The Long-run Effects of Land Productivity on Democracy[1]

Satyendra Kumar Gupta[2]

Abstract This research establishes that an optimal level of regional agro-ecological factors measured by crop yield is inducive for democratic political regime. Empirical findings establish an inverted U-shaped association between crop yield and extent of democracy in cross country analysis. These findings are robust to inclusion of other possible confounders – such as, quality of institutions, indicators of early development, and various other determinants of democracy identified in extant literature. The hypothesis is also supported in precolonial societies data sets. We also find evidence of intergenerational transmission of inverted U-shaped attitude towards democracy in first generation immigrants into Europe, while second generation immigrants seem to assimilate their perception of democratic values with the country of their residence.

Keywords: Democracy, land productivity, institutions.

JEL Classification: N4, P16, E02.

---

[2]   PhD candidate, Department of Economics, School of Humanities and Social Sciences, Nanyang Technological University, Singapore.

1 Introduction

It is an established view in development economics that the differences in economic prosperity in different countries have origin in the quality of institutions and the cultural traits in the past. However, the challenge remains to explain where these differences come from. More evidences from archeology, historic archives, and genealogy have assisted researchers in linking the dots between the past and the present. Recent studies have highlighted that geography and historical experience of population a region have persistent effect on the past and present economic development and quality of institutions (Acemoglu, Johnson et al. (2001); Alesina, Giuliano et al. (2013); Nunn and Puga (2012); Galor and Özak (2016)). Agricultural produce became the main source of food supply and employment after the invention of sedentary farming practices. Alesina, Giuliano, et al. (2013) find that persistent effect of gender roles on contemporary female labor force participation while Galor and Özak (2016) find that culture of long term orientation in modern societies originated from the kind of crops indigenous people grew in the region. Olsson and Paik (2016) establish that advent of farming practices developed culture of collectivism and divergence in cultural values developed through agricultural practices still persist.

In this research, we examine the role of most basic endowment, that is land productivity measured by crop yield, that precolonial societies had on the extent of democracy in modern societies. We find an interesting coincidence that the top decile and the bottom decile of the countries categorized by the crop yield have low level of democracy, measured by polity2 score (Table 1.C). We also notice that most of these countries are in either Asia or Africa, with a few exceptions in New world and Europe. This intrigued us to explore the competing effects of higher crop yield in a country on the level of democracy.

We hypothesized an inverted U-shaped association between the crop yield and the extent of democracy in a society. Level of democracy increases with an increase of income and middle class while decreases with the concentration of resources under elites. If the positive effect of crop yield on level of democracy dominates at lower level and the association reverses at higher level, then we expect a hump-shaped effect of crop yield on level democracy throughout the political regimes. Our empirical findings establish the existence of hum-shaped association between the crop yield and the extent of democracy in modern societies in cross country analysis, sub-national analysis in within country analysis, and precolonial societies using ethnographic dataset.

Our findings indicate existence of an optimal level of crop yield for each level of democracy because of competing effects of crop yield on level of democracy. The negative effect of crop yield on the level of democracy relates to the "resource curse" of a region. As there is surplus level of resources some people can afford not to work and provide other services – like protection from attacks by members of other societies – to the members of their groups for a fee. A class of people emerges in the society that does not want to work again and protect their elite standard in the society. This gives rise to inequality in the society and raises the possibility of an autocratic rule in the society. The positive effect of crop yield on the level of democracy is related to the modernization theory proposed by Lipset (1959), that says, a higher income is precondition for democracy. A higher income is likely to create a broader middle class in a society that is conducive to the development of democracy. In a similar vein, Diamond (1997) argued that the societies with a higher endowment of grains species, and with resistance to germs, led technological advancement and this divergence still persists.

The idea that land endowment has an impact on the kind of institutions developed in different countries has been explored earlier. Engerman and Sokoloff (1997) and Sokoloff and Engerman (2000) (henceforth ES) document the differences in the land endowment in Latin America and North America. They highlight that land endowment in Latin America lent themselves to commodities featuring economies of scale and/or the use of slave and indigenous labor (sugar cane, rice, silver) and thus were historically associated with power concentrated in the hands of the plantation and mining elite. Once power was concentrated, the elite in Latin America created institutions to preserve their hegemony, like a narrow franchise for voting, restricted distribution of public lands and mineral rights, and low access to schooling. In countries like Mexico, Chile, and Peru up through the early 20th century, land was redistributed away from indigenous populations towards a small group of landowners. ES suggest that the elites in Latin America opposed democracy and other institutions promoting equality before the law because they were afraid of the poor majority gaining power. This behavior of elits The elites feared in particular that the majority would use power to redistribute income and rents away from the elite towards the majority. ES note that even when Latin American nations were nominal democracies, they imposed literacy or wealth requirements for voting that sharply restricted the franchise well into the 20th century. Conditions were somewhat different in the southern colonies, where crops such as tobacco and rice did exhibit some limited scale economies; cotton, which was grown predominantly on large slave plantations, was not a quantitatively important crop until the nineteenth century.

In contrast, the endowments of North America lent themselves to commodities grown on family farms (wheat, maize) and thus promoted the growth of a large middle class in which power was widely distributed. So, North America enjoyed a larger middle class with a less powerful elite so that the United States and Canada created more open, egalitarian institutions. For instance, these regions adopted earlier a broad franchise for voting, equal protection before the law, widespread distribution of public lands and mineral rights, cheap patent fees ($35 in US in the late 19th century), relatively easy entry for new banks and corporations, and a big government push on schooling.

The work of ES follows a long history literature that postulates domination by the elite owners of encomiendas (land grants for plantations and mines from the crown, accompanied by feudal rights over the indigenous population) as the ''original sin'' of Latin American underdevelopment (Chasteen, 2000). These economies were not endowed with substantial populations of natives able to provide labor, nor with climates and soils that gave them a comparative advantage in the production of crops characterized by major economies of using slave labor. For these reasons, their development, especially north of the Chesapeake, was based on laborers of European descent who had relatively high and similar levels of human capital. Compared to either of the other two categories of New World colonies, this class had rather homogenous populations. Correspondingly equal distributions of wealth were also encouraged by the limited advantages to large producers in the production of grains and hays predominant in regions such as the Middle Atlantic and New England. With abundant land and low capital requirements, the great majority of adult men were able to operate as independent proprietors (Sokoloff and Engerman (2000)) .

Regions that became part of current United States of America, Canada, and Latin American countries were colonized by Europeans to exploit vast land for plantation and other natural resources. However, the institutions developed in these countries differ vastly from each other. Institutions that were developed in USA and Canada promoted economic growth, secure property rights, and democracy. In contrast, several

former colonies with high agricultural potential (e.g. Uruguay, Haiti, Dominic republic) have low economic prosperity, corruption, and non-democratic polity regimes.

Our research is related, but not similar, to work done by Litina (2016) and Galor and Özak (2016). Both papers have extended the argument that historic land productivity has played important role in formation of cultural traits that still persists even after agriculture does not play dominant role in the life of many societies. Litina (2016) explored the association between land productivity and comparative development through formation of social capital. She argues that there is reversal of fortune once the industrialization process started because less productive regions had an incentive to develop agricultural infrastructure, such as irrigation facilities, and social capital, in the form of cooperation and trust, and this was conducive for faster economic development after industrialization started. Galor and Özak (2016) propose and establish that high land productivity, they measured in terms of crop yield, develops the culture of long term orientation and this culture still persists in modern societies.

Our research extends the above line of literature by identifying long-lasting influence of crop yield on democracy. We establish that the hump-shaped influence of crop yield on democracy is robust to the inclusion for various potentially confounding controls, such as measures of early development, measures of contemporary development, institutions, social cleavages, European influence, migration, human capital, and other geographical factors that have been identified to influence democracy in empirical studies on cross-country comparative development. We also find evidence that the hump-shaped association between crop yield and democracy existed in precolonial era as well.

The remainder of the paper is organized as follows. Section 2 presents regression model and data description. Section 3 reports regression analysis and findings of various robustness results. Sections 4 concludes.

2 Empirical Approach and Data

2.1 Regression Model

We estimate the following regression model to evaluate the influence of crop yield on the extent of democracy:

$$democracy_i = \beta_0 + \beta_1 cropyield_i + \beta_2 cropyield_i^2 + \beta_3 Controls_i + \epsilon_i \tag{1}$$

where $democracy_i$ is the average of democracy index over the period of study for country i, $cropyield_i$ is potential crop yield in country i, and $Controls_i$ is a vector of control variables included in the regression to minimize the possibility of getting spurious estimates, and ϵ_i is country-specific the error term.

Equation (1) represents reduced-form model specification of influence of crop yield on the extent of democracy. As hypothesized earlier, crop yield has a quadratic influence on a society's level of democracy through two competing influences on the extent of democracy – a positive influence through development of social infrastructure, and negative influence through concentration of power. We expect the overall influence of crop yield on cross-country extent of democracy should be hump-shaped. Specifically, we

expect both, β_1 and β_2, to be significant and have positive and negative sign, respectively. Our baseline sample used in the cross-country analysis consists of data for up to 148 countries.

2.2 Data

A. Outcome measures
The dependent variables are constructed using data over the period 1960-2015. The main objective of this research is to examine the role played by historical agro-climatic conditions in development of democratic political regimes in modern societies, so we focus on post-1960 period as most of the former European colonies in Sub-Saharan Africa, Middle East, South and East Asia gained independence since then. This let us explore the political regime with minimum possibility that the results are confounded by colonial powers directly influencing the domestic institutions in these countries. However, we tested our model with alternative periods as well for robustness.

Main source of data is Polity IV project, Political Regime Characteristics and Transitions, 1800-2015 (Marshall, Gurr et al. (2015)) that provides annual score of political regime authority characteristics for all independent countries with total population greater than half a million in 2015 (167 in total). The project examines concomitant qualities of democratic and autocratic authority in governing institutions, rather than discreet and mutually exclusive forms of governance. This perspective envisions a spectrum of governing authority that spans from fully institutionalized autocracies through mixed, or incoherent, authority regimes (termed "anocracies") to fully institutionalized democracies.

