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Discussion Paper

WHAT DRIVES THE HISTORICAL FORMATION AND PERSISTENT DEVELOPMENT OF TERRITORIAL STATES?

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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 distribution across countries has received a lot of attention in the recent literature on long-run comparative development. The literature, however, is silent about its deep historical origins. Against this backdrop, this paper makes the first attempt to explore the determinants of statehood by considering the potential roles of an early transition to fully-fledged agricultural production, the adoption of state-of-the-art military innovations, and the opportunity for economic interaction with the regional economic leader. The results demonstrate that only the association between economic interaction and the rise and development of the state is statistically robust.

Key words: state antiquity; nation formation; long-run comparative economic development.
JEL classification: H70; O10; O40

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1. Introduction

Historically, states have been the world's largest and most powerful organisations (Tilly, 1992). Well-functioning states provide welfare and security to their citizens, set up mechanisms for the exchange of goods and services, establish order in their societies, 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 origins 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), financial development (Ang, 2013a), and the quality of institutions (Ang, 2013b), among others. The results of these studies generally suggest that the length of state history is associated with better economic outcomes.

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 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. However, despite significant attention having been paid to this specific dimension of historical development in understanding the variations in contemporary performance across countries, the historically-rooted determinants of state antiquity remain largely unexplored in the literature.

Motivated by a large and growing literature on the economic impacts of state antiquity and the lack of empirical evidence in exploring its determinants, 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 51 AD, across countries. A better understanding of what is associated with accumulated state experience is desirable particularly if, as has been found in previous studies, these historically-rooted covariates also affect contemporary economic outcomes through channels other than state development over the last two millennia. This would highlight the need to control for them in any study that examines the 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; Mayshar et al., 2011; Lagerlof, 2014). The theoretical results of Besley and Persson (2009, 2010, 2011) suggest that appropriate political institutions and common interests are key ingredients for developing legal and fiscal state capacities whereas Mayshar et al. (2011) propose that the emergence of the state was the outcome of greater transparency in farming. This paper is also related to the recent work of Lagerlof (2014), who develops a unified framework to examine how stateless societies first transit to autocratic statehood, and subsequently to democratic statehood under some conditions. 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.

Cross-country correlations between state antiquity and either contemporary income per capita or contemporary economic growth documented in the previous literature (e.g., Bockstette et al., 2002; Chanda and Putterman, 2007) suggest that the length of state experience tends to be associated with a longer and deeper exposure to "good", or "inclusive" (to use the terminology of Acemoglu and Robinson, 2012), institutions.[1] However, they do not necessarily imply that state antiquity always goes in tandem with institutions that are conducive to long-run economic development. Historical records indeed suggest that some of the earliest centralized states in human history, such as ancient China, ancient Egypt, and Mesopotamia, were highly tyrannical in nature and closely associated with "bad" or "extractive" institutions. The advent of institutions that are conducive to long-run economic development did not occur until much later in human history, possibly around the end of the first half of the second millennium of the Common Era. It should therefore be highlighted that the analysis conducted in this paper is about exploring

[1] Inclusive institutions refer to those that provide private property rights protection, an unbiased legal system, an effective system of contract enforcement, and the imposition of checks and balances on the discretionary power of political elites in societies (Acemoglu and Robinson, 2012).

the determinants of the long-run experience of societies with centralized statehood rather than their historical exposure to "good" or "inclusive" institutions.

We argue 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 empirical evidence consistently establishes that geographical proximity to the regional frontier is the only factor significantly associated with state experience. The hypothesized positive relationships between other covariates and the rise and persistent development of statehood, however, are found to be lacking. The estimates remain robust when country-specific unobserved heterogeneity and the endogeneity of the agricultural transition timing variable are allowed for. The regression results also survive even after including a broad range of geographic control variables, which are chosen on the basis of what is commonly regarded in the long-run comparative development literature as possibly having a bearing on the accumulation of state experience, and after conducting a series of sensitivity checks.

