)		
First Lag of Vanhanen Index of Democratization					0.923***	0.844***
					(0.013)	(0.021)
Year FE	No	Yes	No	Yes	No	Yes
Number of Observations	6,060	6,060	1,768	1,768	5,419	5,419
Number of Countries	60	60	62	62	62	62
Adjusted R^2	0.890	0.890	0.660	0.666	0.836	0.843
Signif. of main coeff.=1 test	.00	.00	.00	.00	.00	.00

This table establishes that the degree of persistence of institutions is below one, accounting for year fixed effects. The estimation is performed with both OLS as well as the GMM estimator by Arellano and Bond (1991) where institutions are instrumented using a double lag. Robust standard errors are shown in the parentheses. *** Significant at the 1 percent level. ** Significant at the 5 percent level. * Significant at the 10 percent level.

Table A.8: Institutional Persistence — 5-Year Data — Sample Restricted to Colonies

	Constraint on Executive			Freedom House Measure of Democracy			Vanhanen Index of Democracy		
	OLS (1)	OLS (2)	GMM (3)	OLS (4)	OLS (5)	GMM (6)	OLS (7)	OLS (8)	GMM (9)
First Lag of Constraint on the Executive	0.707***	0.625***	0.513***						
	(0.048)	(0.060)	(0.054)						
First Lag of Freedom House Measure of Democracy				0.339***	0.320***	0.331***			
				(0.067)	(0.072)	(0.116)			
First Lag of Vanhanen Index of Democratization							0.728***	0.462***	0.417***
							(0.046)	(0.065)	(0.066)
Year FE	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Number of Observations	1,152	1,152	1,066	400	400	290	1,061	1,061	997
Number of Countries	60	60	60	62	62	61	62	62	62
Adjusted R^2	0.478	0.515		0.133	0.144		0.481	0.590	
Signif. of main coeff.=1 test	.00	.00	.00	.00	.00	.00	.00	.00	.00

This table establishes that the degree of persistence of institutions is below one, accounting for year fixed effects. The estimation is performed with both OLS as well as the GMM estimator by Arellano and Bond (1991) where institutions are instrumented using a double lag. Robust standard errors are shown in the parentheses. *** Significant at the 1 percent level. ** Significant at the 5 percent level. * Significant at the 10 percent level.

Table A.9: Institutional Persistence — 10-Year Data — Sample Restricted to Colonies

	Constraint on Executive			Freedom House Measure of Democracy			Vanhanen Index of Democracy		
	OLS (1)	OLS (2)	GMM (3)	OLS (4)	OLS (5)	GMM (6)	OLS (7)	OLS (8)	GMM (9)
First Lag of Constraint on the Executive	0.511***	0.383***	0.329***						
	(0.076)	(0.091)	(0.084)						
First Lag of Freedom House Measure of Democracy				-0.143	-0.180**	0.106			
				(0.088)	(0.088)	(0.191)			
First Lag of Vanhanen Index of Democratization							0.598***	0.222***	0.092
							(0.063)	(0.068)	(0.092)
Year FE	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Number of Observations	564	564	493	145	145	61	517	517	453
Number of Countries	60	60	60	61	61	61	62	62	62
Adjusted R^2	0.237	0.346		0.021	0.058		0.291	0.537	
Signif. of main coeff.=1 test	.00	.00	.00	.00	.00	.00	.00	.00	.00

This table establishes that the degree of persistence of institutions is below one, accounting for year fixed effects. The estimation is performed with both OLS as well as the GMM estimator by Arellano and Bond (1991) where institutions are instrumented using a double lag. Robust standard errors are shown in the parentheses. *** Significant at the 1 percent level. ** Significant at the 5 percent level. * Significant at the 10 percent level.

Table A.10: Institutional Persistence — 30-Year Data — Sample Restricted to Colonies

	Constraint on Executive			Vanhanen Index of Democracy		
	OLS (1)	OLS (2)	GMM (3)	OLS (4)	OLS (5)	GMM (6)
First Lag of Constraint on the Executive	0.072	0.030	0.609***			
	(0.096)	(0.117)	(0.192)			
First Lag of Vanhanen Index of Democratization				0.161	-0.285	-0.002
				(0.180)	(0.223)	(0.441)
Year FE	No	Yes	Yes	No	Yes	Yes
Number of Observations	162	162	101	106	106	75
Number of Countries	59	59	31	30	30	25
Adjusted R^2	-0.003	0.269		0.004	0.241	
Signif. of main coeff.=1 test	.00	.00	.04	.00	.00	.02

This table establishes that the degree of persistence of institutions is below one, accounting for year fixed effects. The estimation is performed with both OLS as well as the GMM estimator by Arellano and Bond (1991) where institutions are instrumented using a double lag. Robust standard errors are shown in the parentheses. *** Significant at the 1 percent level. ** Significant at the 5 percent level. * Significant at the 10 percent level.

