What Drives the Formation and Persistent Development of Territorial States since 1 AD?

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WHAT DRIVES THE FORMATION AND PERSISTENT DEVELOPMENT OF TERRITORIAL STATES SINCE 1 AD?

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Abstract: The importance of the length of state history for understanding variations in income levels, growth rates, quality of institutions and income distributions across countries has received a lot of attention in the recent literature on long-run comparative development. The standard approach, however, is to regard statehood as a given. The main objective of this paper is to explore the determinants of statehood and to uncover its deep historical roots. The empirical analysis shows that early transition to fully-fledged agricultural production, adoption of state-of-the-art military innovations, and more opportunity for economic interaction with the regional economic leader all play a catalytic role in the rise and development of the state. However, the hypothesized positive effect of lower cultural diffusion barriers across borders on the rise of statehood is found to be lacking.

Key words: state antiquity; nation formation; comparative economic development.

JEL classification: H70; O10; O40

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1. Introduction

States are the world's largest and most powerful organizations in human history (Tilly, 1992). Well-functioning states provide welfare and security to their citizens, set up mechanisms for the exchange of goods and services, intervene in their societies to establish order, and have the capacity to improve economic outcomes. The emergence of the state was neither the result of chance nor an automatic sequence. It was not a one-off historical event, but rather a recurring phenomenon which continues to shape today's world. States emerged when constraints hindering their development disappeared or when appropriate conditions existed. They arose independently in different regions and at different times throughout the world. The first state was formed by the Sumerians in southern Mesopotamia (modern southern Iraq) around 3000 BC to 4000 BC. States flourished across different parts of the Middle East and Eurasia over the next millennium and subsequently spread across the world. However, despite being the most far-reaching political development in human history, the origin of the state and what determines the age of statehood are still not very well understood.

Within history, sociology, anthropology and political science, the amount of work devoted to analysing the emergence of states and the process of their formation is enormous, demonstrating that the intellectual merit of this exercise should not be understated (see, e.g., Mann, 1986; Tilly, 1992; Spruyt, 1994, 2002; Diamond, 1997). In economics, the length of state experience, or state antiquity, has often been linked to various economic outcomes, including contemporary income levels (Chanda and Putterman, 2005, 2007; Putterman, 2008; Putterman and Weil, 2010), economic growth (Bockstette et al., 2002), income inequality (Putterman and Weil, 2010), and the quality of institutions (Ang, 2012), among others. The results of these studies generally suggest that the length of state history is associated with better economic outcomes.

State antiquity, however, has been assumed by economists to be an exogenous factor capturing a specific dimension of historical development. It is often believed that the development of states is inevitable and is therefore taken for granted. However, state antiquity has its own barriers which might have very well hindered its development. Given the central role played by state governments in the process of economic development and in improving economic outcomes, a natural question to ask is why some countries have a longer state history than others. For example, why have China, Italy and Turkey all experienced supratribal levels of authority in their societies for more than a few thousand years whereas states were only very recently formed in Papua New Guinea, the Philippines and Uruguay? Moreover, state sovereignty is constantly shifting throughout the course of human history. Why have even mature societies which once appeared to be coherent polities sometimes broken apart so rapidly? These questions highlight the need to have a better understanding of the forces behind the evolution of states.

Motivated by a large and growing literature on the economic impacts of state antiquity and the lack of empirical evidence in exploring the determinants of state antiquity, the aim of this paper is to fill this gap by empirically uncovering the forces that shape the formation and persistent development of state governments since 1 AD across countries. Uncovering the historical determinants of statehood is desirable, particularly if these determinants also influence contemporary economic outcomes, as have been found in previous studies, through channels other than state experience accumulated over the last two millennia. This would highlight the need to control for the determinants of statehood in any study that examines the causal effect of statehood on contemporary economic performance. This study is related to a growing literature which focuses on providing analytical frameworks in exploring the roots of state fragility or the forces that shape the emergence of competent states (see, e.g., Besley and Persson, 2009, 2010, 2011). The theoretical results of these studies suggest that appropriate political institutions and common interests are key ingredients for developing legal and fiscal state capacities. The empirical analysis conducted in this paper complements these theoretical exercises, although we focus on what explains the variation in the length of state experience across countries.

Using data for 124 countries, the empirical evidence establishes that an early transition to sedentary agriculture, the adoption rate of military technology, and geographical proximity to the regional frontier are important forces that drive variations in the length of state history across nations. The results remain robust even after controlling for endogeneity, the effects of geography and a range of other factors which may have a bearing on state experience. The paper proceeds as follows. The next section provides a discussion on different accounts for the emergence of states, drawing insights from different perspectives that stress the roles of agricultural settlement, military prowess, trade barriers, and cultural diffusion barriers. The empirical framework is set out in Section 3. Data, measurement and construction of variables are also discussed. Section 4 presents the results and provides several robustness checks. The last section concludes.

2. Catalysts for the Rise of the State

The creation and development of states was a complex historical event with manifold origins. The transition to agriculture, changes in the military environment, opportunities for trade and economic interaction, and cross-border cultural diffusion barriers have often been stressed in the literature as possible forces that have been crucial in this process (see, e.g., Childe, 1950; Carneiro, 1970; McNeill, 1982; Mann, 1986; Tilly, 1992; Spruyt, 1994, 2002; Diamond, 1997). Although these factors have been conceptually analysed, a systematic empirical study exploring their effects on state formation and development has so far been lacking.