POLITY2: The Polity score is based on coding of six component measures that record salient features about executive recruitment process, constraints on executive authority and political competition. It also records changes in the institutionalized qualities of governing authority. The "Polity Score" captures the regime authority on a 21-pont scale ranging from -10 (hereditary monarchy) to +10 (consolidated democracy). We have also used democratic (polity2 greater than 5) and autocratic (polity2<-5) categorizations suggested by Polity IV projects as robustness checks.

DEMOC and AUTOC: These are indices from the Polity IV project that reflects the degree of institutionalized democracy and institutionalized autocracy, respectively. The variables are measured on a scale of 0 to 10, where 10 indicates the largest degree of democracy or autocracy for respective variable (source: Marshall, Gurr, et al. (2015)).

Civil liberties and political rights: Freedom of political rights and civil rights is a key feature of democratic regimes. Freedom House (2016) provides indices for political rights and civil rights since 1973. Both these indices are highly correlated, so we use mean over period 1973-2015 of these variables.

B. Independent variable (crop yield)
As discussed earlier, our independent variable in reduced-form, cross-country, and precolonial society analysis is crop yield. This index captures variation in potential crop yield (measured in millions of kilocalories per hectare per year) across different regions at the unit of analysis level. It addresses the limitations of other available weight-based agricultural yield indices. For example, the land productivity index constructed by Ramankutty, Foley et al. (2002), does not reflect the fact that equally suitable land can have a large variation in crop yield since caloric-intensive crops may not be cultivated in some regions (see

5

Galor and Özak (2015b)).

The data on crop yield are taken from Galor and Özak (2016), who construct their dataset from the Global Agro-Ecological Zones (GAEZ) project of the Food and Agriculture Organization (FAO). GAEZ supplies global yield and growth cycle estimates for 48 crops in grids with cells size of 5'x5' (approximately 100 km[2]).[3] GAEZ supplies crop yield estimates for each crop based on three alternative levels of input – high, medium and low – and two feasible sources of water supply – rain-fed water supply and irrigation. The FAO dataset supplies potential yield estimates for each crop in each agro-climatic grid while accounting for the effect of temperature and moisture on the growth of the crop.

The crop yield index is constructed using a low level of inputs and rain-fed agriculture cultivation methods in order to account for the agricultural conditions that were prevalent during the pre-industrial era. This reflects farming practices prevalent during the early stages of development. Furthermore, the crop yield data are based on agroclimatic conditions that are independent of any human intervention. This, therefore, mitigates any potential endogeneity pertaining to agricultural inputs, irrigation method, and soil quality.

Each crop yield in the GAEZ data (measured in tons per hectare per year) is converted by Galor and Özak (2016) into caloric yield (millions of kilocalories per hectare per year) to represent the nutritional variation across crops and to compare crop yields among different crops. The US Department of Agriculture Nutrient Database for Standard Reference provides data on the caloric content of various crops. Using these measures, the estimated average regional crop yield reflects the average regional levels of two variables – crop yield and crop cycle – among crops that maximize the caloric yield in each cell. Our analysis focuses on the averages across cells where the maximum potential crop yield is positive.

The bottom decile of countries has a crop yield below 907, while the top decile has a variation of over 11474. This is interesting to note that most of the countries in the top and the bottom decile are either from Asia or Africa and have very low level of average polity2 score over period 1960-2015, which supports our hypothesis that the crop yield has an inverted U-shaped association with extent of democracy. Figure 2 shows that crop yield and extent of democracy, measures by polity2 score, displays a hump-shaped relationship in global sample.

[Figure 1]

C. **Control variables**

Several control variables which may potentially confound the association between crop yield and the extent of democracy are accounted for in the regressions. This includes terrain ruggedness, absolute latitude, elevation, different in elevation, distance to nearest waterway, and landlockness. We also include continent dummies to account for any omitted variable bias of time-invariant continent-specific geographical, cultural and historical characteristics. Summary statistics and the correlations of the variables are given in Table 1A.

---

[3] These 48 crops are alfalfa, banana, barley, buckwheat, cabbage, cacao, carrot, cassava, chickpea, citrus, coconut, coffee, cotton, cowpea, dry pea, flax, foxtail millet, greengram, groundnuts, indigo rice, maize, oat, oilpalm, olive, onion, palm heart, pearl millet, phaseolus bean, pigeon pea, rye, sorghum, soybean, sunflower, sweet potato, tea, tomato, wetland rice, wheat, spring wheat, winter wheat, white potato, yams, giant yams, subtropical sorghum, tropical highland sorghum, tropical lowland, sorghum, white yams.

[Table 1A]
[Table 1B]

3   Empirical Results

3.1   Cross-Country Analysis

Table 2 presents our findings for influence of crop yield on extent of democracy, measured by average polity2 score over the period 1961-2015. Column (1) reports unconditional influence of crop yield on extent of democracy. R-squared value indicates that our specification can explain around 11.6% of polity2 score in cross-country sample of 148 countries.

[Table 2]

Progressively, we include more geographical control variables from column (2) to (4). Following Hall & Jones (1999), they argue that latitude of a place is a good proxy for social infrastructure of the place, we include absolute latitude in our specification in column (2). We find that influence of crop yield on democracy remains intact and absolute latitude is complementary to crop yield in explaining the extent of democracy. Our result remains robust to the inclusion of more geographical controls – terrain ruggedness, average elevation, elevation variation, landlockedness, and distance to waterways – in column (3). We account for continent fixed effect in column (4) and find that influence of crop yield remains robust and statistical significant at 1% level. However, absolute latitude becomes insignificant after the inclusion of continent dummies. Our specification in column (4) explains around 52.7% variation in democracy in cross-country analysis.

3.1.1   Robustness to Alternative Measures of Democracy and Crop Yield

Democracy is a broad concept and there is no general consensus on a single measure of democracy that represents democracy for a country. In this study, we use widely used Polity2 score to measure level of democracy since 1961. Most of the former colonies gained independence by 1961 and the influence of former European colonizers on domestic political regimes was not present. Table 3 presents our finding for hump-shaped association between potential crop yield and democracy using alternative period, definitions from other sources, and alternative definition to define democracy over the period. We also used ancestry-adjusted crop yield, following Putterman and Weil (2010) world migration matrix, to account for migration since 1500 AD.

[Table 3]

Column (1) repeats our baseline estimation from Table 2 for easy comparison. The focus of the study is to examine the long term influence of crop yield on extent of democracy, however, there are political regime changes in many countries over the years so we investigate, by varying the duration of study, whether the results are influence by the choice of period of study. Polity2 score is available since 1800, so we change the duration of study from 1800 to 2015 and calculate the average of polity2 score for all the countries since the data is available. Our findings in column (2) present indicate the hump-shaped influence of crop yield on

extent of democracy is robust and the coefficients of both, positive and negative, influences of crop yield on democracy are qualitatively similar to column (1). However, there is substantial reduction in R-squared value from 0.527 to 0.344, which suggests that the explanatory power of model specification, though significant, but comparatively, suffers as the duration of study extends to two centuries in the past.

We repeat this exercise by changing the period of study and results are reported in column (3) to (5) for post 1900, 1931-2015, and 1991-2015 periods, respectively. We find that the inverted U-shaped influence of crop yield on extent of democracy has remarkably similar qualitative coefficients in column (3) and (4) as reported in baseline findings. However, the coefficient of crop yield square, that is negative influence of crop yield on extent of democracy, has dropped substantially in column (5). We interpret this as the influence of third wave of democratization and end of cold war as increasing number of countries adopted democratic parliamentary regimes.

Freedom House (2016) is another source that provides measure for civil rights and political rights, essential ingredients for any democratic regime, for a large number of countries since 1973. We take the average of both the indicators over period 1973-2015 for all the countries to construct our outcome measure in column (6). We have transformed the outcome variable so that a higher value indicates more democratic regime for similar interpretation as in earlier specification of column (1) to (5). Findings in column (6) suggests that the hump-shaped influence of crop yield on extent of democracy, measured by civil liberties and political rights, survives in cross-country analysis.

Next, we use measure of institutional democracy (i.e. democ) and institutional autocracy (i.e. autoc) from latest version of Polity IV dataset (Marshall, Gurr, et al. (2015)) in column (7) and (8), respectively, to mitigate the criticism that composite polity2 score masks quality of institutional democracy. democ score lies between 0 and 10, where a higher value indicates a higher level of institutional democracy. Similarly, an autoc score lies between 0 and 10, where a higher value indicates a higher level of institutional autocracy. We constructed the outcome variables using these indices. For each country, when democ (or autoc) score is larger than 5, we assign a value 1 for that year, otherwise 0. Then, a simple mean over the period 1961-2015 indicates the probability of a country to have institutional democracy (or autocracy) in the period. The results in column (7) and (8) indicate that the both coefficients of interest, positive influence and negative influence, are qualitative similar to what we have in baseline results in column (1).

Further, we construct a new measure of democracy using polity2 score. We assign a value of 1 when the polity2 score is higher than 5 for any year, otherwise 0. Then, a simple mean over the period 1961-2015 is calculated. This represents the probability of a country to have democracy in the period similar to column (7), but based on polity2 score. A similar measure of autocracy is also constructed by using polity2 score but the criterion is that the polity2 score is less than -5. These two outcome measures are used in regression in column (9) and (10), respectively. We find that the hump-shapes influence of crop yield on extent of democracy remains intact.

Additionally, we address any concern of large scale migration influencing the effective social capital of current population residing in the territories of current countries. As we argued earlier that crop yield and other geographical conditions of a region shaped the economic prosperity and cultural values and the social capital persists till modern societies. To mitigate such concerns, we construct population weighted crop yield using the world migration matrix developed by Putterman and Weil (2010). We used this

ancestry-adjusted crop yield as an explanatory variable in the last column. We find there is no significant effect of migration of the explanatory power of crop yield on extent of democracy. This result will further strengthen when we estimate the influence of crop yield on attitude towards democracy with the immigrants into Europe in a later section. We will show that the association between crop yield and extent of democracy does not exist among second generation migrants. This is possible because of second generation immigrants might get assimilate with the residence of adopted country and adopt local values and type of institutions.