The paper proceeds as follows. The next section provides a discussion of different factors that may explain the emergence of states, drawing insights from various perspectives that stress the roles of agricultural settlement, military prowess, and opportunity for economic interaction. The empirical framework is set out in Section 3. Data, measurement and construction of variables are also discussed. Section 4 presents the results and Section 5 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, and opportunities for trade and economic interaction 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 how they are related to state formation and development has, so far, been lacking.[2]

The emergence of Neolithic agriculture, which occurred independently throughout most of 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

[2] The studies of Petersen and Skaaning (2010), Boix (2011) and Borcan et al. (2013) also examine related issues but test specifically the proposition of Diamond (1997) and focus only on how the rise of states is related to the timing of agricultural transition (also known as the Neolithic Revolution).

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 calorific 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 society gradually emerged out of the initial hunter-gatherer base.[3] Settled agricultural villages with small-scale 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, arguing 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 a major engine of state development throughout Europe in the medieval and early modern periods,, which subsequently had some influential global implications.

The idea that the adoption and development of state-of-the-art military tactics and technology precipitated 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 involved greater costs, which

[3] In this connection, Mayshar et al. (2011) provide an alternative view, arguing that a greater requirement for food storage following the improvement in agricultural productivity made expropriation rewarding and thus led to an increase in the demand for protection from bandits by farmers, which in turn subjected them to hierarchical leaders.

subsequently induced the creation of centralized states through higher demand in the areas of logistical, 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 order to defend themselves against the Western invaders. Greater sophistication in military prowess reduced external threats and allowed them to consolidate further (Herbst, 2000).

Finally, 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 at the frontier, which in turn enables states to gain strength and catch up to their frontiers. 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 did not possess the means to facilitate trade, production, and the modernization of their economies were likely to fail, be displaced by others and hence experience retarded state development (Spruyt, 2002).

3. Empirical Strategy and Data

3.1 Empirical specification

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

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

where $State_i$ is an indicator of state antiquity, $IniState_i$ is initial state presence, $AgriTran_i$ 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, CV_i is a set of variables controlling for continent, geographic and other effects, and ε_i is an error term.

The inclusion of continent fixed effects, in particular, ensures that the results are not being spuriously driven by unobserved time-invariant region-specific characteristics. The regressions also control for the geographical antecedents of the Neolithic transition emphasized by Diamond (1997), namely absolute latitude, climate condition, East-West orientation, size of continents (see, e.g., Hibbs and Olsson, 2004; Olsson and Hibbs, 2005). Apart from these, other geographic measures which have been argued to be potentially influential for economic outcomes, including land suitability for agriculture, soil suitability for agriculture, islands, landlockedness, distance to the nearest coast or river, percentage of arable land, percentage of population living in tropical zones, percentage of population living in temperate zones, temperature, precipitation, terrain ruggedness, and mean elevation are also controlled for in the regressions (see, e.g., Ashraf and Galor, 2011, 2013). The above consideration is important to ensure that the early historical development indicators we include in Eq. (1) are not proxying some kind of geographic characteristics. Definitions and sources of these variables are given in Section C in the Appendix (see Table A4).

Initial state presence is controlled for in the regression since states are unlikely to arise without pre-existing state level institutions. Doing so also reduces the possibility of obtaining spurious estimates, given that the development of military technology, for example, may be correlated with initial state presence. Our aim is to investigate how the proposed three early development indicators are related to subsequent state presence and development, while controlling for other effects.

3.2 Measuring early performance

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, and geographic proximity to the regional technological frontier, we need measures of these underlying factors and an indicator of the historical length of statehood. The following describe the construction of these variables, and their summary statistics are given in Section A of the Appendix (see Table A1).