The emergence of Neolithic agriculture, which occurred independently over nearly all the world, was one of the most important events in human history. As proposed by Diamond (1997), the abundance in food supply following the Neolithic transition led to the onset of the institutionalization of power relations, which was a key catalyst for state formation. The invention and adoption of better farming techniques following the Neolithic transition also significantly improved agricultural productivity, allowing polities to enhance their fiscal capacity through raising more tax revenues.

During the Neolithic or New Stone ages, food production was focused on domesticating rather than gathering wild plants and hunting animals. The greater capacity of the agricultural unit to yield food satisfied caloric requirements and the economic wants of people. Such a shift to fully-fledged agricultural production gave rise to rapid population growth where more extensive, complex and settled forms of agricultural societies gradually emerged out of the initial hunting-gathering base. Settled agricultural villages with small-scaled political entities governed by supratribal authorities subsequently compounded into larger polities and thereby fully-fledged states emerged (Childe, 1950; Diamond, 1997).

This line of argument is consistent with *modern voluntaristic theories*, which hold that food surplus led to the formation of a non-food producing class specializing in different areas. Independent communities were united into a state as people voluntarily gave up their sovereignties in order to form a stronger political unit (Carneiro, 1970). Hence, this hypothesis suggests that an earlier transition to agriculture is expected to have a positive influence on the length of statehood experience.

The *coercive or conquest theories* popularized by Oppenheimer (1922), on the other hand, stress that state formation was simply an outcome of violent conquest and subjugation. Military historians such as Gat (2006) provide similar accounts that states were the key products of warfare. However, as pointed out by Service (1975), warfare has occurred universally throughout human development and thus cannot provide a foundation for state formation per se. This provides a basis for the argument that advancement in military technology more plausibly accounts for the emergence of states since, historically, successful warfare was often backed by sophistication in military weapons and war strategies, and the extent of military innovation was not homogenous across societies. As emphasized by Bean (1973), McNeill (1982) and Tilly (1992), sporadic technological discovery in the methods of warfare and weapon systems was one of the key drivers giving rise to the formation of states in ancient societies, particularly in the era of Babylonia, Assyria, ancient Persia, etc. Such military innovation was also major engine of state development in the medieval and early modern periods throughout Europe, which subsequently had some influential global implications.

The idea that adoption and development of state-of-the-art military tactics and technology precipitates the creation of modern states, dubbed "the military revolution", was first introduced by Roberts (1956). He proposed that innovations in military technology and methods of warfare in early modern Europe significantly increased the need for a larger army and consequently greater costs, which subsequently induced the creation of centralized states through higher demand in the levels of logistic, financial and administrative support. States that were unable to provide such support were weeded out (Tilly, 1992). Such a "military revolution", which first took place in Europe, provided its states an opportunity to diffuse their military influence across the globe through imperialism and mercantilism (Parker, 1996). In order to resist European expansion, some states such as China, Japan and the Mughal Empire in South Asia in turn developed new military techniques in defending against the Western invasion. Greater sophistication in military prowess reduced their external threat and allowed them to consolidate further (Herbst, 2000).

Theories of international trade have highlighted that trade and knowledge diffusion diminished significantly with distance (see, e.g., Eaton and Kortum, 2002; Keller, 2002). Geographical barriers or isolation can hinder state development through imposing higher costs of trade and reducing trade intensity across borders (McNeill, 1982). In contrast, proximity to the economic leader in the region lowers the cost of travel, encourages trade and economic interaction, and facilitates the adoption and adaption of technologies created in the frontier, which in turn enables them to strengthen state systems and catch up to their frontier. Despite different geographical locations, human beings face certain common problems, and can learn the solutions quickly from others and adapt them to their own use. An increase in trade activity with the regional frontier provides a channel for knowledge and state experience diffusion, which in turn enhances state capacity. It also provided the opportunity, especially in the Neolithic Age, to create permanent urban settlements that stimulated the formation of the state through promoting economic and population growth. States that lacked the opportunities for trade and were unable to provide means that facilitated trade, production, and the modernization of their economies were likely to fail, be displaced by others and hence experience retarded state development (Spruyt, 2002).

Finally, a lower degree of cross-border cultural diffusion barriers is likely to be associated with stronger history of statehood since the diffusion of state experience across borders enhance the state's capacity to rule and deploy its citizens in servicing the state, thus resulting in more integrated and persistent polities. Spolaore and Wacziarg (2009) argue that genetic distance to the frontier captures the long-run divergence in a number of human traits such as cultures, customs, beliefs, habits, etc which are transmitted from one generation to another over a long period of time. They posit that such a divergence or long-term historical non-relatedness could act as a barrier to the diffusion of development such as preventing effective adoption of technology and institutions. However, greater genetic distance would also increase barriers to cross-country migrations and population admixtures, thereby serving to block the diffusion of state experience across borders. On the other hand, genetically similar countries are able to facilitate diffusion more effectively since they are culturally similar and hence tend to trust each other more. Consequently, societies with genetic features closer to those of the leader face a lower cost of adoption and imitation, and thereby are more likely to benefit from the state experience accumulated by the frontier. In sum, we argue that genetic distance is capturing cultural barriers to the diffusion of state experience and economic development, over and above the barriers arising from geographical distance.

3. Empirical Strategy and Data

3.1 Empirical Strategy

The following equation is estimated to elucidate the various trajectories of state formation as discussed above:

$$State_i = \alpha + \beta_1 AgriTran_i + \beta_2 MilTech_i + \beta_3 GeoProx_i + \beta_4 GeneProx_i + \gamma' CV_i + \varepsilon_i \qquad (1)$$

where $State_i$ is an indicator of state antiquity, $AgriTran_i$ is the number of years elapsed since the occurrence of the agricultural transition, $MilTech_i$ is the adoption rate of military technology, $GeoProx_i$ is geographic proximity to the regional frontier, $GeneProx_i$ is genetic proximity to the regional frontier, CV_i is a set of variables controlling for continent and geographic effects, and ε_i is an error term. Our aim is to investigate the influence of these four potential determinants on subsequent state development, while controlling for other effects. These variables will be entered individually as well as jointly in the regressions.