3.1.2 Robustness to Institutions and Early Development

In this section, we account for various institutions developed centuries ago and other early development indicators that can possibly have confounding effect on the extent of democracy in contemporary world.

Europeans setup many modern institutions in the colonies according the need of particular region and the type of association they had with these regions. Acemoglu, Johnson, et al. (2001) hypothesized that the local environment that affected the mortality of Europeans in respective regions had an influence on the kind of institutions they setup in former colonies. Taking this argument further they also establish the persistence of these institutions and their influence on the contemporary economic development. We account for the effect of this potentially confounding historic event, whether a country was colonized or not, and further, we also account different European colonizer. Column (1) in Table 4 reports the findings after accounting for the dummies for various colonizers – namely, Britain, France, Spain, Portugal, and other European colonizers – in global sample. Our results suggest that the colonial history does not affect the hump-shaped influence of crop yield on the extent of democracy. We restrict our sample to the countries that were ever colonized and the findings in column (2) indicate that the coefficients of both, positive and negative, influence on extent of democracy increase qualitatively and remain robust. P-value of Wald test of colonial history in column (2) suggests that the origin of the colonizers does have positive and significant effect on the extent of democracy in the countries that were ever colonized.

[Table 4]

Other influence of colonial history was on the legal system that countries inherited from European colonizers. Most of the legal systems around the world have origin in Europe. Various studies find that the legal origin of a country plays an important role in financial development, labor market regulations, and economic growth (La Porta, Lopez-de-Silanes et al. (2008)). We account for the confounding effect of legal origin in column (2). We find that there is no change in the hump-shaped influence of crop yield on extent of democracy after controlling for legal origin – namely, British common law, French civil law, German civil law, Scandinavian law, and socialist law. However, the p-value of Wald test suggests a strong influence of legal origin on the extent of democracy in cross country analysis.

Hall and Jones (1999) argues that social infrastructure – institutions, and government policies – are endogenously determined by geography and other regional factors that can be captured by language. They compiled the share of European languages spoken in modern nations. In a similar vein, Easterly and Levine (2016) documents that the share of European population in colonies during colonization shaped the economic characteristics of countries. We account for the possible confounding effects of through these two

channels in column (4). The number of observations reduces to 119 as the share of European languages is available for smaller number of countries. We find that the share of European languages and the share European population in colonies can explain the cross-country variation in contemporary democracy at 10% and 5 % significance level, respectively, while the hump-shaped influence of crop yield on the extent of democracy remains intact. We also control for these variables separately and we do not find any significant qualitative change in our results.

Health conditions of population and disease environment of nations are identified to affect development of institutions (Acemoglu, Johnson et al. (2003)). We account for disease environment measured by pathogen stress in column (5). Our hypothesis that crop yield has inverted U-shaped influence on the extent of democracy continues to hold.

Next, we focus on various measures of early development that can act as possible confounder in our model specification. We account for three measures of early development that are strongly correlated with current economic development, social capital, and quality of institutions. The first is state history in 1500 BCE. This composite index, constructed by Chanda and Putterman (2007,(2005), reflects whether there was a government, how much territory it covered, and whether the government was indigenous or externally imposed. They divide the period 1-1500 into 50 years periods and discount the past experience of having a state by 5% for each half century. Ang (2013b) provides evidence that early development of state has an influence on the development of contemporary institutions. Column (6) reports our findings of hump-shaped influence of crop yield on extent of democracy after accounting for state history in 1500 BCE. We find that both, positive and negative, influence of crop yield on extent of democracy robust and statistically significant.

Second measure of early development, we account for, is the number of years since society in a country started sedentary agricultural practices, leaving hunter-gathering life style, and started getting most of their food need from cultivated foods. Years since transition to agriculture can strongly explain comparative financial development, technological advancement, income level (Ang (2013a); Ang (2015); Putterman (2008)). We account for this in column (7), and find that there is no qualitative change in our results.

Third measure of early development is the population density in 1500 in estimation. Malthusian proposition suggests that higher agricultural productivity resulted into higher fertility and lower mortality and population growth, rather than any economic development. Column (8) shows influence of crop yield on the extant of democracy remains robust after accounting for population density.

Additionally, we account for the influence of genetic diversity on extent of democracy in column (9). Genetic diversity was determined tens of thousands of year ago by the human society that was migrating out of Africa. Literature suggests that genetic diversity place an important role in determination of contemporary productivity, economic development, ethnic conflicts, and hierarchy in the society (Ashraf and Galor (2013; Ashraf, Galor et al. (2015); Ashraf and Galor (2011); Arbatli, Ashraf et al. (2015); Galor and Klemp (2015)). Our findings suggest that the hump-shaped influence of crop yield on extent of democracy is robust and statistically significant after accounting for genetic diversity.

3.1.3 Robustness to Contemporary Development and Social Cleavages

A higher crop yield is likely to result in higher economic development and consequently promote democracy as argued by Lipset (1959). We account for economic development, measured by per capita GDP in 1960, in column (1) of Table 5. The sample size has reduced to 96 countries as all countries in our global sample does not have per capita GDP data for 1960 in Penn World Tables (Feenstra, Inklaar et al. (2015)). However, we find that there is no qualitative change in our results. Our findings also support that GDP per capita is complementary to crop yield in explaining cross-country variation in extent of democracy[4].

[Table 5]

There is no consensus on the influence of education on democracy. On one hand, education is argued to play an important role in the development of "culture of democracy" (John Dewey (1916)). Lipset (1959) also argues that people understand the need of norms of tolerance and they make more rational electoral choices as education broadens people's outlook. He goes even further and suggests that education is "close to being a necessary condition" for democracy. Castelló-Climent (2008) find a positive association between education and democracy when he controls for the distribution of education among population over age of 25 years. In a recent paper, Murtin and Wacziarg (2014) find that education does promote democracy over long period 1870-2000. On the contrary, Acemoglu, Johnson et al. (2005) find no effect of education on democracy in a panel studies when time and country fixed effect are used. However, they did not reject the causal relationship between education and democracy in long-term. So, we control for average number of schooling in 1960 to account for any confounding effect of education on the extent of democracy. Our findings in column (2) show that the influence of crop yield on democracy is robust and statistically significant. Average number of years in school is also complementary to crop yield and seems to promote democracy[5].

Several studies (See, Barro (1999); Ross (2001); Tsui (2011); Van der Ploeg (2011)) highlight negative association between oil and democracy. Tsui (2011) find that discovery of 100 billion barrel new oil pushes down the democracy level of a country after three decades by 20%. We account for oil income as a proportion of GDP in column (3). A large income coming from oil production explains cross-country variation in contemporary democracy at 10% significant level as established in literature[6]. However, hump-shaped influence of crop yield on democracy remains robust.

Main objective of foreign aid is to promote economic growth and improve institutional quality in the recipient country. However, recent studies have highlighted that foreign aid might be counterproductive to the main objectives as adverse spillover effects offset any benefits from capital infusion (Svensson (2000); Rajan and Subramanian (2007); Young and Sheehan (2014)). Nunn and Qian (2014) find that US food aid seems to prolong intrastate civil conflicts as the rebel groups gets a large proportion of the food aid and it helps them in sustaining their fight against the government. We account for foreign aid (net official development aid as a fraction of recipient country's GDP over period 1961-2015 in our specification in

---

[4] We get similar results when we use average GDP per capita for period 1961-2015.

[5] Our results hold for average number of years in primary, secondary, and higher education as well.

[6] We get similar results when we control for large proportion of export income (>1/3 of export) coming from export of oil endowment.

column (4) to control for any confounding effect. We find that the inverted U-shaped influence of crop yield on extent of democracy remains unaffected.

Recent studies highlight that religion and political regime of a country have positive association. Several studies highlight the role of protestant missionaries played in spread and development of many moral and cultural values that were inducive to the development of democracy. For instance, emphasis on reading bible in vernacular languages promoted education and printing press that are foundation of modern democracy (Woodberry (2012)). Some studies establish that Islam promotes cultural values that are impediment to democratic regimes (Barro (1999); Karatnycky (2002)). There is perception of strong association between Islam and authoritative institutions. Few studies have found contrary results to this perception using survey data (Rowley and Smith (2009)). To account for the influence of religion on democracy, we control for percentage of population that follows protestant Christianity, Roman Catholic, Islam, and Hindu in column (5). Our results show that the hump-shaped influence of crop yield on the extent of democracy remains robust. P-value of Wald test suggests that religion have complementary role to crop yield. Our results are unaffected even when we account for any single religion individually in our specification (results not reported here).

Next, we control for potentially confounding measures of heterogeneity of population. Some of the most common measures of diversity are ethnic fractionalization, linguistic fractionalization, and religious fractionalization constructed by Alesina, Devleeschauwer et al. (2003) and Fearon (2003). Essentially, all these indices indicate the probability of finding two similar persons, based on different criteria, in a population. Diversity in population is found to have positive and negative effects. Ethnic diversity and linguistic diversity are identified as detrimental to economic growth and to impede the development of high quality institutions (Easterly and Levine (1997); Collier (2001)). In a survey study, Alesina and Ferrara (2005) find positive effect on economic performance of social diversity in rich countries. Michalopoulos (2012) establish that geography and climatic conditions of a region plays an important role in development of sociocultural cleavages. We control for ethnic, linguistic, and religious fractionalization in column (6), however, none of these is significant in our estimation and the inverted U-shaped influence of crop yield on democracy remains robust and significant.

In a recent paper, Alesina, Harnoss et al. (2016) propose and construct a diversity index for place of birth of immigrants. They find that the birthplace diversity highly correlates with the economic property. Since, in recent decades, more people are migrating to different place, so, we control for the effect of birthplace diversity in column (7)[7]. In a similar vein, Docquier, Lodigiani et al. (2016) propose that emigration rate has association with the development of institutions – namely, Freedom House's political rights and civil liberties, and Simon Fraser Institute's economic freedom of the world – in the country of origin. We find that crop yield has inverted U-shaped and robust influence over extent of democracy when we account for emigration rate in column (8), however, emigration seems to have negative association with level of democracy. This needs to be interpreted with caution as many control variables are possibly confounding and the result might be bias for this reason.