Table A.11: Institutional Persistence — 1-Year Data — Balanced Sample

	Constraint on Executive		Freedom House Measure of Democracy		Vanhanen Index of Democracy	
	OLS (1)	OLS (2)	OLS (3)	OLS (4)	OLS (5)	OLS (6)
First Lag of Constraint on the Executive	0.960***	0.931***				
	(0.006)	(0.010)				
First Lag of Freedom House Measure of Democracy			0.783***	0.721***		
			(0.030)	(0.039)		
First Lag of Vanhanen Index of Democratization					0.965***	0.909***
					(0.010)	(0.022)
Year FE	No	Yes	No	Yes	No	Yes
Number of Observations	4,578	4,578	725	725	4,195	4,195
Number of Countries	25	25	25	25	25	25
Adjusted R^2	0.909	0.911	0.666	0.677	0.908	0.912
Signif. of main coeff.=1 test	.00	.00	.00	.00	.00	.00

This table establishes that the degree of persistence of institutions is below one, accounting for year fixed effects. The estimation is performed with both OLS as well as the GMM estimator by Arellano and Bond (1991) where institutions are instrumented using a double lag. Robust standard errors are shown in the parentheses. *** Significant at the 1 percent level. ** Significant at the 5 percent level. * Significant at the 10 percent level.

Table A.12: Institutional Persistence — 5-Year Data — Balanced Sample

	Constraint on Executive			Freedom House Measure of Democracy			Vanhanen Index of Democracy		
	OLS (1)	OLS (2)	GMM (3)	OLS (4)	OLS (5)	GMM (6)	OLS (7)	OLS (8)	GMM (9)
First Lag of Constraint on the Executive	0.764***	0.639***	0.500***						
	(0.040)	(0.052)	(0.057)						
First Lag of Freedom House Measure of Democracy				0.480***	0.475***	0.283**			
				(0.108)	(0.116)	(0.141)			
First Lag of Vanhanen Index of Democratization							0.874***	0.663***	0.596***
							(0.031)	(0.070)	(0.075)
Year FE	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Number of Observations	888	888	844	192	192	143	833	833	807
Number of Countries	25	25	25	25	25	25	25	25	25
Adjusted R^2	0.562	0.609		0.273	0.353		0.673	0.728	
Signif. of main coeff.=1 test	.00	.00	.00	.00	.00	.00	.00	.00	.00

This table establishes that the degree of persistence of institutions is below one, accounting for year fixed effects. The estimation is performed with both OLS as well as the GMM estimator by Arellano and Bond (1991) where institutions are instrumented using a double lag. Robust standard errors are shown in the parentheses. *** Significant at the 1 percent level. ** Significant at the 5 percent level. * Significant at the 10 percent level.

Table A.13: Institutional Persistence — 10-Year Data — Balanced Sample

	Constraint on Executive			Freedom House Measure of Democracy			Vanhanen Index of Democracy		
	OLS (1)	OLS (2)	GMM (3)	OLS (4)	OLS (5)	GMM (6)	OLS (7)	OLS (8)	GMM (9)
First Lag of Constraint on the Executive	0.595***	0.421***	0.301***						
	(0.065)	(0.071)	(0.073)						
First Lag of Freedom House Measure of Democracy				0.245	0.297*	0.052			
				(0.150)	(0.146)	(0.110)			
First Lag of Vanhanen Index of Democratization							0.798***	0.470***	0.367**
							(0.048)	(0.099)	(0.143)
Year FE	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Number of Observations	439	439	406	73	73	25	414	414	388
Number of Countries	25	25	25	25	25	25	25	25	25
Adjusted R^2	0.326	0.456		0.131	0.277		0.496	0.639	
Signif. of main coeff.=1 test	.00	.00	.00	.00	.00	.00	.00	.00	.00

This table establishes that the degree of persistence of institutions is below one, accounting for year fixed effects. The estimation is performed with both OLS as well as the GMM estimator by Arellano and Bond (1991) where institutions are instrumented using a double lag. Robust standard errors are shown in the parentheses. *** Significant at the 1 percent level. ** Significant at the 5 percent level. * Significant at the 10 percent level.