3.2 Data

To provide an investigation of whether variations in the length of state history across nations can be attributed to the timing of transition to agriculture, the adoption rates of military technology, geographic proximity to the regional technological frontier, and human genealogical similarity relative to the technology frontier, we need measures of these underlying factors and an indicator of the historical length of statehood. We will define the variables and provide their summary statistics before presenting the empirical estimates in the next section.

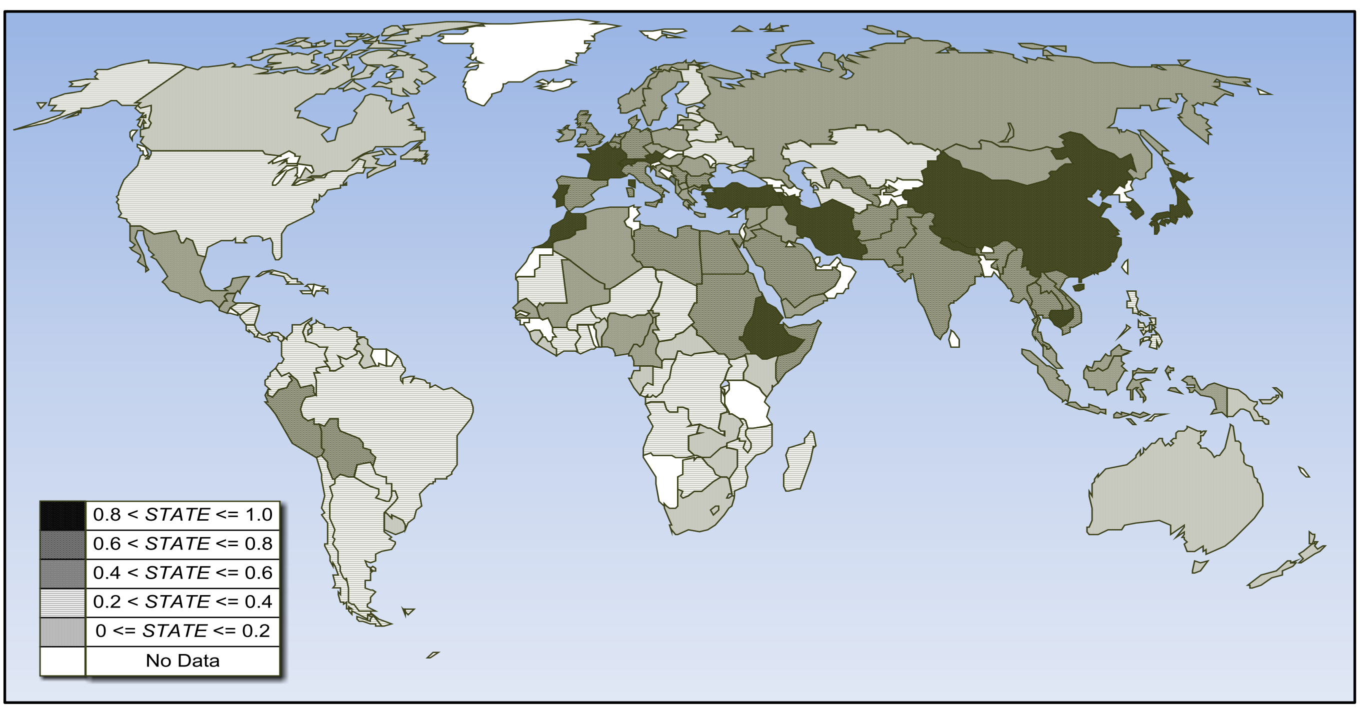
(a) State history

Our dependent variable is obtained from Putterman (2012), who provides state antiquity data covering 39 half centuries from 1 AD to 1950 AD for 149 countries. This index of state history gives a score from 0 to 50, reflecting: (1) the presence of a government above the tribal level, (2) whether this government is foreign or locally based; and (3) the proportion of the current territory covered by this government. To illustrate, state history ($State$) for nineteen centuries to 1950 AD is calculated as follows:

$$State_i = \frac{\sum_{t=1}^{39}(1.05)^{1-t} \cdot SA_{i,t}}{\sum_{t=1}^{39}(1.05)^{1-t} \cdot 50} \tag{2}$$

where $SA_{i,t}$ is the state antiquity for country i for the fifty-year period t. A five percent discount rate is applied to each of the half centuries so that less importance is attached to states formed in the more distant past. The estimates are not sensitive to the use of alternative depreciation rates. This approach of measuring state antiquity is consistent with Bockstette et al. (2002), Chanda and Putterman (2005, 2007); Putterman (2008) and Putterman and Weil (2010). The index is converted to a scale from 0 to 1 where higher values reflect the presence of a longer state history.

Figure 1: Distribution of state antiquity for 124 countries (1 AD to 1950 AD)



Notes: the above show *STATE* data for only the 124 countries used in the regressions. A higher value indicates the presence of a longer state history.