(a) State history

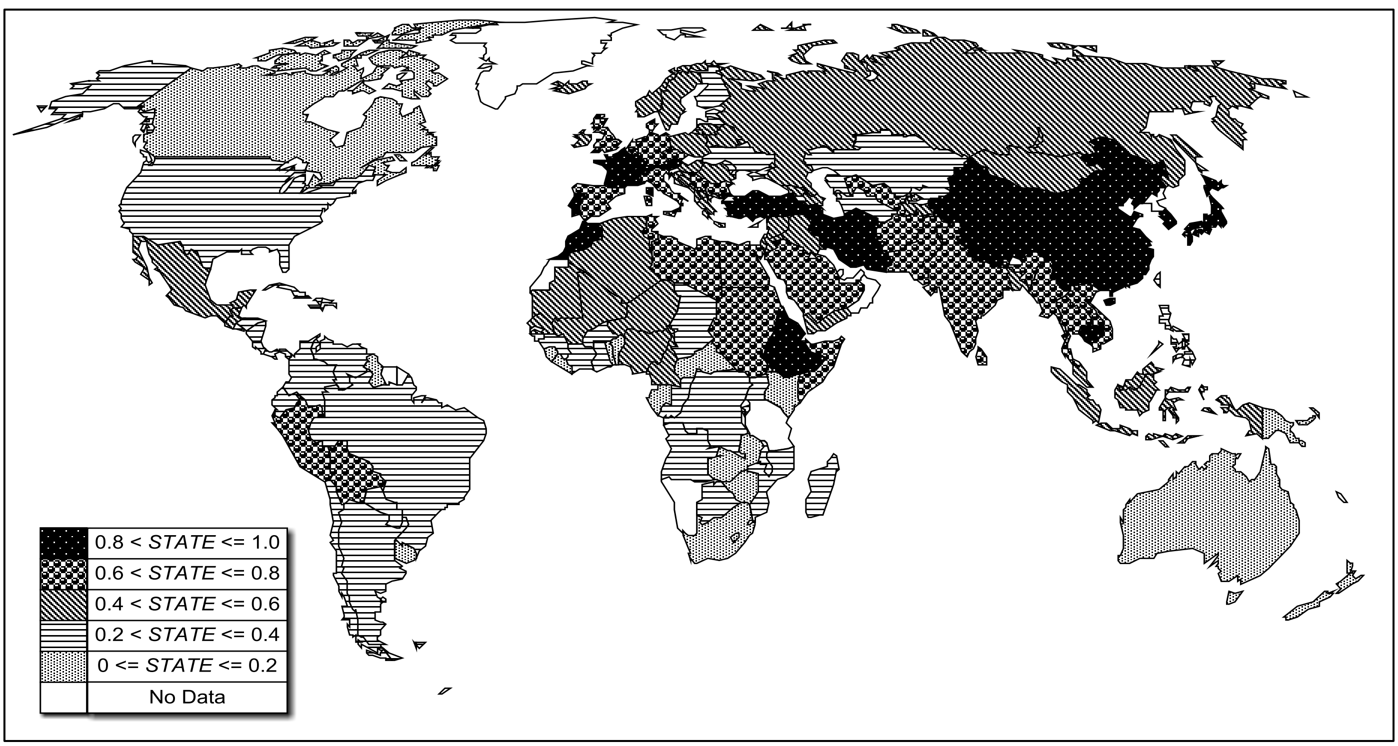
Our dependent variable is obtained from the latest version (version 3.1) of the state history data assembled by Putterman (2004), who provides state antiquity data covering 39 half centuries from 1 AD to 1950 AD for 151 countries. This index of state history gives a score from 0 to 50, reflecting: (1) 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:

$$State_i = \frac{\sum_{t=1}^{38}(1.05)^{1-t} \cdot S_{i,t}}{\sum_{t=1}^{38}(1.05)^{1-t} \cdot 50} \quad (2)$$

where $S_{i,t}$ is the state presence for country i for the fifty-year period t (see Putterman and Weil, 2010). Statehood in 1 AD – 50 AD ($t = 39$) is excluded from the above calculation as it is used as a regressor to capture the effect of initial state presence. A 5% 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 ranging from 0 to 20%. This approach of measuring state antiquity is broadly consistent with Bockstette et al. (2002), Chanda and Putterman (2005, 2007), Putterman (2008), Putterman and Weil (2010), and more recently, Ang (2013a, b). 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 151 countries (1 AD to 1950 AD)



Notes: the above show *STATE* data for only the 151 countries used in the regressions. A higher value indicates the presence of a longer state history. Source: Putterman (2004).