---

[7] We present results using birthplace diversity for skilled migrants, however, our results are similar for other birthplace diversity indices.

Variation in crop yield is identified to exacerbate civil conflicts in earlier studies. Easterly, Gatti et al. (2006) find a relationship between democracy and mass killing. Conflicts are known to affect various institutions and economic growth across countries. To account for any confounding effect of variation in crop yield on hump-shaped influence of crop yield on extent of democracy, we introduce variation in crop yield in our empirical specification. Our findings reported in column (9) suggested that variation in crop yield is positively associated with extent of democracy. However, there is no change in the association of crop yield and extent of democracy.

Additionally, we account for the irrigation facilities in 1900 in last column. In a recent paper, Bentzen, Kaarsen et al. (2016) establish that a higher level of irrigation potential increase the possibility of an autocratic regime. They argue that the irrigation facilities are an asset that can be appropriated and controlled by elites in the society that gives rise to a hierarchical society. Our findings in last column (10) after accounting for percentage of land irrigated in 1900 show that the inverted U-shaped influence of crop yield on extent of democracy remains robust and statistically significant. Irrigation also comes significant at 10% level, though the coefficient is much smaller in comparison to either of the coefficients of crop yield.

3.1.4 Robustness to Restricted-Sample Estimation

In this section, we estimate our regression model given by equation (1) after restricting the sample by various criteria.

First, there is concern that our results – specifically, with respect to the hump-shaped influence of crop yield on the extent of democracy– are driven by the inclusion of a particular region in our sample. To mitigate such concern, we drop the observations belonging to a particular continent sequentially and re-estimate our baseline model. Results after dropping one continent at a time are reported in column (2) to (7) of Table 6. Column (1) reports the baseline results with global sample for easy comparison of findings after elimination of various observations based on different criteria. The estimates indicate that the hump-shaped influence of crop yield is found to be statistically significant all cases. The statistical significance has fallen to 10% level for both, positive and negative, influences of crop yield on extent of democracy in after dropping observations from Asia, however, the model specification can explain around 65% variation in extent of democracy across countries. Hence, we conclude that our results are not sensitive to the exclusion of observations from any particular continent.

[Table 6]

Next, we know that the institutions in the new world were setup by the migrants from the old world. Many features of early development – such as, state, agriculture, etc – did not exist in the new world as early as they did in the old world. So, we exclude new world from our sample, to examine the influence of crop yield on old world and the findings are reported in column (8). We find that the inverted U-shaped influence of crop yield on extant of democracy remains intact.

Additionally, we look at the countries where agriculture has become less important contributor to the net GDP. So, we want to test whether the influence of crop yield, primarily associated with agricultural activity, still survives in industrialized countries. The sample size reduces to 58 countries after applying this restriction. The results of influence of crop yield on democracy on a sample of industrialized countries are

presented in column (10). Both, the linear and quadratic, coefficients are significant at 1% level in small sample.

3.2 Evidence from Immigrants Sample: European Value Survey

This section presents the findings of the direct influence of crop yields on attitude towards democracy in immigrants in Europe. Idea behind this analysis is that the immigrants already developed cultural values in their home country before immigrating to their current location. So, we want to analyze whether the cultural traits that support hump-shaped association between crop yield in democracy does carries on by immigrants. We utilize following reduced-form model specification for the empirical analysis to test this hypothesis.

$$democracy_{ijr} = \beta_0 + \beta_1 cropyield_r + \beta_2 cropyield_r^2 + \beta_3 I_i + \beta_4 Controls_r + \beta_5 X_j + \epsilon_{ijr} \quad (2)$$

where, $democracy_{ijr}$ is the attitude of individual i residing in an European region j categorized at NUTS (Nomenclature of territorial units for statistics) level 2 based on classification of Eurostat, and has ancestry from country r; $cropyield_r$ is the crop yield of country r; I_i is a vector of individual's characteristics; $Controls_r$ is a vector of relevant controls for country r; X_j is the region fixed effect to capture any observed characteristics of the region where interview was conducted; and ϵ_{ijr} is individual specific robust standard error. As in previous section, we expect a hump-shaped association between crop yield and approach towards democracy i.e. $\beta_1 > 0$, and $\beta_2 < 0$.

Fourth wave of European value survey provides details about whether the respondent is an immigrant. It is interesting to note that the sample has immigrants from 101 [? CHECK in final sample] in 26 European countries. We focus on two specific questions in the sample – "*On the whole are you very satisfied, rather satisfied, not very satisfied or not at all satisfied with the way democracy is developing in our country?*", and "*Democracy may have problems but it's better than any other form of government*". Respondents are given four options for each of these questions – 'Agree strongly', 'Agree', 'Disagree', and 'Disagree strongly' in increasing order from 1 to 4. We have transformed our data so that a higher value indicates higher level of support towards democracy e.g. 'Agree strongly' in each case for easy interpretation.

We divide the sample into two categories – first generation immigrants, and second generation immigrants – for empirical analysis. First generation immigrants are those respondents who do not have nationality of the country where interview was conducted and second generation immigrants are those respondents who are citizens of the country, where interview was conducted, but whose both parents were born in foreign country. It is straight forward to choose the country of origin of first generation immigrants as it is recorded in the survey. However, the parents of second generation immigrants may belong to two different countries. We choose the country of the father of respondent as the country of origin in these ambiguous cases to determine the origin of second generation immigrants.

European value survey also provides individual's other characteristics, such as, age at the time of interview, the gender, income level, marital status, and religious denomination.

Table 8 presents results of estimation of equation (2) discussed above for migrants into Europe. Columns (1a) and (2a) reports findings of estimating the influence of crop yield on the attitude towards democracy

using responses to two questions discussed above. We account for regional fixed effect where the interview was conducted and the country of origin for the immigrants in both specifications. Results indicate that the crop yield of country of origin of migrant can successfully explain their attitude towards democracy. Further, we account for the respondent's personal characteristics – such as, age, the gender, educational standard, marital status, income group, and religious denomination – in columns (1b) and (2b), respectively, for the responses of two questions to indicate their attitude towards democracy. We find that the crop yield of country of origin of respondents can still explain their attitude towards democracy. In the last two columns (1c) and (2c), we account for polity2 score and geographical factors of country of origin on respondents and our findings suggest that the hump-shaped influence of crop yield on attitude towards democracy of respondents remains unchanged.

[Table 7]

We also repeated similar regression analysis for second generation migrants in European value survey, however, the results are not significant. This indicates that the intergenerational transmission of values that supports the hump-shaped association between the crop yield and positive attitude towards democracy does not happen among the immigrants in Europe.

3.3   Evidence from Precolonial Indigenous Societies

This section presents the finding for the influence of crop yield on measures of democracy in precolonial societies for which relevant data is available in Standard Cross-Cultural Sample (SCCS) compiled by Murdock and White (1969). The SCCS provides representative sample of world cultures on 186 societies "for the earliest period for which satisfactory ethnographic data are available or can be constructed" in order to avoid the influence of European colonizers on these societies (Murdock and White (1969)). There is possibility of the culture of these societies getting influenced after coming into contact with the Europeans as the year of observation for most of these societies are in nineteenth and early twentieth century. However, we can be reassured as the authors suggest "cultural independence of each unit in terms of historical origin and cultural diffusion could be considered maximal with respect to the others societies in the sample"

The database provides information on two important political dimensions. First, it provides information on the process of how "Local political succession" in these societies happened. The database categories the process of succession in nine different categories – namely, no headmen or council, by appointment, seniority, divination, informal consensus, electoral process, patrilineal, matrilineal, and hereditary without personal qualifications. We consider that the process of local political succession is democratic when it happens through 'informal consensus' or 'electoral process', otherwise not. Second, it provides information on who is the executive in the society – whether, council, 'executive and council', 'plural executives', or 'single leader'. We consider a society is more democratic when the executive power is with a council, as form of current parliament in representative democracies, than with a 'single leader'.

We use same regression specification as described by equation (1) in cross-country empirical analysis, except that the unit of analysis here is the society from SCCS database. The SCCS database does not have

information about the land area these precolonial societies covered, however, we get centroid of the society from the dataset. There is possibility of an error in measuring the precise location of the societies, so, following Alesina, Giuliano, et al. (2013), we use a buffer zone of 200km around the centroid of the societies to extract independent variable and other control variables from other datasets. The (mean) crop yield for a societies is calculated using this 200 km buffered land area and global crop yield dataset, a raster image, compiled and made available by Galor and Özak (2016,(2015a). We use same process to extract other control variables that are not available in the SCCS dataset.

[Table 8]

Our findings of empirical estimation using this data for these precolonial societies are reported in Table 9. We replicate the process as we followed in Table 2 – first, look at the unconditional influence of crop yield on two variables, then, include all the baseline control variables, and finally, control for regional fixed effects, on two outcome variables discussed in this section. We find evidence of the hump-shaped influence of crop yield on measure of democracy in the precolonial societies as well. Statistical significance of linear and quadratic terms is not as strong as in the cross-country analysis, however, full model specification able to explain upto 18 and 21 percent variation in extent of democracy in precolonial societies.

3.3.1 Transmission of Democracy from Precolonial Societies to Modern Nation-States

Earlier, we established the hump-shaped association between crop yield and extent of democracy in cross-country and subnational samples. This section takes this hypothesis further and established this association in precolonial societies. Now, natural question is whether there is any persistence of influence of crop yield on extent of democracy from precolonial societies to modern nation states. We are aware of Persson and Tabellini (2009), Giuliano and Nunn (2013), and Bentzen, Hariri et al. (2015) who have answered exactly this question under different settings.