In the empirical analyses, state experiences accumulated up to 500 AD, 1000 AD and 1500 AD are also considered in order to gain an understanding of how the importance of each of the determinants of state antiquity evolves over time. For similar reasons, indices of state presence since 1501 AD, 1651 AD and 1801 AD are also regressed. In our dataset of 124 countries, the average value of state presence from 1 to 250 AD was 0.23 without adjusting the depreciation in state experience. Average state presence increased nearly three-fold to 0.65 for the period 1701 to 1950 AD. For the period 1-50 AD, there were only ten countries with full presence of domestic government that ruled the entire current territory. By 1901 to 1950 AD, this number had increased by about five times to 42. Figure 1 provides the distribution of state antiquity (1 AD to 1950 AD) across the globe where state antiquity is derived using Eq. (2). It is apparent that state antiquity shows a wide disparity across countries. This calls for a detailed investigation with regard to the forces that shape state development.

(b) Timing of agricultural transition

Data for the timing of agricultural transition are obtained from Putterman (2008). They cover a time span of 11 millennia, from 8,500 BC to the present day, circa 2000 AD. The years of agricultural transition reflect the estimated number of years since the transition has occurred. Therefore, a higher value implies an earlier transition. In the dataset, the first transition occurred circa 8,500 BC (or 10,500 years ago). The transition years are estimated based on the first year in which more than half of a human's calorific needs were obtained from cultivated plants and domesticated animals. In our sample of 124 countries, the transition to agriculture is estimated to have first occurred in Jordan, Israel and the Syrian Arab Republic (10,500 years ago) and last occurred in Australia (400 years ago), followed by Cuba and New Zealand (800 years ago).

(c) Military technology

A direct measure capturing the extent of military technologies adopted in 1 AD is not available. Comin et al. (2010) argue that metallurgy was closely related to the development of military weapons in ancient times, and they construct an overall measure of military technology adoption based on the availability of the types of metal (stone, bronze and iron tools) in each society. Bronze and iron were very rare materials and were indispensable for military innovations to enhance war capacity in ancient societies, which subsequently set the path for state formation. The introduction of bronze in about 3500 BC, for instance, was associated with the formation of the first state in Mesopotamia (McNeill, 1982). Specifically, a value of one is assigned if bronze or iron tools were adopted and zero otherwise. The average value of these individual measures provides a rough indicator for the overall adoption level of military technology in 1 AD. For the analysis involving state development since 1500 AD, adoption of military technology is constructed based on the absence or presence (i.e., with a binary value of 0 or 1) of standing armies, cavalry, firearms, muskets, field artillery, warfare capable ships, heavy naval guns and large warships. The overall military adoption level in 1500 AD is obtained by assigning an equal weight to the adoption of each of these military technologies. Both variables are obtained from the technology datasets of Comin et al. (2010).

(d) Geographical proximity to the frontier

The extent of the barriers of trade activity and economic interaction with the regional leading economy is measured by geographical distance to the frontier based on the assumption that these barriers would be lower if a country was situated closer to the regional frontier. Proximity to the regional frontier may also induce state presence under the situation where a neighbouring territory that is not subject to the sovereignty of any state is claimed controlled by the regional leader.

Geographic distance is estimated using the 'Haversine' formula, which calculates the shortest distance between two points on the surface of a sphere from their longitudes and latitudes. The location of a country is based on the central point of its present territory. The frontier is identified as one of the two countries having the highest population density in each continent. For example, Greece and Italy have been identified as the frontiers in Europe in 1 AD since they had the highest level of population density in 1 AD. Geographical distance to the frontier for a country located in Europe is thus measured by its geographical distance from its closest frontier. For instance, the frontier for France would be Italy rather than Greece due to its geographical proximity with the former.

Geographical proximity to the regional frontier for a country is then calculated as: $1 - \left(\frac{Geog.Dist._{i,RF}}{Geog.Dist._{Max}}\right)$ where $Geog.Dist._{i,RF}$ is the geographical distance between country i and its regional frontier RF and $Geog.Dist._{Max}$ is the maximum distance in the sample. The results are almost identical if proximity is calculated using the largest distance between two countries in each continent instead. Countries located closer to the regional leader have greater opportunity to trade and interact with the frontier, thus facilitating the adoption and adaptation of the state knowledge and experience created at the frontier.

For the post-1500 AD analysis, geographical proximity to the frontier is measured in the same way but the frontiers are identified using population density data for 1500 AD. Here, France and the United Kingdom were set as the regional economic leaders in Europe instead. However, these regional leaders are likely to have accumulated significant state experience and so their inclusion in the regression may generate some pseudo correlation between the dependent variable and the distance to the regional frontier measure. We tried to exclude the regional leaders in the estimations but the results did not change in any significant manner.

(e) Genetic proximity to the frontier

We use genetic distance as a measure for barriers to the diffusion of state experience, based on the assumption that such diffusion occurs mainly through the channel of population mixing. It is measured using the fixation index (F_{ST}), which reflects the degree of genealogical dissimilarities or historical unrelatedness between two populations. By construction, the index takes a value between 0 and 1 where 0 indicates that two populations are genetically identical and 1 indicates that they are genetically unrelated. Hence, a higher value reflects larger genetic differences and a longer period of separation between two populations.

Table 1: Descriptive statistics of key variables

	Obs.	Mean	Std. Dev.	Min.	Max.
Timing of agricultural transition ('000 years)	124	4.827	2.344	0.400	10.500
Index of military technology adoption (1 AD)	124	0.806	0.397	0.000	1.000
Index of geographical proximity to the frontier (1 AD)	124	0.586	0.253	0.000	1.000
Index of genetic proximity to the frontier (1 AD)	124	0.693	0.364	0.000	1.000
Index of state history (1 – 1950 AD)	124	0.475	0.246	0.021	0.964
Index of military technology adoption (1500 AD)	105	0.394	0.380	0.000	1.000
Index of geographical proximity to the frontier (1500 AD)	105	0.573	0.265	0.000	1.000
Index of genetic proximity to the frontier (1500 AD)	105	0.711	0.350	0.000	1.000
Index of state history since (1500 – 1950 AD)	105	0.639	0.227	0.050	1.000

Notes: sources and definition of data are described in the text.