Table A.14: Institutional Persistence — 30-Year Data — Balanced Sample

	Constraint on Executive			Vanhanen Index of Democracy		
	OLS	OLS	GMM	OLS	OLS	GMM
	(1)	(2)	(3)	(4)	(5)	(6)
First Lag of Constraint on the Executive	0.133**	-0.075	0.122			
	(0.062)	(0.071)	(0.160)			
First Lag of Vanhanen Index of Democratization				0.782***	0.338	-0.211
				(0.220)	(0.326)	(0.344)
Year FE	No	Yes	Yes	No	Yes	Yes
Number of Observations	143	143	118	110	110	85
Number of Countries	25	25	25	24	24	24
Adjusted R^2	0.006	0.321		0.197	0.327	
Signif. of main coeff.=1 test	.00	.00	.00	.33	.05	.00

This table establishes that the degree of persistence of institutions is below one, accounting for year fixed effects. The estimation is performed with both OLS as well as the GMM estimator by Arellano and Bond (1991) where institutions are instrumented using a double lag. Robust standard errors are shown in the parentheses. *** Significant at the 1 percent level. ** Significant at the 5 percent level. * Significant at the 10 percent level.

Table A.15: Institutional Persistence — 1-Year Data — All Countries — Including Post-1965 Interaction Term

	Constraint on Executive		Vanhanen Index of Democracy	
	OLS (1)	OLS (2)	OLS (3)	OLS (4)
First Lag of Constraint on the Executive	0.960*** (0.006)	0.949*** (0.007)		
First Lag of Vanhanen Index of Democratization			0.953*** (0.010)	0.919*** (0.012)
Interaction Term (Post-1965)	-0.023*** (0.006)	-0.032*** (0.007)	-0.014** (0.006)	-0.001 (0.006)
Level Shift in 1965	0.185*** (0.032)		0.827*** (0.093)	
Year FE	No	Yes	No	Yes
Number of Observations	14,117	14,117	12,012	12,012
Number of Countries	158	158	163	163
Adjusted R^2	0.912	0.913	0.913	0.915
Signif. of main coeff.=1 test	.00	.00	.00	.00
Signif. of unit root test (P-P)	.01		.00	

This table establishes that the degree of persistence of institutions is below one, accounting for year fixed effects. The estimation is performed with both OLS as well as the GMM estimator by Arellano and Bond (1991) where institutions are instrumented using a double lag. Robust standard errors are shown in the parentheses. *** Significant at the 1 percent level. ** Significant at the 5 percent level. * Significant at the 10 percent level.

Table A.16: Institutional Persistence — 5-Year Data — All Countries — Including Post-1965 Interaction Term

	Constraint on Executive			Vanhanen Index of Democracy		
	OLS (1)	OLS (2)	GMM (3)	OLS (4)	OLS (5)	GMM (6)
First Lag of Constraint on the Executive	0.790***	0.749***	0.540***			
	(0.027)	(0.030)	(0.043)			
First Lag of Vanhanen Index of Democratization				0.850***	0.736***	0.671***
				(0.035)	(0.040)	(0.046)
Interaction Term (Post-1965)	-0.107***	-0.136***	-0.078**	-0.080***	-0.031	-0.070***
	(0.031)	(0.033)	(0.037)	(0.025)	(0.022)	(0.024)
Level Shift in 1965	0.910***			3.611***		
	(0.160)			(0.429)		
Year FE	No	Yes	Yes	No	Yes	Yes
Number of Observations	2,625	2,625	2,388	2,324	2,324	2,145
Number of Countries	158	158	158	162	162	144
Adjusted R^2	0.601	0.626		0.711	0.734	
Signif. of main coeff.=1 test	.00	.00	.00	.00	.00	.00
Signif. of unit root test (P-P)	.14			.00		

This table establishes that the degree of persistence of institutions is below one, accounting for year fixed effects. The estimation is performed with both OLS as well as the GMM estimator by Arellano and Bond (1991) where institutions are instrumented using a double lag. Robust standard errors are shown in the parentheses. *** Significant at the 1 percent level. ** Significant at the 5 percent level. * Significant at the 10 percent level.