Persson and Tabellini (2009) proposed the concept of "democratic capital" that is "a slow accumulation of a stock of civic and social assets" which promotes the idea of democracy as a valuable form of political regime. They provide evidence to support their hypothesis that a country that became democratic early and remains democracy is more likely to remain democracy in future as well. Essentially, they argues that the societies learn to respect democracy as longer they experience a democratic political regime. Giuliano and Nunn (2013) discover the persistence of democratic tradition from traditional preindustrial societies to modern nation-states. Using data from Ethnographic Atlas, they find that a higher proportion of traditional preindustrial societies where local leader was chosen through democratic process, political consensus or formal election, is likely to result in a democratic political regime in modern nation-states. They illustrate that the societies that had experience of democratic institutions in the past were more likely to have national democratic institution. In a similar vein, Bentzen, Hariri, et al. (2015) finds that the influence of traditional societies on modern institutions survives. However, they argue that this influence is not unconditional, but, there exists heterogeneity. They measured this heterogeneity by three characteristics of traditional ethnic groups – distance of ethnic group from the capital of modern states, complexity of settlement of ethnic groups, and economic prosperity of ethnic group. So, the institutions of all the traditional ethnic groups do not survive in modern states.

In the light of existing literature and our empirical evidences, we argue that the hump-shaped association between crop yield and extent of democracy is a robust finding that existed since precolonial era, intergenerational transmission happened through social values to modern societies, and persists in modern societies.

4 Concluding Remarks

Political regime of a country, because of the endogeneity with other institution in the country, attracts considerable attention in literature. The idea of democracy existed for over two millennium and practiced in various forms in different societies, though, widespread democratization at national level is recent phenomena started in twentieth century. However, the causes of democratization at national as well as regional level are not well understood.

In this research, we argue that many possible causes of democracy discussed in literature – such as, economic prosperity, human capital, social infrastructure, and culture – are themselves results of geographical conditions that are exogenous to human intervention. We propose and provide evidence that potential crop yield that is exogenous to a region was an essential endowment for the precolonial agricultural societies. However, an optimal level of endowment was required for promotion of democracies in societies. While a low level of crop yield endowment was not sufficient to promote democracy, at the same time a very high level of crop yield was also counterproductive to the idea of democracy. So, we hypothesized an inverted U-shaped association between crop yield and extent of democracy.

Our empirical findings support our hypothesis that the crop yield has hump-shaped influence over extent of democracy in cross country, subnational level, precolonial societies, and individual level. Our findings are robust to the inclusion various confounding control variables, alternative definition of democracy, and change of period of study from 1800 to recent years.

This research contributes to the extant literature on the influence of historical events on contemporary institutions. We highlight and establish the role of crop yield on democracy in present countries.

Table 1A : Summary statistics and correlation

	Number of observations	Mean	Standard deviation	Minimum	Maximum
Polity2 (1961-2015)	148	0.8	6.1	-10.0	10.0
Crop yield	148	7335	3905	0.0	17998
Absolute latitude	148	26.6	16.9	1.0	64.0
Terrain ruggedness	148	1.3	1.2	0.0	6.7
Landlocked	148	0.2	0.4	0.0	1.0
Elevation (average)	148	0.6	0.5	0.0	2.7
Elevation (variation)	148	0.4	0.4	0.0	1.9
Distance to waterways	148	0.4	0.4	0.0	2.2

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(1) Polity2 (1961-2015)	1							
(2) Crop yield	0.32	1						
(3) Absolute latitude	0.33	-0.23	1					
(4) Terrain ruggedness	0.01	-0.01	0.15	1				
(5) Landlocked	-0.09	0.05	0.1	0.27	1			
(6) Elevation (average)	-0.15	-0.1	-0.02	0.71	0.48	1		
(7) Elevation (variation)	-0.06	-0.11	-0.01	0.57	0.14	0.74	1	
(8) Distance to waterways	-0.21	-0.26	0.11	-0.02	0.57	0.42	0.23	1

Notes: This table presents summary statistics and correlations of variables used in baseline estimation.

Table 1.C: Bottom and top decile countries by crop yield in the sample

Bottom decile														
Country	Yemen	Bahrain	Qatar	Saudi Arabia	Kuwait	Egypt	Oman	UAE	Djibouti	Libya	Mauritania	Algeria	Mongolia	Jordan	Norway
Crop yield	0	0	0	6	23	36	59	63	70	323	425	512	597	880	908
Polity2 score	-2	-9	-10	-10	-8	-6	-9	-8	-3	-6	-6	-5	1	-6	10
Continent	Asia	Asia	Asia	Asia	Asia	Africa	Asia	Asia	Africa	Africa	Africa	Africa	Asia	Asia	Europe
Top decile															
Country	Madagascar	Swaziland	Hungary	Cuba	Benin	Dominican Republic	Tanzania	Mozambique	Malawi	Guinea-Bissau	Haiti	Zambia	Paraguay	Korea, Rep.	Uruguay
Crop yield	11475	11661	11743	11848	11914	12071	12150	12223	12241	12331	12339	12339	12856	14018	17998
Polity2 score	1	-8	1	-7	0	4	-4	-1	-3	-1	-4	-1	-1	2	5
Continent	Africa	Africa	Europe	N. America	Africa	N. America	Africa	Africa	Africa	Africa	N. America	Africa	S. America	Asia	S America

Notes: This table documents top and bottom decile of countries.

Table 2: Crop yield on democracy after accounting for geographical controls

Dependent variable	(1)	(2)	(3)	(4) (Baseline)
	polity2 (1961-2015)			
Crop yield	1.12***	1.11***	1.12***	0.82***
	(2.99)	(4.21)	(4.07)	(3.43)
Crop yield square	-0.96**	-0.82***	-0.87***	-0.69***
	(-2.26)	(-2.78)	(-2.82)	(-2.83)
Absolute latitude		0.49***	0.52***	0.30**
		(7.64)	(7.90)	(2.28)
Terrain ruggedness			-0.09	-0.05
			(-0.76)	(-0.44)
Elevation (average)			-0.02	0.21
			(-0.10)	(1.49)
Elevation (std dev.)			0.02	-0.18
			(0.23)	(-1.60)
Landlocked			-0.07	-0.10
			(-0.72)	(-1.31)
Distance to waterways			-0.15	-0.09
			(-1.48)	(-1.14)
Optimum crop yield	7.96	9.16	8.79	8.04
	(1.05)	(1.30)	(1.17)	(0.92)
Observations	148	148	148	148
Adj R-squared	0.116	0.340	0.369	0.527
Continent dummies	No	No	No	Yes

Notes: This table presents standardized coefficients for the effect of average crop yield (measured in billions of kilocalories per hectare per year) on polity2 score over period 1961-2015. All specifications use an intercept term but not reported for brevity. The continent dummies are Africa, Asia, Australia, Europe, North America, Oceana, and South America. Robust t-statistics are given in parentheses. ***, **, * denotes significance at the 1%, 5%, and 10% level, respectively.

Table 3: Influence of crop yield on democracy (alternative measures of democracy and crop yield)

Dependent variable (Period)	(1) polity2 (1961-2015)	(2) polity2 (1800-2015)	(3) polity2 (1901-2015)	(4) polity2 (1931-2015)	(5) polity2 (1991-2015)	(6) freedom house (1973-2015)	(7) democ (prob) (1961-2015)	(8) autoc (prob) (1961-2015)	(9) polity2>5 (1961-2015)	(10) polity2<-5 (1961-2015)	(11) polity2 (1961-2015)
Crop yield	0.82***	0.81***	0.78***	0.79***	0.61**	0.55***	0.77***	-0.85***	0.66***	-0.87***	
	(3.43)	(3.22)	(3.11)	(3.16)	(2.61)	(2.97)	(3.75)	(-2.88)	(3.15)	(-2.95)	
Crop yield square	-0.69***	-0.71***	-0.67***	-0.68***	-0.38*	-0.47**	-0.68***	0.68**	-0.59**	0.70**	
	(-2.83)	(-2.75)	(-2.63)	(-2.66)	(-1.73)	(-2.42)	(-3.11)	(2.48)	(-2.59)	(2.56)	
Crop yield (Ancestory adjusted)											0.80***
											(3.19)
Crop yield square (Ancestory adjusted)											-0.61**
											(-2.41)
Observations	148	148	148	148	147	149	148	148	148	148	146
Continent dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Baseline controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adj R-squared	0.527	0.344	0.445	0.452	0.487	0.590	0.542	0.345	0.545	0.352	0.525

Notes: This table presents standardized coefficients of (mean) crop yield (measured in millions of kilocalories per hectare per year) on various measures of democracy using OLS regression. Dependent variable in column (1) to (4) is average polity2 score over various periods, in column (5) is average of political rights and civil rights over 1961-2015 period, and subscores democ in column (6). Dependent variables in column (6), (7), and (9) are transformed appropriately so that a higher value indicates higher value of democracy. In column (7), dependent variable is probability of a country in a year to be democratic (democ>5) over period 1961-2015. Baseline controls used are absolute latitude, terrain ruggedness, elevation (average), elevation (variation), landlockness, distance to waterways. All specifications use an intercept term but not reported for brevity. Robust t-statistics are given in parentheses. ***, **, * denotes significance at the 1%, 5%, and 10% level, respectively.

Table 4: Influence of crop yield on democracy after accounting for institutions and early development

Dependent variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Polity2 (1961-2015)								
Crop yield	0.88***	1.11***	0.90***	0.94***	0.88***	0.64**	0.77***	0.78***	0.77***
	(3.51)	(2.83)	(3.47)	(3.13)	(4.02)	(2.56)	(2.91)	(3.05)	(3.21)
Crop yield square	-0.73***	-0.91**	-0.74***	-0.76**	-0.67***	-0.59**	-0.70**	-0.68**	-0.68***
	(-2.92)	(-2.18)	(-2.97)	(-2.58)	(-3.17)	(-2.36)	(-2.59)	(-2.59)	(-2.82)
Colonial history (F-statistics)	1.52	2.48							
	[p=0.19]	[p=0.05]							
Legal origin (F-statistics)			7.22						
			[p=0.00]						
European population (%)				0.14*					
				(1.79)					
European language (%)				0.19**					
				(2.14)					
Pathogen stress					-0.19				
					(-1.38)				
State antiquity (1500)						-0.05			
						(-0.70)			
Years since agricultural transition							-0.20		
							(-1.61)		
Population density (1500), log								-0.03	
								(-0.29)	
Genetic diversity (predicted)									-0.33
									(-1.21)
Observations	148	96	148	119	133	132	145	138	148
Adj R-squared	0.534	0.396	0.608	0.540	0.582	0.504	0.532	0.501	0.531
Continent dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Baseline controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sample	Global	Former colonies	Global	Global	Global	Global	Global	Global	Global

Notes: This table presents standardized coefficients for the effect of (mean) crop yield (measured in millions of kilocalories per hectare per year) on polity2 during 1961-2014.All specifications use an intercept term but not reported for brevity. The continent dummies are Africa, Asia, Australia, Europe, North America, Oceana, and South America. Standard errors are clustered at the country level. Baseline controls use are absolute latitude, terrain ruggedness, elevation (average), elevation (variation), landlockness, distance to waterways. Robust z-statistics are given in parentheses. ***, **, * denotes significance at the 1%, 5%, and 10% level, respectively.