Genetic distance from the frontier is defined as the genetic distance for a particular country relative to the technological frontier in 1 AD, where the frontiers are chosen based on population density in 1 AD. Genetic distance data as of 1500 AD from Spolaore and Wacziarg (2009) are used since the matching of populations to countries in 1 AD is infeasible due to data unavailability. This approach implicitly assumes that the composition of population in 1 AD for the large majority of countries was not significantly different from that in 1500 AD since movements of people across borders due to slavery, colonialism and voluntary migration were fairly limited during the pre-colonial era. Consequently, the unobserved genetic distance in prehistory is likely to be highly correlated with the observed genetic distance in 1500 AD. Accordingly, for the post-1500 AD regressions, the frontiers are chosen using population density data in 1500 AD. These measures are expressed in proximity form using the procedure described above. Table 1 provides the summary statistics of the key variables used in the empirical estimation.

4. Results

4.1. State antiquity over the last two millennia

The estimated results of Eq. (1) are presented in Table 2. Columns (1) to (4) provide univariate analyses to shed light on the correlations between statehood and the individual covariates considered in Eq. (1). Column (1) of Table 2 shows the effect of agricultural transition on the history of state formation since 1 AD across countries. The coefficient of agricultural transition is found to be highly significant at the one percent level and carries the expected sign. The magnitude of the coefficient suggests that if an average country experiences the Neolithic transition one thousand years earlier its experience in statehood is likely to increase by an index value of 0.065 out of one.

Table 2: Determinants of state history since 1AD

$Dep.var. =$ $State\ (1 - 1950\ AD)$	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$Agricultural\ Transition$	0.065***				0.041***	0.032***	0.300***
	(9.173)				(3.919)	(2.944)	(2.944)
$Military\ Technology\ (1\ AD)$		0.231***			0.158***	0.173***	0.279***
		(5.666)			(3.806)	(3.962)	(3.962)
$Geographic\ Proximity\ (1\ AD)$			0.439***		0.190**	0.232***	0.239***
			(6.122)		(2.343)	(2.743)	(2.743)
$Genetic\ Proximity\ (1\ AD)$				0.095	0.090*	0.068	0.100
				(1.638)	(1.915)	(1.454)	(1.454)
$Island$						0.030	0.029
						(0.390)	(0.390)
$Landlocked$						-0.069	-0.118
						(-1.484)	(-1.484)
$Latitude$						0.141	0.112
						(1.340)	(1.340)
$Climate$						-0.014	-0.065
						(-0.767)	(-0.767)
$Terrain\ ruggedness$						0.038*	0.177*
						(1.859)	(1.859)
$Intercept$	0.163***	0.289***	0.218***	0.410***	-0.024	-0.040	
	(4.434)	(8.810)	(4.554)	(8.859)	(-0.452)	(-0.615)	
R-squared	0.380	0.139	0.204	0.020	0.443	0.478	0.478
Observations	124	124	124	124	124	124	124

Notes: Robust standard errors are used and *t*-statistics are reported in the parentheses. *, ** and *** indicate significance at the 10%, 5% and 1% levels, respectively. The last column reports standardized beta coefficients.

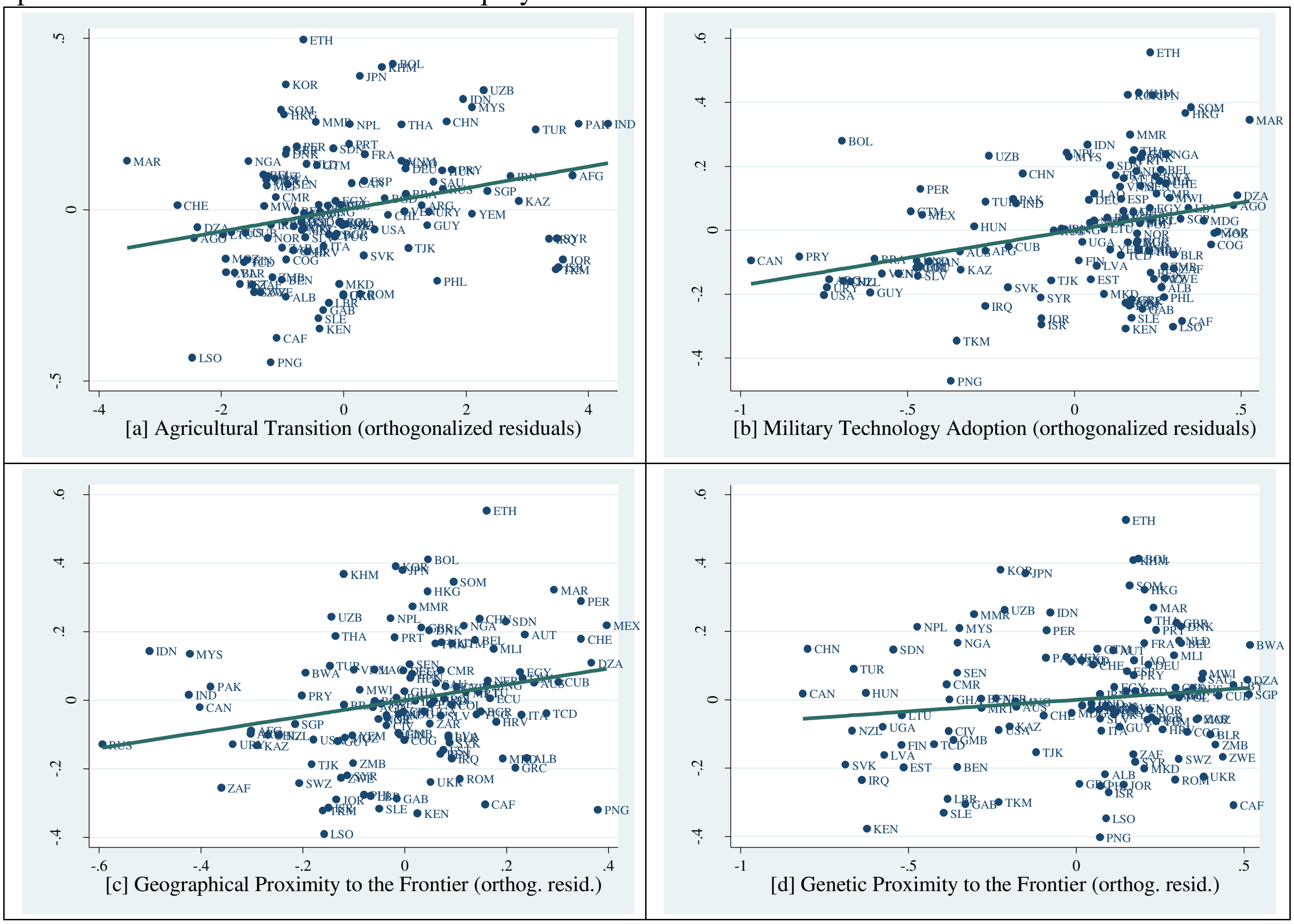
To assess the independent effect of the military technology adoption rate on state antiquity throughout the last two millennia, column (2) replaces years since the transition to agriculture with the rate of military technology adoption rate in 1 AD. The coefficient is also very precisely estimated at the one percent level. The results suggest that a complete change from no to full adoption of military technology in 1 AD is associated with an increase of state antiquity by about 0.23 units. Hence, the results suggest that the adoption of more sophisticated battle tactics and firearms has a large positive effect on subsequent state development. Consistent with the prediction, column (3) shows that the effect of geographical proximity to the technology frontier is very precisely estimated with the expected sign. The effect of human genetic proximity to the frontier, however, is found to be insignificant in column (4).