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 Putterman's (2004) dataset of 151 countries, the average value of state presence from 1 to 250 AD was 0.22 without adjusting for the depreciation in state experience. Average state presence increased nearly three-fold to 0.63 for the period 1701 to 1950 AD. For the period 1-50 AD, there were only 11 countries with the full presence of a domestic government that ruled the entire current territory. By 1901 to 1950 AD, this number had increased about fourfold to 45.

Figure 1 provides the distribution of accumulated state experience from 1 AD to 1950 AD for all available countries in Putterman (2004) 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. The detailed description of the construction of this variable is given in section B in the Appendix.

(b) Timing of agricultural transition $[AgriTran]$

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 the original dataset, consisting of 165 countries, the transition to agriculture is estimated to have first occurred in Israel, Jordan, Lebanon and the Syrian Arab Republic (10,500 years ago) and last occurred in Mauritius (362 years ago), followed by Australia (400 years ago), Cape Verde (538 years ago), Cuba and New Zealand (800 years ago).

(c) Military technology adoption in 1000 BC $[MilTech]$

A direct measure capturing the extent of prehistoric military technology sophistication 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 crucial for military innovations to enhance war capacity in ancient societies, which subsequently set a 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). This line of argument suggests that the availability of metal tools is a good proxy for the extent of military sophistication. Specifically, according to the technology datasets of Comin et al. (2010), a value of one is assigned if bronze or iron tools were adopted and zero otherwise. The average value of these individual measures is used to provide a rough indicator for the overall adoption level of military technology in 1000 BC.

(d) Geographical proximity to the frontier in 1000 BC $[GeoProx]$

The extent of the barriers to 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 to be controlled by the regional leader.

Following the approach of Ashraf and Galor (2011, 2013), 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 or, in cases where only one leader can be determined, the country having the largest cities in each continent. For example, China (Xi'an) and Iraq (Babylon) have been identified as the frontiers in Asia since they had the largest urban settlements in the continent in 1000 BC (Modelski, 2003).[4] Geographical distance to the frontier for a country located in Asia is then measured by its geographical distance from its closest frontier. For instance, the frontier for Malaysia would be China rather than Iraq, due to its geographical proximity to 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. The underlying rationale for using this measure is that countries located closer to the regional leader have greater opportunities to trade and interact with the frontier, thus facilitating the adoption and adaptation of the state knowledge and experience created at the frontier.

[4] The number of frontiers in each region is set to be two, but in cases where the second frontier cannot be identified only one frontier has been chosen. Specifically, the frontiers chosen in each continent for 1000 BC are Egypt (Thebes, Memphis) for Africa, Mexico (Olmec civilization) and Peru (Chavín civilization) for America, China (Xi'an, Luoyang) and Iraq (Babylon) for Asia, Greece (Mycenaean civilization) for Europe, and Australia for Oceania. Source: Chandler (1987), Modelski (2003), Morris (2010) and TimeMaps (2013) where the brackets indicate the cities or city states.

3.3 Issues in identifying causal effects

There are, however, several doubts about the appropriateness of the above empirical design that implicitly assumes all early development regressors to be exogenous, and hence reasons to be concerned about whether the estimates represent any causal relationships. As will become clear in the following, there are good reasons to believe that all these regressors are endogenous to state history. The requirement that the number of instruments has to be at least as great as the number of endogenous regressors poses a particular problem here. We would need to have at least three instruments that credibly predict each of these endogenous variables and yet do not have a direct effect on statehood in order to satisfy the exclusion restrictions. There is no easy way around this issue since it is an incredibly challenging task to find appropriate instruments for this purpose. While the extent of the endogeneity problem for each of the endogenous regressors is unclear, the credibility of our estimates will be limited by the lack of suitable instruments and plausible identification strategies. We discuss below how some of these issues are dealt with wherever possible, but provide a cautionary note on issues that we are unable to address due to the difficulties outlined above.