Table 5: Influence of crop yield on democracy after accounting for contemporary development and social cleavages

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Dependent variable					Polity2 (1961-2015)					
Crop yield	0.71***	0.70**	0.74***	1.08***	0.72***	0.73***	0.84***	0.89***	0.64***	0.79***
	(2.72)	(2.52)	(3.29)	(3.78)	(2.68)	(3.24)	(3.74)	(3.80)	(2.68)	(3.32)
Crop yield square	-0.62**	-0.59**	-0.64***	-0.86***	-0.68**	-0.61***	-0.73***	-0.76***	-0.51**	-0.67***
	(-2.41)	(-2.14)	(-2.87)	(-2.91)	(-2.54)	(-2.85)	(-3.10)	(-3.15)	(-2.15)	(-2.78)
GDP per capita (1960)	0.24*									
	(1.87)									
Years schooling (1960)		0.46***								
		(5.04)								
Oil production/GDP			-0.14**							
			(-2.35)							
Foreign aid (% of GDP)				-0.00						
				(-0.02)						
Religion (F-statistics)					2.57					
					[p=0.04]					
Ethnic fractionalization						-0.11				
						(-0.98)				
Language fractionalization						0.21*				
						(1.74)				
Religion fractionalization						0.01				
						(0.21)				
Birthplace diversity							-0.08			
							(-1.40)			
Emigration rate								-0.05		
								(-1.14)		
Crop yield variation									0.17**	
									(2.09)	
Irrigation (1900) (%)										-0.048*
										(-1.935)
Observations	96	125	146	122	147	141	147	146	148	148
Adj R-squared	0.577	0.592	0.551	0.402	0.547	0.561	0.541	0.533	0.537	0.375
Continent dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
Baseline controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: This table presents standardized coefficients for the effect of (mean) crop yield (measured in millions of kilocalories per hectare per year) on polity2 during 1961-2015. All specifications use an intercept term but not reported for brevity. The continent dummies are Africa, Asia, Australia, Europe, North America, Oceana, and South America. Baseline controls use are absolute latitude, terrain ruggedness, elevation (average), elevation (variation), landlockness, distance to waterways. Religion accounts for Protestant, Roman Catholic, Muslim, and Hindu. Standard errors are clustered at the country level. Robust z-statistics are given in parentheses. ***, **, * denotes significance at the 1%, 5%, and 10% level, respectively.

Table 6: Influence of crop yield on democracy after omitting various regions

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Dependent variable	Polity2 (1961-2015)									
Crop yield	0.82***	1.03***	0.44*	0.81***	0.75***	1.00***	0.83***	0.97***	0.66**	1.08***
	(3.43)	(3.44)	(1.69)	(3.09)	(3.24)	(3.86)	(3.39)	(3.53)	(2.51)	(3.01)
Crop yield square	-0.69***	-0.81***	-0.52*	-0.66**	-0.60**	-0.84***	-0.69***	-0.80***	-0.44*	-0.88**
	(-2.83)	(-2.67)	(-1.87)	(-2.49)	(-2.61)	(-3.22)	(-2.79)	(-2.90)	(-1.80)	(-2.32)
Observations	148	117	106	101	135	136	145	123	113	58
Continent dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Baseline controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adj R-squared	0.527	0.337	0.647	0.482	0.558	0.537	0.515	0.537	0.570	0.497
Omitted continent	None	Europe	Asia	Africa	N. America	S. America	Oceana	None	None	None
Sample	Global	Global	Global	Global	Global	Global	Global	Old world	Native >0.6	Industrial

Notes: This table presents standardized coefficients of (mean) crop yield (measured in millions of kilocalories per hectare per year) on various measures of democracy using OLS regression. Baseline controls use are absolute latitude, terrain ruggedness, elevation (average), elevation (variation), landlockness, distance to waterways. All specifications use an intercept term but not reported for brevity. Robust t-statistics are given in parentheses. ***, **, * denotes significance at the 1%, 5%, and 10% level, respectively.

Table 7: Crop yield on democracy among first generation immigrants into Europe

|	(1a)	(1b)	(1c)	(2a)	(2b)	(2c)
Dependent variable	democracy is best			satisfied with democracy		
Crop yield	0.35**	0.41***	0.32*	0.94***	0.87***	0.69***
	(2.28)	(2.62)	(1.78)	(5.51)	(5.32)	(3.12)
Crop yield square	-0.29*	-0.34**	-0.28*	-0.70***	-0.65***	-0.58***
	(-1.81)	(-2.13)	(-1.71)	(-4.02)	(-3.96)	(-2.76)
polity2 (1961-2015)			0.08**			0.06
			(2.27)			(1.57)
Observations	1,608	1,608	1,608	1,633	1,633	1,633
EU Region FE	Yes	Yes	Yes	Yes	Yes	Yes
Origin FE	Yes	Yes	No	Yes	Yes	No
Individual characteristics	No	Yes	Yes	No	Yes	Yes
Geographic Controls	No	No	Yes	No	No	Yes
R-squared	0.06	0.07	0.06	0.11	0.12	0.14

Notes: This table presents standardized coefficients for the effect of crop yield (measured in millions of kilocalories per hectare per year) on two alternative definition of democracy from European value survey (4th wave). EU region FE indicates the region at NUTS level 2 where interview was conducted. Origin FE indicates the nationality of the respondent (immigrant). Individual characteristics used are age, the gender, educational standard, income group, marital status, and religious denomination. Geographic controls used are absolute latitude, terrain ruggedness, elevation (average), elevation (variation), landlockness, distance to waterways, and the continent dummies are Africa, Asia, Europe, North America, Oceana, and South America. All specifications use an intercept term but not reported for brevity. Robust t-statistics are given in parentheses. ***, **, * denotes significance at the 1%, 5%, and 10% level, respectively.

Table 8: Crop yield on democracy in Standard Cross Cultural Sample (SCCS)

| Dependent variable	(1a)	(1b)	(1c)	(2a)	(2b)	(2c)
	Local political succession			Concentration of power in executive		
Crop yield	0.57**	0.60**	0.47*	0.80**	1.26***	1.35**
	(2.22)	(2.06)	(1.90)	(2.62)	(2.84)	(2.33)
Crop yield square	-0.59**	-0.60**	-0.57**	-0.73***	-1.13**	-1.13*
	(-2.50)	(-2.38)	(-2.29)	(-2.86)	(-2.78)	(-2.03)
Observations	141	141	141	70	70	70
Baseline controls	No	Yes	Yes	No	Yes	Yes
Region FE	No	No	Yes	No	No	Yes
R-squared	0.03	0.05	0.18	0.05	0.11	0.21
Language clusters	41	41	41	24	24	24

Notes: This table presents standardized coefficients for the effect of crop yield (measured in millions of kilocalories per hectare per year) on two alternative definition of democracy from Standard Cross Cultural Sample (SCCS). Baseline controls use are absolute latitude, terrain ruggedness, elevation (average), elevation (variation), landlockness, distance to waterways. Latitude for the societies are used from SCCS database, while other controls - terrain ruggedness, elevation (average), elevation (variation), landlockness, distance to waterways – are for the present country where these societies existed. The region dummies are Subsaharan Africa, Middle Old World, Southeast Asia/Insular Pacific, Sahul, North Eurasia/Circumpolar, Northwest Coast of NA, North and west of NA, Eastern Americas, Mesoamerica/Andes, and Far south America as described in SCCS database. All specifications use an intercept term but not reported for brevity. Standard errors are clustered at language group level. Robust t-statistics are given in parentheses. ***, **, * denotes significance at the 1%, 5%, and 10% level, respectively.

Figure 1: Scattered plot of crop yield and democracy during 1961-2015
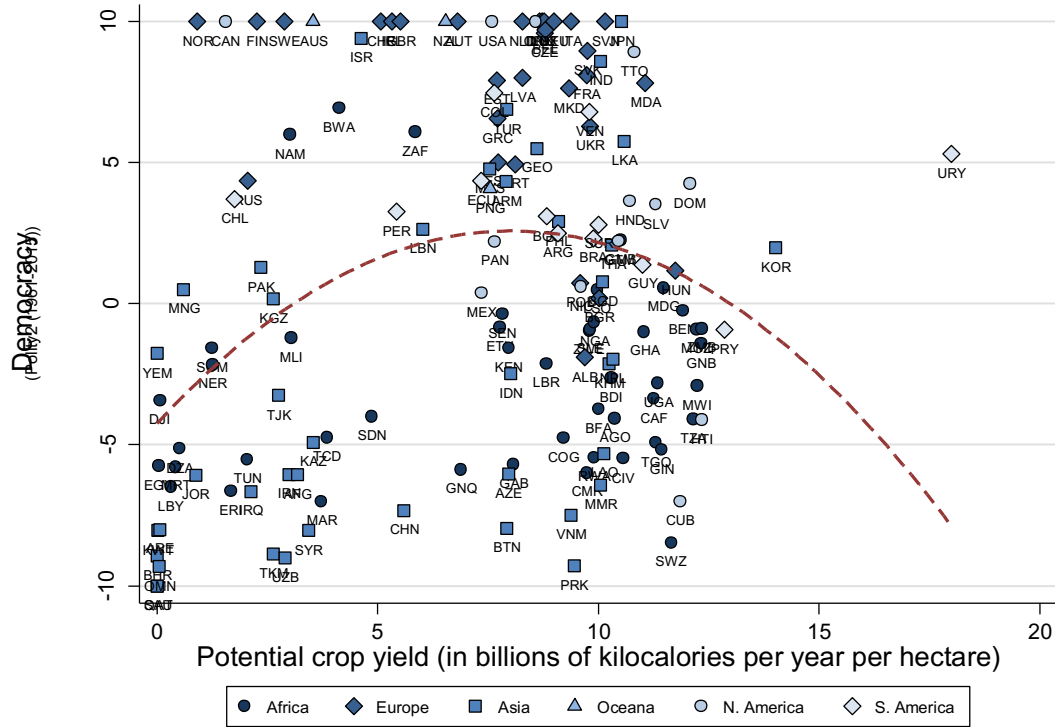
Notes: This scatter plot presents distribution of crop yield, measured in billions of kilocalories per year per hectare, and democracy, measured as average of polity2 score over 1961-2015. The number of observations included in the sample is 148. (Source: Galor and Özak (2016))