All these variables are included simultaneously in column (5) to gauge their relative strength in explaining the variation of statehood across nations. The results are largely similar to those found in the previous columns. Column (6) adds some of the commonly used geographic variables in the literature of long-run comparative economic development, including an island dummy, landlockedness, absolute latitude, climate condition (based on the Köppen classification) and terrain ruggedness. This consideration is important to ensure that the early historical development indicators we consider in Eq. (1) are not proxying some kind of geographic characteristics. Our findings in column (5) remain largely unaltered with the inclusion of these geographic variables. All these additional controls are found to be largely insignificant, consistent with the observation that R-squared shows very little improvement. Very consistent results are obtained if these geographic variables were included in the univariate regressions of columns (1) to (4). This suggests that our results are unlikely to be driven by any geographic circumstances.

The last column reports the beta coefficients, which allows us to compare the explanatory power of each covariate. These are coefficients obtained from regressions carried out on variables that have been standardized to have a mean of 0 and a standard deviation of 1. It is apparent that agricultural transition and military technology adoption have the strongest predictive power in explaining the variation in state experience accumulated across countries where one standard deviation improvement in the proximity to the frontier is correlated with about 0.3 units of standard deviation improvement in statehood. Consistent with the estimates in the previous column, geographic variables have little explanatory power.

Figure 2 shows the partial regression lines for the individual effect of each of the regressors in Eq. (1) on state antiquity, while controlling for the influence of the other three main regressors and control variables. As is evident, the partial regression lines show that agricultural transition, military technology adoption rates, and geographical proximity to the frontier are positively correlated with the length of state history whereas genetic proximity to the frontier depicts a mild positive or no clear relationship with statehood, thus confirming the findings in Table 2.

Figure 2: Partial effects of agricultural transition, military technology adoption, geographical and genetic proximities to the frontier on state antiquity



Notes: the above figures illustrate the respective partial effects of agricultural transition, military technology adoption, geographical and genetic proximities to the frontier on statehood. For example, Figure 1(a) shows the partial regression line for the effect of agricultural transition on statehood while partialling out the effects of all other explanatory variables, including the control variables, in Eq. (1). These partial regression lines are obtained based on the regression in column (6) of Table 2.

4.2. State presence up to 500 AD, 1000 AD and 1500 AD

To gain some understanding of how these variables affect the accumulation of state experience over time, we consider state history for five, ten and fifteen centuries since 1 AD as alternative dependent variables. The estimates are reported in the first three columns of Table 3. Consider column (1) which regresses Eq. (1) using state history data for the first five centuries. Not only is the coefficient of agricultural transition much more precisely estimated (as indicated by a larger *t*-statistic), but economically the size of the coefficient is also 50% larger than that obtained in Table 2 (column (7)).

Consistent with the estimates reported in Table 2, both military technology adoption and geographical proximity to the frontier are found to have a positive impact on state formation. Very similar results are obtained when we regress Eq. (1) using state history up to 1000 AD as the dependent variable (column (2)). Column (3) reports the estimates based on using state history up to 1500 AD as the dependent variable. However, unlike the earlier results, coefficients of military technology and geographic proximity to the frontier now become both economically and statistically much more significant whereas the reverse is found for the coefficient of agricultural transition.