(a) The timing of agricultural transition

First, available anthropological and archaeological evidence typically suggests that territorial states were hardly prevalent prior to the emergence of sedentary agricultural settlements, and hence reverse causality from statehood to agricultural transition is less likely to occur. The alternative scenario of an omitted third variable which is unobservable, however, cannot be ruled out completely. For instance, substantial variation in the hierarchy of the institutional structures may exist at the tribal level across prehistoric hunter-gatherer societies (see, e.g., Smith, 1991). To the extent that less egalitarian institutions were not only conducive for the adoption of sedentary agriculture but were also beneficial for state development after the Neolithic transition, such unobserved heterogeneity may generate a spurious relationship between the timing of the Neolithic transition and subsequent state development. In this case, any observed association merely reflects a correlation of both state history and agricultural transition with some unmeasured characteristics, and thus is uninformative about the causal effect of agricultural transition.

In order to isolate the exogenous variation in the timing of agricultural transition, we use geographic distance to the Neolithic frontier as an instrument, following the identification strategy developed by Ashraf and Michalopoulos (2014). This is based on the reasoning that countries located in close proximity to the Neolithic centers tend to have similar cultural, ecological and geographic conditions, and thus enjoy a lower imitation cost. Faced with lower adoption barriers, this enabled them to absorb the diffusions of the frontier's technology more effectively, thus facilitating the spread of farming techniques (Ang, 2013c).

To test the overidentifying restriction, we use the availability of prehistoric endowments of domesticable species of wild plants and animals as an additional excluded instrument for the timing of the Neolithic Revolution. This identification strategy is developed by Ashraf and Galor (2011, 2013), which is consistent with the hypothesis of Ammerman and Cavalli-Sforza (1984) and Diamond (1997) that an 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. Data on biogeographic endowments are introduced by Hibbs and Olsson (2004) and Olsson and Hibbs (2005), who stress the importance of initial biogeographic conditions in shaping the subsequent timing of agricultural transition.

(b) Adoption rate of military technology

Another source of concern is that there could be a reverse causation running from state antiquity to the adoption of military technology in the sense that highly experienced states are also more capable of collecting taxes to finance military spending. This endogeneity problem can be addressed by regressing statehood since 51 AD on the degree of initial military prowess in 1000 BC.

While doing so mitigates the issue of reverse causality, it does not address the issue of omitted variable bias. For example, suppose that there are increasing returns to state experience in that societies that had more developed states in 1 AD also experienced faster accumulation of state experience thereafter, but for reasons that have nothing to do with initial military prowess. Given that initial military prowess and initial state development are correlated, this would suggest that the observed relationship between initial military prowess and the subsequent rate of state development is spurious, being latently mediated by the initial level of state development. For this reason, we also include the level of state development in the initial period as a control variable in all regressions.

Notwithstanding this consideration, there are other good reasons to believe that the association between state history and initial military technology adoption may not be casual, and the latter is picking up the effect of some unobservable omitted variables due to other potential latent channels. To isolate the causal impact of military technological sophistication on the age of statehood, we would need to find an appropriate instrument for military prowess. However, it seems unlikely that there are factors that have had indirect effects on state formation that can only be attributed to their direct impact on military technology. As such, given the difficulties associated with finding credible instruments for military technology adoption, the ensuing estimates cannot be ascribed any causal interpretations.

(c) Geographic proximity to the frontier

Finally, there is no guarantee that geographic proximity to the frontier captures a measure of the causal effect of economic interaction on statehood. Unlike conventional geographical factors, the exogeneity of geographical proximity to the frontier does not hold, given that the spatial distribution of societies may be subject to some systematic patterns. In fact, the definition of a regional frontier is endogenous since relatively more developed frontier societies choose not to locate too close to one another for fear of being invaded by the other and to maintain politico-economic dominance in the surrounding region. This means that laggard societies have been relegated to occupy the intervening space between the frontier societies. It is also possible that, amongst the laggard societies, those that are better disposed (due to unobserved factors) to adopt technologies and institutions from the frontier also locate themselves closer to the frontier. Because these decisions are made simultaneously, OLS estimates may overstate the true effect of geographical proximity on state history.