Figure 2: Crop yield on democracy during 1961-2015
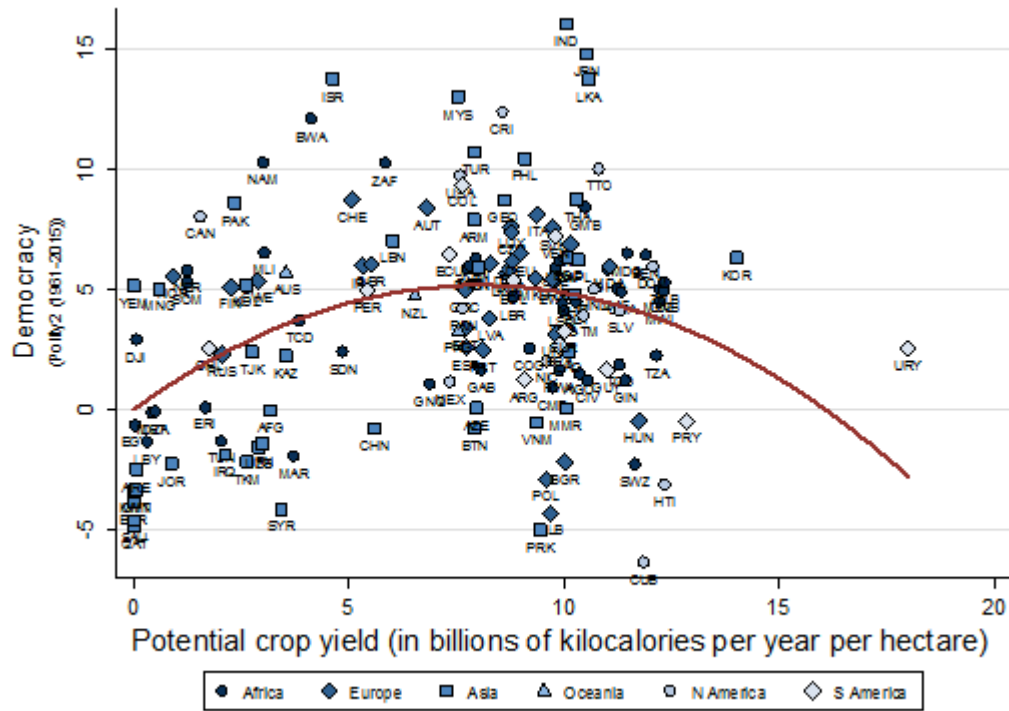
Notes: This figure shows the inverted U-shaped influence of crop yield, measured in billions of kilocalories per year per hectare, on democracy, measured as average of polity2 score over the period 1961-2016, after accounting for the effects of all other control variables in a sample of 148 countries (Column (4) of Table 2). This figure is an augmented component-plus-residual plot[8]. The horizontal axis represents crop yield and the vertical axis represents fitted values of democracy, predicted by crop yield and square of crop yield, plus residual from full model specification used in column (2) of Table 2.

---

[8] This is a departure from traditional practice to present add-variable plot where both, vertical and horizontal, axis represents residuals of outcome variable and independent variable respectively. This methodology allows us to illustrate quadratic association of crop yield and democracy in one scatter plot.

Data Appendix

A. Outcome variable

Democracy (polity2): An composite index from the Polity IV project that is computed by subtracting the AUTOC score from the DEMOC score. The variable has possible values of -10 to +10, where 10 indicates the largest degree of democracy (source: Marshall, Gurr, et al. (2015)).

B. Crop yield (main explanatory variable)

This index captures maximum potential crop yield (measured in billions of kilocalories per hectare per year) across different regions in a country. Crop yield index is constructed using crop yield (measured in tons per hectare per year) from Global Agro-Ecological Zones (GAEZ) project of Food and Agriculture Organization (FAO) and caloric content of various crops from US Department of Agriculture Nutrient Database for Standard Reference (source: Galor and Özak (2016)).

C. Geographic controls

Distance to waterways. The distance, in thousands of km, from a GIS grid cell to the nearest ice-free coastline or sea-navigable river, averaged across the grid cells of a country (source: Harvard University's CID Research Datasets on General Measures of Geography).

Elevation. The average elevation of a country, in thousands of kilometers above sea level, calculated using geospatial data at a 1-degree resolution from the Geographically based Economic data (G-ECON) project.

Latitude. The absolute value of latitude of a country's centroid, as reported on http://gothos.info/resources.

Ruggedness. The calculation for ruggedness takes a point on the earth's surface and measures the difference in elevation between this point and each of the eight major directions of the compass (north, northeast, east, southeast, south, southwest, west, and northwest). The index at the central point is given by the square root of the sum of the squared differences in elevation between the central point and the eight adjacent points (source: Nunn and Puga (2012)).

D. Additional controls

Birthplace diversity: This index measures the probability that two individuals drawn randomly from the entire population have two different countries of birth (source: Alesina, Harnoss, et al. (2016))

Colonial history. A classification of a country's colonial origin into British, French, Portuguese, Spanish, or other European (i.e., Dutch, Belgian, and Italian) since 1700. For countries ruled by several colonial powers, the most recent one is taken provided that it was ruled for ten years or longer (source: Nunn and Puga (2012)).

Emmigration rate: This variable is created by diving the total number of emigrants by the average population of the source country. *(*source: IAB brain-drain dataset (Brücker, Capuano et al. (2013)))

Ethnic fractionalization. This is defined as the probability that two randomly selected individuals in a country will be from different ethnic groups (source: Fearon (2003)).

Genetic diversity: An index that incorporates the expected heterozygosities of the precolonial ancestral populations of contemporary subnational groups as well as the pairwise genetic distances between these ancestral populations. (source: Ashraf and Galor (2013)

European population (%): The fraction of a country's population having European ancestors during colonization (source: Easterly and Levine (2016))

European language (%): The fraction of a country's population speaking one of the five primary Western European languages (i.e. English, French, German, Portuguese, and Spanish) as their first language (source: Hall and Jones (1999).

Foreign aid (% of GDP): This variable is constructed using data on 'net official development assistance and official aid received' and GDP for recipient countries (source: World Bank).

GDP per capita: GDP per capita data at constant price (2005 US$) (source: Feenstra, Inklaar, et al. (2015)).

Irrigation (1900): This variable is created by dividing the area irrigated in 1900 AD by land area of the country. The irrigated area and land area are retrieved from Siebert, Kummu et al. (2015) and World Bank respectively.

Language fractionalization. This index is constructed as: $F = \sum_{i=1}^{m} n_i(1 - n_i)$, where n_i is the population share of group *i* and *m* is the number of groups (source: Esteban, Mayoral et al. (2012)).

Legal origins. A classification of a country's legal tradition into British common law, French civil law, German civil law, Scandinavian law or Socialist law (source: La Porta, Silanes et al. (1998)).

Oil. A dummy variable indicating whether the proportion of export revenues from oil is larger than 1/3 (Fearon and Laitin (2003)).

Pathogen stress: A standardized index of historical pathogen prevalence for nine diseases, including leishmanias, schistosomes, trypanosomes, leprosy, malaria, typhus, filariae, dengue, and tuberculosis (source: Murray and Schaller (2010)).

Population density (1500): This variable is constructed by dividing total population in 1500 AD by land area. The population in 1500 AD and land area are retrieved from McEvedy and Jones (1978) and World Bank, respectively.

Religion (% of population): This variable indicates the fraction of population following major religions in each country in year 2000 (source: The Association of Religion Data Archives).

Religion fractionalization: This variable is computed as one minus Herfindahl index of religious group shares. It reflects the probability that two randomly selected individuals from population belongs to different religion groups (source: Alesina, Devleeschauwer, et al. (2003)).

State Antiquity (1500): An index of state history covering the period between 1 AD and 1500 AD. (source: Chanda and Putterman (2007))

Years since transition to agriculture: The number of years before 2000AD when the people of a country, today's territories, started getting more than half of their calories from cultivated foods and domesticated animals. (source: Putterman (2006))

Years of schooling: Average number of years spent at school by 15 years or older people. (source:Barro and Lee (2013))

References

Acemoglu, Daron; Simon Johnson and James Robinson. 2003. "Disease and Development in Historic Perspective." *Journal of the European Economic Association*, 1(2-3), 397-405.

Acemoglu, Daron; Simon Johnson and James A Robinson. 2001. "The Colonial Origins of Comparative Development: An Empirical Investigation." *American Economic Review*, 91(5), 1369-401.

Acemoglu, Daron; Simon Johnson; James A Robinson and Pierre Yared. 2005. "From Education to Democracy?" *American Economic Review*, 95(2), 44-49.

Alesina, Alberto; Arnaud Devleeschauwer; William Easterly; Sergio Kurlat and Romain Wacziarg. 2003. "Fractionalization." *Journal of Economic Growth*, 8(2), 155-94.

Alesina, Alberto and Eliana La Ferrara. 2005. "Ethnic Diversity and Economic Performance." *Journal of economic literature*, 43(3), 762-800.