Table 3: State history up to 500, 1000 and 1500 AD and since 1500 AD (standardized estimates)

	(1)	(2)	(3)	(4)	(5)	(6)
	Statehood: 1-500AD	Statehood: 1-1000AD	Statehood: 1-1500AD	Statehood: 1501-1950AD	Statehood: 1651-1950AD	Statehood: 1851-1950AD
Agricultural Transition	0.460***	0.448***	0.332***	0.129	0.103	-0.002
	(4.934)	(5.211)	(3.682)	(1.325)	(1.077)	(-0.020)
Military Technology	0.136*	0.174**	0.314***	0.473***	0.335***	0.003
	(1.689)	(2.178)	(4.297)	(4.755)	(3.100)	(0.021)
Geographic Proximity	0.172**	0.194**	0.268***	0.083	0.068	0.076
	(2.083)	(2.566)	(3.111)	(0.869)	(0.663)	(0.671)
Genetic Proximity	0.063	0.080	0.075	0.094	0.137	0.235**
	(1.070)	(1.363)	(1.206)	(1.069)	(1.485)	(2.578)
R-squared	0.462	0.507	0.539	0.421	0.368	0.304
Observations	124	124	124	105	105	105

Notes: the estimated coefficients are standardized beta coefficients. An intercept is included in the estimations but not reported. Robust standard errors are used and *t*-statistics are reported in the parentheses. *, ** and *** indicate significance at the 10%, 5% and 1% levels, respectively. For columns (4) to (6), military technology adoption, geographical and genetic proximities to the frontier are measured as of 1500 AD. All geographic control variables (i.e., island dummy, landlockedness, absolute latitude, climate condition and terrain ruggedness) used in Table 2 are included in the estimations but the results are not reported to conserve space.

On the whole, these findings along with those reported in Table 2 suggest that: (1) an early transition to agriculture plays a much more prominent role in the accumulation of state experience in the early periods of development, particularly before 1000 AD, although its effect remains detectable until 1500 AD or even more recent times; (2) in line with the Western historical chronicles in which there were only less than 10 years of peacetime in the sixteenth century, military prowess was found to be especially important for the formation of European states after 1000 AD but less so during the period 1-1000 AD when the continent was mostly at peace (see Parker, 1996); (3) geographic barriers to development consistently mattered for the accumulation of state experience throughout the history of state development with its influence peaked in 1500 AD; and (4) barriers to cross-border cultural diffusion are found to have no effect on state formation for all the sub-periods considered. To sum up, the results in

Table 3 indicate that what mattered most during the process of early state formation was the provision of food. The importance of the adoption of cutting edge military weapons and geographic location only became apparent after 1000 AD.

4.3. State presence since 1500 AD

In contrast to the above, we now focus on analyzing the formation of states since 1500 AD. State experiences accumulated over the following periods are considered: (1) 1501-1950 AD; (2) 1651-1950 AD; and 1801-1950 AD. The adoption rate of military technology in 1500 AD, geographical proximity to the frontier in 1500 AD and genetic proximity to the frontier as of 1500 AD, instead of their 1 AD counterparts, are used here since they are more relevant initial conditions for states formed since 1501 AD. This results in the use of a smaller sample size of only 105 countries since data for military technology adopted in 1500 AD provided by Comin et al. (2010) are only available for a smaller number of countries. The results are reported in columns (4) to (6) in Table 3.

Interestingly, the timing of agricultural transition is found to be unrelated to statehood during the sub-periods considered here, perhaps due to the fact that its effect has in part been absorbed in the earlier periods of state development and in part been transmuted into other forms. This result is consistent with the phenomenon of states in which those that relied on elementary agricultural modes of production such as Spain and Portugal being displaced by more advanced powers such as Britain and the Netherland (Spruyt, 2002). Similarly, geographical distance to the frontier, however, was no longer a relevant factor for the formation of states since 1501 AD. This result is unsurprising given that the technologies of transportation and telecommunications have gradually improved over time.

Military technology adoption continued to exert a significant influence on statehood during the periods 1501-1950 AD and 1651-1950 AD, but had no role to play in 1801-1950 AD. This finding perhaps suggests that military sophistication attained 300 years ago before 1800 AD was no longer relevant for the formation of states in recent periods (contemporary and modern statehood) or technological innovations in other areas such as agriculture, telecommunications or transportation have displaced the influence of military prowess. Surprisingly, genealogical similarity with the frontier is found to have some positive influence on state formation since 1801 AD, suggesting that cultural barriers can act as a constraint on the diffusion of state experience in recent times. Consistent with the above findings, the *R*-squared values drop as greater attention is given to effects on states formed more recently, suggesting that some of these historical development measures are less relevant in explaining recent statehood.

4.4. Robustness checks

Several robustness checks are in order. Firstly, our results may be influenced by the use of a depreciation rate in the construction of the state antiquity variable where more recent periods are weighted more heavily than the more distant ones, and this may excessively downplay the importance of early state history. Column (1) provides the estimates with no discounting applied to the state history variable. The results, however, do not show any significant variation. Secondly, the results also prevail when outliers are adjusted based on a robust regression approach that eliminates outliers using Cook's distance and some iteration procedures. No influential outliers were detected and dropped, and the coefficients of the variables of interest reported in column (2) are remarkably stable.

Although territorial statehood is unlikely to exist prior to the Neolithic transition, which precludes the possibility of reverse causality from the prevalence of statehood to the emergence of sedentary agriculture, this does not preclude the possibility of omitted variable bias. For instance, there may be substantial variation in hierarchical institutional structures at the tribal level across hunter-gatherer societies where some were not only more conducive for the adoption of sedentary agriculture but were also more beneficial for state development after the Neolithic transition. Such an unobserved heterogeneity across prehistoric hunter-gather societies, if unaccounted for, can be responsible for generating a spurious relationship between the timing of the Neolithic Revolution and subsequent state development.