This issue can be mitigated by investigating how geographic proximity to the regional frontier in 1000 BC is related to the accumulation of state experience after 51 AD, thereby focusing on the way initial proximity is associated with subsequent statehood. However, although we measure proximity in 1000 BC rather than in 1 AD, it could be argued that this does not rule out the possibility that it still proxies for some omitted factors in the state history equation, even if initial state presence is controlled for in the regressions. And while we control for some of the geographic influence we cannot be sure that all possible confounders have been accounted for. These possibilities manifest themselves as correlations between the disturbance term and the covariate in question and hence the conventional OLS estimator used in this study will generate biased estimates. Obtaining unbiased estimates of the effect of geographic proximity on state formation and development requires an exogenous source of variation in the proximity measure. While we recognize that such potential endogeneity is a legitimate concern, establishing a credible identification strategy that satisfies the exclusion restriction assumption is incredibly difficult in this case. Consequently, the estimates are likely to reflect correlations rather than causations.

3.4 Instruments for agricultural transition

As discussed above, two instruments are used to estimate the causal effect of agricultural transition on state history: distance to the Neolithic frontier and biogeography. First, following the lead of Ashraf and Michalopoulos (2014), we use the geographical distance between a particular country and its nearest Neolithic frontier located in the same continent as a proxy for the diffusion barriers of Neolithic technology. This is constructed using the same approach as $GeoProx$ described above, except that the variable is presented in distance rather than in proximity form. The Neolithic frontiers are determined by the countries that had the earliest dates of agricultural transition in each continent and are as follows: Egypt and Libya (Africa); Mexico and Peru (America); Israel, Jordan, Lebanon and Syria (Asia); Cyprus and Greece

(Europe), and Papua New Guinea (Oceania). These frontiers are determined based on details provided by Diamond and Bellwood (2003) and Bellwood (2005), which are more or less consistent with the transition timing estimates of Putterman (2006).

The amount of prehistoric biogeographic endowments is measured by the first principal component of the numbers of locally available wild animals (14 species in total) and plants (33 species in total) about 12,000 years ago, which are edible to humans or carry economic values, based on the data of Hibbs and Olsson (2004) and Olsson and Hibbs (2005). The term "plants" refers to the number of annual or perennial prehistoric wild grasses with a mean kernel weight greater than 10 mg (the ancestors of barley, rice, corn, wheat, beans, potatoes, etc). The term "animals" denotes the number of prehistoric mammals with weights exceeding 45 kg. They are the ancient ancestors of the following 14 domesticable animals: sheep, goat, cow, pig, horse, Arabian camel, Bactrian camel, llama, donkey, reindeer, water buffalo, yak, Bali cattle and Mithan (Diamond, 1997; Olsson and Hibbs, 2005).

4. Results

4.1. State antiquity over the last two millennia

The estimated results of Eq. (1) are presented in Table 1. Column (1) investigates how agricultural transition, military transition and geographic proximity to the frontier are related to the history of state formation since 51 AD without considering the role of geographic influence. Column (2) adds the four "Diamond" variables whereas column (3) controls for other geographic effects commonly considered in the literature of long-run comparative economic development. All control variables are included simultaneously in column (4). The specification used in column (4) will be used as our baseline model for robustness checks of the results.

In all cases, geographic proximity to the frontier is found to be significantly correlated with statehood with the expected sign, although no plausible causal relationship necessarily exists. This correlation is found to be significant at the 1% level in all models. In contrast to the predictions, there is no significant relationship that exists between statehood and the timing of the transition to sedentary agriculture or the adoption of more sophisticated battle tactics and firearms.[5] The estimates in column (1) and other columns are qualitatively very similar, suggesting that the findings are unlikely to be driven by any geographic circumstances. Interestingly, both the economic and statistical significance of the coefficient of geographic proximity to the frontier improves substantially with the inclusion of control variables.

[5] We have also considered taking logs on the timing of agricultural transition, following Ashraf and Galor (2011). However, the results are insensitive to this consideration. In particular, the coefficients of agricultural transition remain insignificant whereas those of geographical proximity to the frontier and initial state presence remain statistically significant.