Table A.17: Institutional Persistence — 10-Year Data — All Countries — Including Post-1965 Interaction Term

	Constraint on Executive			Vanhanen Index of Democracy		
	OLS (1)	OLS (2)	GMM (3)	OLS (4)	OLS (5)	GMM (6)
First Lag of Constraint on the Executive	0.622***	0.560***	0.388***			
	(0.050)	(0.051)	(0.072)			
First Lag of Vanhanen Index of Democratization				0.790***	0.606***	0.460***
				(0.062)	(0.070)	(0.119)
Interaction Term (Post-1965)	-0.204***	-0.236***	-0.100*	-0.158***	-0.055	-0.002
	(0.051)	(0.050)	(0.060)	(0.052)	(0.051)	(0.046)
Level Shift in 1965	1.675***			5.683***		
	(0.256)			(0.812)		
Year FE	No	Yes	Yes	No	Yes	Yes
Number of Observations	1,258	1,258	1,057	1,113	1,113	958
Number of Countries	157	157	137	144	144	139
Adjusted R^2	0.386	0.456		0.595	0.653	
Signif. of main coeff.=1 test	.00	.00	.00	.00	.00	.00
Signif. of unit root test (P-P)	.00			.00		

This table establishes that the degree of persistence of institutions is below one, accounting for year fixed effects. The estimation is performed with both OLS as well as the GMM estimator by Arellano and Bond (1991) where institutions are instrumented using a double lag. Robust standard errors are shown in the parentheses. *** Significant at the 1 percent level. ** Significant at the 5 percent level. * Significant at the 10 percent level.

Table A.18: Institutional Persistence — 30-Year Data — All Countries — Including Post-1965 Interaction Term

	Constraint on Executive			Vanhanen Index of Democracy		
	OLS (1)	OLS (2)	GMM (3)	OLS (4)	OLS (5)	GMM (6)
First Lag of Constraint on the Executive	0.341***	0.247***	0.468***			
	(0.071)	(0.080)	(0.143)			
First Lag of Vanhanen Index of Democratization				1.196***	0.818***	0.467
				(0.177)	(0.170)	(0.318)
Interaction Term (Post-1965)	-0.456***	-0.371***	-0.200*	-0.543***	-0.244*	-0.033
	(0.063)	(0.061)	(0.117)	(0.155)	(0.143)	(0.148)
Level Shift in 1965	3.139***			3.832*		
	(0.356)			(2.037)		
Year FE	No	Yes	Yes	No	Yes	Yes
Number of Observations	374	374	236	232	232	160
Number of Countries	131	131	73	71	71	54
Adjusted R^2	0.243	0.409		0.461	0.528	
Signif. of main coeff.=1 test	.00	.00	.00	.27	.29	.09
Signif. of unit root test (P-P)	.25			.9		

This table establishes that the degree of persistence of institutions is below one, accounting for year fixed effects. The estimation is performed with both OLS as well as the GMM estimator by Arellano and Bond (1991) where institutions are instrumented using a double lag. Robust standard errors are shown in the parentheses. *** Significant at the 1 percent level. ** Significant at the 5 percent level. * Significant at the 10 percent level.

Table A.19: Institutional Persistence — 1-Year Data — Alternative Measures of Institutions

	Democracy		Autocracy		Vanhanen Index of Competition	
	OLS (1)	OLS (2)	OLS (3)	OLS (4)	OLS (5)	OLS (6)
First Lag of Democracy	0.968*** (0.004)	0.948*** (0.006)				
First Lag of Autocracy			0.962*** (0.004)	0.943*** (0.006)		
First Lag of Vanhanen Index of Competition					0.880*** (0.011)	0.829*** (0.011)
Year FE	No	Yes	No	Yes	No	Yes
Number of Observations	14,117	14,117	14,117	14,117	12,012	12,012
Number of Countries	158	158	158	158	163	163
Adjusted R^2	0.933	0.934	0.923	0.924	0.771	0.780
Signif. of unit root test	.00		.00		.00	
Signif. of main coeff.=1 test	.00	.00	.00	.00	.00	.00

This table establishes that the degree of persistence of institutions is below one, accounting for year fixed effects. The estimation is performed with both OLS as well as the GMM estimator by Arellano and Bond (1991) where institutions are instrumented using a double lag. Robust standard errors are shown in the parentheses. *** Significant at the 1 percent level. ** Significant at the 5 percent level. * Significant at the 10 percent level.