As an identification strategy, we use the availability of prehistoric endowments of domesticable species of wild plants and animals as the excluded instrument for the timing of the Neolithic Revolution. This follows hypothesis of Ammerman and Cavalli-Sforza (1984) and Diamond (1997) that abundant presence of domesticable species of large seeded grasses and large mammals for prehistoric societies triggers the transition from hunting and gathering to sedentary agriculture. The 2SLS estimates are reported in column (3) of Table 4. The R-squared in the first-stage regression is 0.69 and the F-statistic is 16.35, indicating that prehistoric biogeographic endowments are valid instruments.

For similar reasons, the adoption rate of military technology in 1 AD is instrumented by geographical proximity to the military frontier, where the frontiers are chosen by countries having achieved the full adoption rate of military technology in 1000 BC in each continent based on the data of Comin et al. (2010). The results shown in column (4) are qualitatively very similar to the baseline estimates in column (7) of Table 2, suggesting that our results are unlikely to be plagued by endogeneity.

The transition from statelessness to statehood may be precipitated by some forces of population pressure. This is consistent with the notion that higher population density leads to more competition for territorial agricultural land or increased desirability for the rulers to provide public goods and services due to the benefits of economies of scale. In column (5), we include population density in the regressions to capture this effect, but its coefficient is found to be insignificant and the results are largely unaffected.

Table 4: Robustness of results (standardized estimates)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	No depreciation for statehood	Robust regression	IV-2SLS (*AgrTran* is instrumented)	IV-2SLS (*MilTech* is instrumented)	Add Pop density	Add Colony	Add Neoeurope	Include all controls from col. (5) to (7)
$AgriTran$	0.375***	0.303***	0.610***	0.332***	0.289***	0.284***	0.300***	0.272***
	(4.040)	(2.854)	(3.274)	(3.192)	(2.827)	(2.809)	(2.925)	(2.714)
$MilTech$	0.264***	0.269***	0.175**	0.220***	0.270***	0.248***	0.272***	0.240***
	(3.666)	(3.186)	(1.969)	(2.642)	(3.812)	(3.214)	(3.389)	(2.803)
$GeoProx$	0.236***	0.246**	0.084	0.221**	0.235***	0.218**	0.236***	0.214**
	(2.948)	(2.577)	(0.724)	(2.576)	(2.694)	(2.443)	(2.646)	(2.359)
$GeneProx$	0.089	0.093	0.072	0.085	0.097	0.098	0.095	0.096
	(1.443)	(1.194)	(1.037)	(1.259)	(1.398)	(1.399)	(1.241)	(1.248)
$Pop\ density$					0.062			0.064
					(1.038)			(1.179)
$Colony$						-0.147		-0.150
						(-1.050)		(-1.040)
$Neoeurope$							-0.016	0.005
							(-0.283)	(0.090)
R-squared	0.527	0.464	0.436	0.476	0.481	0.486	0.478	0.490
Observations	124	124	124	124	124	124	124	124

Notes: the estimated coefficients are standardized beta coefficients. An intercept is included in the estimations but not reported. Robust standard errors are used and *t*-statistics are reported in the parentheses. *, ** and *** indicate significance at the 10%, 5% and 1% levels, respectively. All geographic control variables (i.e., island dummy, landlockedness, absolute latitude, climate condition and terrain ruggedness) used in Table 2 are included in the estimations but the results are not reported to conserve space. In column (3), agricultural transition is instrumented by the availability of domesticable plants and animals. In column (4), military technology adoption is instrumented by geographical proximity to the military frontier.

Columns (6) and (7) control for the effects of colonialism and neo-Europes, respectively. The European colonization from the fifteenth century may have had a dramatic effect on state formation since colonial policy was often designed to increase ethnic fractionalization in colonial states. This effect is captured by the inclusion of a binary variable indicating whether a country was a former European colony. The inclusion of a neo-Europe dummy for Australia, Canada, New Zealand and the United States ensures that our estimates are not driven by some unique characteristics of these countries, which were once dominated by the European settlers who brought in a different set of state institutions. However, these effects are all found to be insignificant.

Column (8) additionally controls for the regional effects to ensure that the results are not being spuriously driven by unobserved time-invariant region-specific characteristics. The last column includes all additional control variables considered in columns (5) to (8) in the same specification. Our results prevail in both cases.

5. Conclusions

State antiquity has gained considerable attention from the literature on long-run comparative economic development in order to uncover the reasons for low income levels, bad institutions, unequal distribution of income, poor growth rates, etc. This attention is warranted since the state is one of the most important forms of institutional development that has led to a number of fundamental and far-reaching changes in human history. The common approach taken, however, has been to take statehood as a given. Little attention has been paid to understanding state development. Against this backdrop, this study attempts to empirically uncover the factors that underlie the formation and development of state systems.

In particular, we explore the role of the timing of agricultural transition, military technology adoption, geographical proximity to the frontier, and human genetic distance to the frontier in the formation of state government. Our results indicate that a longer duration since agricultural transition and higher adoption rates of military technology are positively associated with a longer state history. However, countries which are located far from the frontier tend to suffer from a lack of state experience. The effect of having genetically more heterogeneous populations relative to the frontier on the rise of statehood is found to be absent.

Results of further analyses suggest that agricultural transition and geographical proximity to the frontier mattered for statehood predominantly before 1500 AD, after which their effects vanished. State experiences accumulated since 1500 AD can be best explained by adoption of military technology. On the whole, our empirical evidence highlights the important roles of some historical and pre-historical factors in shaping state formations across the globe.

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