Table 1: Determinants of state history from 51 to 1950 AD

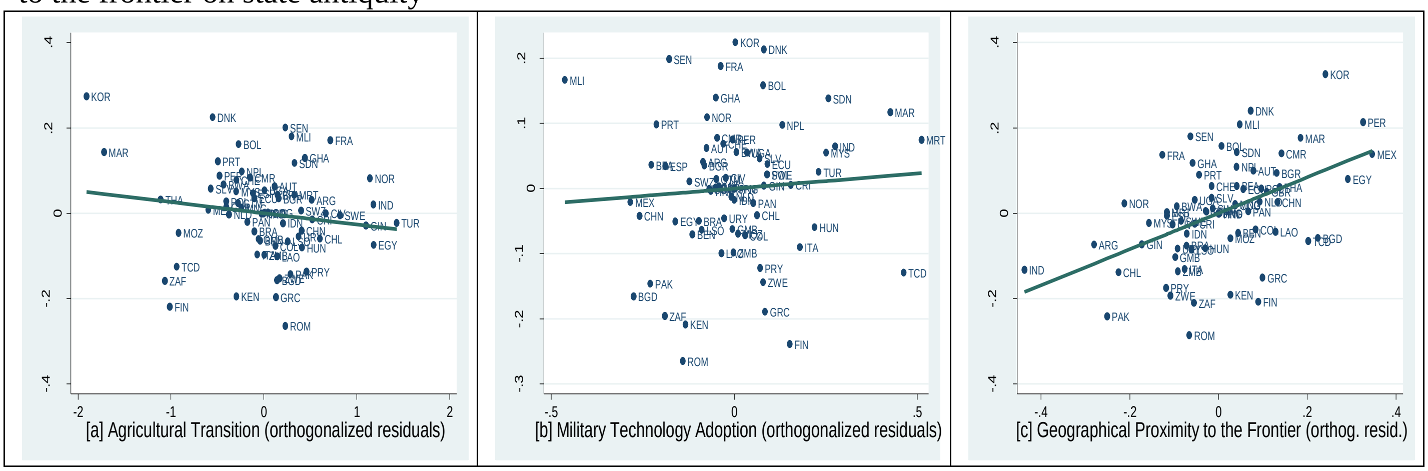
$Dep. var. = \ Statehood\ (51\ to\ 1950\ AD)$	(1)	(2)	(3)	(4)	(5)
$Initial\ state\ presence$	0.297***	0.263***	0.189**	0.202**	0.259**
	(4.264)	(2.891)	(2.475)	(2.179)	(2.179)
$Agricultural\ transition$	-0.004	-0.002	-0.008	-0.026	-0.216
	(-0.277)	(-0.126)	(-0.424)	(-0.842)	(-0.842)
$Military\ technology\ (1000\ BC)$	0.016	0.022	0.045	0.046	0.064
	(0.196)	(0.225)	(0.409)	(0.438)	(0.438)
$Geographic\ proximity\ (1000\ BC)$	0.190***	0.278***	0.301***	0.422***	0.421***
	(2.802)	(3.026)	(3.693)	(4.031)	(4.031)
$Absolute\ latitude$		0.032		1.133**	0.847**
		(0.209)		(2.173)	(2.173)
$Climate$		0.029		0.054	0.218
		(0.876)		(1.468)	(1.468)
$East - West\ orientation$		-0.057		-0.032	-0.087
		(-1.524)		(-0.766)	(-0.766)
$Size\ of\ continent$		-0.004***		-0.003**	-0.140**
		(-3.317)		(-2.262)	(-2.262)
$Land\ suitability\ for\ agriculture$			-0.199	-0.269	-0.254
			(-0.981)	(-1.313)	(-1.313)
$Soil\ suitability\ for\ agriculture$			0.022	0.129	0.092
			(0.083)	(0.463)	(0.463)
$Island$			0.078	0.160	0.076
			(0.685)	(1.380)	(1.380)
$Landlocked$			-0.016	0.035	0.060
			(-0.244)	(0.558)	(0.558)
$Mean\ distance\ to\ nearest\ coast\ or\ river$			-0.133	-0.172	-0.224
			(-1.371)	(-1.419)	(-1.419)
$\%\ of\ arable\ land$			0.000	-0.002	-0.140
			(0.128)	(-1.055)	(-1.055)
$\%\ of\ population\ living\ in\ tropical\ zones$			-0.090	0.151	0.232
			(-1.027)	(1.410)	(1.410)
$\%\ of\ population\ living\ in\ temperate\ zones$			0.102	0.165	0.275
			(0.890)	(1.570)	(1.570)
$Temperature$			0.004	0.029**	0.926**
			(0.704)	(2.594)	(2.594)
$Precipitation$			0.000	-0.000	-0.016
			(0.407)	(-0.075)	(-0.075)
$Terrain\ ruggedness$			-0.016	-0.048	-0.230
			(-0.535)	(-1.424)	(-1.424)
$Mean\ elevation$			0.043	0.214**	0.441**
			(0.688)	(2.253)	(2.253)
$Intercept$	-0.047	-0.045	-0.175	-0.995	
	(-0.887)	(-0.401)	(-0.687)	(-1.598)	
R-squared	0.647	0.735	0.762	0.828	0.828
Observations	106	75	89	70	70
Continent dummies	Yes	Yes	Yes	Yes	Yes