Table A.20: Institutional Persistence — 1-Year Data — Alternative Measures of Institutions

	Democracy			Autocracy			Vanhanen Index of Competition		
	OLS (1)	OLS (2)	GMM (3)	OLS (4)	OLS (5)	GMM (6)	OLS (7)	OLS (8)	GMM (9)
First Lag of Democracy	0.833***	0.747***	0.563***						
	(0.022)	(0.029)	(0.050)						
First Lag of Autocracy				0.802***	0.725***	0.587***			
				(0.023)	(0.029)	(0.048)			
First Lag of Vanhanen Index of Competition							0.595***	0.428***	0.368***
							(0.037)	(0.041)	(0.044)
Year FE	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Number of Observations	2,625	2,625	2,388	2,625	2,625	2,388	2,324	2,324	2,145
Number of Countries	158	158	158	158	158	158	162	162	144
Adjusted R^2	0.669	0.695		0.620	0.652		0.334	0.428	
Signif. of unit root test	.00			.00			.00		
Signif. of main coeff.=1 test	.00	.00	.00	.00	.00	.00	.00	.00	.00

This table establishes that the degree of persistence of institutions is below one, accounting for year fixed effects. The estimation is performed with both OLS as well as the GMM estimator by Arellano and Bond (1991) where institutions are instrumented using a double lag. Robust standard errors are shown in the parentheses. *** Significant at the 1 percent level. ** Significant at the 5 percent level. * Significant at the 10 percent level.

Table A.21: Institutional Persistence — 1-Year Data — Alternative Measures of Institutions

	Democracy			Autocracy			Vanhanen Index of Competition		
	OLS (1)	OLS (2)	GMM (3)	OLS (4)	OLS (5)	GMM (6)	OLS (7)	OLS (8)	GMM (9)
First Lag of Democracy	0.696***	0.540***	0.374***						
	(0.040)	(0.049)	(0.091)						
First Lag of Autocracy				0.620***	0.490***	0.377***			
				(0.040)	(0.044)	(0.061)			
First Lag of Vanhanen Index of Competition							0.444***	0.217***	0.161**
							(0.052)	(0.056)	(0.079)
Year FE	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Number of Observations	1,258	1,258	1,057	1,258	1,258	1,057	1,113	1,113	958
Number of Countries	157	157	137	157	157	137	144	144	139
Adjusted R^2	0.445	0.527		0.359	0.452		0.178	0.364	
Signif. of unit root test	.00			.00			.00		
Signif. of main coeff.=1 test	.00	.00	.00	.00	.00	.00	.00	.00	.00

This table establishes that the degree of persistence of institutions is below one, accounting for year fixed effects. The estimation is performed with both OLS as well as the GMM estimator by Arellano and Bond (1991) where institutions are instrumented using a double lag. Robust standard errors are shown in the parentheses. *** Significant at the 1 percent level. ** Significant at the 5 percent level. * Significant at the 10 percent level.

Table A.22: Institutional Persistence — 1-Year Data — Alternative Measures of Institutions

	Democracy			Autocracy			Vanhanen Index of Competition		
	OLS (1)	OLS (2)	GMM (3)	OLS (4)	OLS (5)	GMM (6)	OLS (7)	OLS (8)	GMM (9)
First Lag of Democracy	0.339***	0.110	0.334						
	(0.085)	(0.083)	(0.212)						
First Lag of Autocracy				0.240**	0.117	0.399**			
				(0.094)	(0.077)	(0.167)			
First Lag of Vanhanen Index of Competition							0.180**	-0.167	-0.151
							(0.084)	(0.102)	(0.232)
Year FE	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Number of Observations	374	374	236	374	374	236	232	232	160
Number of Countries	131	131	73	131	131	73	71	71	54
Adjusted R^2	0.086	0.377		0.048	0.308		0.027	0.254	
Signif. of unit root test	.99			.01			.00		
Signif. of main coeff.=1 test	.00	.00	.00	.00	.00	.00	.00	.00	.00

This table establishes that the degree of persistence of institutions is below one, accounting for year fixed effects. The estimation is performed with both OLS as well as the GMM estimator by Arellano and Bond (1991) where institutions are instrumented using a double lag. Robust standard errors are shown in the parentheses. *** Significant at the 1 percent level. ** Significant at the 5 percent level. * Significant at the 10 percent level.

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