Alesina, Alberto; Paola Giuliano and Nathan Nunn. 2013. "On the Origins of Gender Roles: Women and the Plough." *The Quarterly Journal of Economics*, 128(2), 469-530.

Alesina, Alberto; Johann Harnoss and Hillel Rapoport. 2016. "Birthplace Diversity and Economic Prosperity." *Journal of Economic Growth*, 21(2), 101-38.

Ang, James B. 2015. "Agricultural Transition and the Adoption of Primitive Technology." *Economic Inquiry*.

____. 2013a. "Are Modern Financial Systems Shaped by State Antiquity?" *Journal of Banking & Finance*, 37(11), 4038-58.

Ang, James B. 2013b. "Institutions and the Long-Run Impact of Early Development." *Journal of Development Economics*, 105, 1-18.

Arbatli, Cemal Eren; Quamrul H Ashraf and Oded Galor. 2015. "The Nature of Conflict," National Bureau of Economic Research,

Ashraf, Quamrul and Oded Galor. 2011. "Dynamics and Stagnation in the Malthusian Epoch." *American Economic Review*, 101(5), 2003.

____. 2013. "The 'out of Africa'hypothesis, Human Genetic Diversity, and Comparative Economic Development." *American Economic Review*, 103(1), 1.

Ashraf, Quamrul; Oded Galor and Marc Klemp. 2015. "Heterogeneity and Productivity." *Brown University, Department of Economics, Working Paper*.

Barro, Robert J. 1999. "Determinants of Democracy." *Journal of Political economy*, 107(S6), S158-S83.

Barro, Robert J and Jong Wha Lee. 2013. "A New Data Set of Educational Attainment in the World, 1950–2010." *Journal of Development Economics*, 104, 184-98.

Bentzen, Jeanet; Jacob Gerner Hariri and James A Robinson. 2015. "The Indigenous Roots of Representative Democracy," National Bureau of Economic Research (No. w21193),

Bentzen, Jeanet Sinding; Nicolai Kaarsen and Asger Moll Wingender. 2016. "Irrigation and Autocracy." *Journal of the European Economic Association (Forthcoming)*.

Brücker, Herbert; Stella Capuano and Abdeslam Marfouk. 2013. "Education, Gender and International Migration: Insights from a Panel-Dataset 1980-2010, Mimeo." *Retrieved August*, 20, 2016.

Castelló-Climent, Amparo. 2008. "On the Distribution of Education and Democracy." *Journal of Development Economics*, 87(2), 179-90.

Chanda, Areendam and Louis Putterman. 2007. "Early Starts, Reversals and Catch-up in the Process of Economic Development." *Scandinavian Journal of Economics*, 109(2), 387-413.

____. 2005. "State Effectiveness, Economic Growth, and the Age of States," *States and Development.* Springer, 69-91.

Diamond, Jared. 1997. "Guns, Steel and Germs: The Fate of Human Societies." *New York*.

Docquier, Frédéric; Elisabetta Lodigiani; Hillel Rapoport and Maurice Schiff. 2016. "Emigration and Democracy." *Journal of Development Economics*, 120, 209-23.

Easterly, William; Roberta Gatti and Sergio Kurlat. 2006. "Development, Democracy, and Mass Killings." *Journal of Economic Growth*, 11(2), 129-56.

Easterly, William and Ross Levine. 2016. "The European Origins of Economic Development." *Journal of Economic Growth*, 21(3), 225-57.

Engerman, Stanley L and Kenneth L Sokoloff. 1997. *Factor Endowments, Institutions, and Differential Paths of Growth among New World Economies*.

Esteban, Joan; Laura Mayoral and Debraj Ray. 2012. "Ethnicity and Conflict: An Empirical Study." *American Economic Review*, 102(4), 1310-42.

Fearon, James D. 2003. "Ethnic and Cultural Diversity by Country." *Journal of Economic Growth*, 8(2), 195-222.

Fearon, James D and David D Laitin. 2003. "Ethnicity, Insurgency, and Civil War." *American Political Science Review*, 97(01), 75-90.

Feenstra, Robert C; Robert Inklaar and Marcel P Timmer. 2015. "The Next Generation of the Penn World Table." *American Economic Review*, 105(10), 3150-82.

Galor, Oded and Marc Klemp. 2015. "Roots of Autocracy." *Brown University Department of Economics Working Paper*, 7.

Galor, Oded and Ömer Özak. 2016. "The Agricultural Origins of Time Preference." *American Economic Review (Forthcoming)*.

____. 2015a. "Land Productivity and Economic Development: Caloric Suitability Vs. Agricultural Suitability," Available at http://ozak.github.io/Caloric-Suitability-Index/,

____. 2015b. "Land Productivity and Economic Development: Caloric Suitability Vs. Agricultural Suitability." *Brown University, Department of Economics Working Papers 2015-5*.

Giuliano, Paola and Nathan Nunn. 2013. "The Transmission of Democracy: From the Village to the Nation-State." *The American Economic Review*, 103(3), 86-92.

Hall, Robert E and Charles I Jones. 1999. "Why Do Some Countries Produce So Much More Output Per Worker Than Others?" *Quarterly Journal of Economics*, 114(1), 83-116.

House, Freedom. 2016. "Freedom House." *Online Data Retrieved on: 30th April 2016*, 7, 2009.

La Porta, Rafael; Florencio Lopez-de-Silanes and Andrei Shleifer. 2008. "The Economic Consequences of Legal Origins." *Journal of economic literature*, 46(2), 285-332.

La Porta, Rafael; Florencio López de Silanes; Andrei Shleifer and Robert W. Vishny. 1998. "Law and Finance." *Journal of Political economy*, 106(6), 1113-55.

Lipset, Seymour Martin. 1959. "Some Social Requisites of Democracy: Economic Development and Political Legitimacy." *American Political Science Review*, 53(01), 69-105.

Litina, Anastasia. 2016. "Natural Land Productivity, Cooperation and Comparative Development." *Journal of Economic Growth (Forthcoming)*, 1-58.

Marshall, MG; TR Gurr and K Jaggers. 2015. "Polity Iv Project: Political Regime Characteristics and Transitions, 1800-2015. Dataset,"

McEvedy, Colin and Richard Jones. 1978. *Atlas of World Population History*. Fact on File, New York.

Michalopoulos, Stelios. 2012. "The Origins of Ethnolinguistic Diversity." *American Economic Review*, 102(4), 1508.

Murdock, George P and Douglas R White. 1969. "Standard Cross-Cultural Sample." *Ethnology*, 8(4), 329-69.

Murray, Damian R and Mark Schaller. 2010. "Historical Prevalence of Infectious Diseases within 230 Geopolitical Regions: A Tool for Investigating Origins of Culture." *Journal of Cross-Cultural Psychology*, 41(1), 99-108.

Murtin, Fabrice and Romain Wacziarg. 2014. "The Democratic Transition." *Journal of Economic Growth*, 19(2), 141-81.

Nunn, Nathan and Diego Puga. 2012. "Ruggedness: The Blessing of Bad Geography in Africa." *Review of Economics and Statistics*, 94(1), 20-36.

Nunn, Nathan and Nancy Qian. 2014. "Us Food Aid and Civil Conflict." *American Economic Review*, 104(6), 1630-66.

Olsson, Ola and Christopher Paik. 2016. "Long-Run Cultural Divergence: Evidence from the Neolithic Revolution." *Journal of Development Economics*.

Persson, Torsten and Guido Tabellini. 2009. "Democratic Capital: The Nexus of Political and Economic Change." *American Economic Journal: Macroeconomics*, 1(2), 88-126.

Putterman, Louis. 2006. "Agricultural Transition Year Country Data Set," *Available: .* http://www.brown.edu/Departments/Economics/Faculty/Louis_Putterman/agricultural%20data%20page.htm.

____. 2008. "Agriculture, Diffusion and Development: Ripple Effects of the Neolithic Revolution." *Economica*, 75(300), 729-48.

Putterman, Louis and David N Weil. 2010. "Post-1500 Population Flows and the Long-Run Determinants of Economic Growth and Inequality." *The Quarterly Journal of Economics*, 125(4), 1627-82.

Rajan, Raghuram and Arvind Subramanian. 2007. "Does Aid Affect Governance?" *The American Economic Review*, 97(2), 322-27.

Ramankutty, Navin; Jonathan A Foley; John Norman and Kevin McSweeney. 2002. "The Global Distribution of Cultivable Lands: Current Patterns and Sensitivity to Possible Climate Change." *Global Ecology and Biogeography*, 11(5), 377-92.

Ross, Michael L. 2001. "Does Oil Hinder Democracy?" *World politics*, 53(3), 325-61.

Rowley, Charles K and Nathanael Smith. 2009. "Islam's Democracy Paradox: Muslims Claim to Like Democracy, So Why Do They Have So Little?" *Public Choice*, 139(3-4), 273-99.

Siebert, Stefan; Matti Kummu; Miina Porkka; Petra Döll; Navin Ramankutty and Bridget R Scanlon. 2015. "A Global Data Set of the Extent of Irrigated Land from 1900 to 2005." *Hydrology and Earth System Sciences*, 19(3), 1521-45.

Sokoloff, Kenneth L. and Stanley L. Engerman. 2000. "History Lessons: Institutions, Factors Endowments, and Paths of Development in the New World." *The Journal of Economic Perspectives*, 14(3), 217-32.

Svensson, Jakob. 2000. "Foreign Aid and Rent-Seeking." *Journal of International Economics*, 51(2), 437-61.

Tsui, Kevin K. 2011. "More Oil, Less Democracy: Evidence from Worldwide Crude Oil Discoveries." *Economic Journal*, 121(551), 89-115.

Van der Ploeg, Frederick. 2011. "Natural Resources: Curse or Blessing?" *Journal of economic literature*, 49(2), 366-420.

Woodberry, Robert D. 2012. "The Missionary Roots of Liberal Democracy." *American Political Science Review*, 106(02), 244-74.

Young, Andrew T and Kathleen M Sheehan. 2014. "Foreign Aid, Institutional Quality, and Growth." *European Journal of Political Economy*, 36, 195-208.