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 the standardized beta coefficients. In this case, the dependent variable and all regressors are "standardized" by subtracting their means then dividing by their standard deviations. Under these conditions, the standardized variables have a mean of 0 and a standard deviation of 1. The intercept estimate is zero, and so it is not shown. The continent dummies are Africa, America, Asia and Europe with Oceania as the excluded group.

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 zero and a standard deviation of one. The estimates suggest that a one standard deviation increase in the proximity to the frontier is correlated with about 0.42 units of standard deviation improvement in statehood. Finally, the coefficients of initial state presence are always positive and very precisely estimated in all regressions. In the robustness check section below, it is shown that omitting initial presence of state in the regressions does not alter the results in any significant manner (see Table 6, column (2)).

Figure 2 shows the partial regression lines for correlation between state antiquity and each of the key regressors in Eq. (1), while controlling for the influence of the other two main regressors and all geographic variables. As is evident, the partial regression lines show that only geographical proximity to the frontier is positively correlated with the length of state history, whereas agricultural transition and military technology adoption depict either a mild negative or no clear relationship with statehood, thus reinforcing the findings in Table 1.

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



Notes: the above figures illustrate the respective partial effects of agricultural transition, military technology adoption and geographical proximity 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 key explanatory variables, including the control variables, in Eq. (1). These partial regression lines are obtained based on the regression in column (4) of Table 1.

Table 2 considers several alternative specifications in which the three main covariates are entered individually or with different combinations in the regressions to ensure that the results are not driven by any particular model specification. In particular, columns (1) to (3) provide univariate analyses to shed light on the correlations between statehood and the individual covariates considered in Eq. (1), whereas columns (4) to (6) consider these covariates in different pairs. Estimates of the control variables are not reported to conserve space.

Table 2: Alternative specifications

$Dep.var. = Statehood\ (51\ to\ 1950\ AD)$	(1)	(2)	(3)	(4)	(5)	(6)
$Initial\ state\ presence$	0.249***	0.237**	0.192**	0.211*	0.244***	0.179*
	(2.687)	(2.424)	(2.177)	(1.822)	(3.115)	(1.994)
$Agricultural\ transition$	-0.011			0.021	-0.063**	
	(-0.394)			(0.668)	(-2.296)	
$Military\ technology\ (1000\ BC)$		0.105		0.091		0.039
		(0.928)		(0.791)		(0.385)
$Geographic\ proximity\ (1000\ BC)$			0.249***		0.431***	0.364***
			(2.744)		(4.171)	(4.455)
$Intercept$	-0.239	-0.539	-0.519	-0.698	-0.458	-1.107*
	(-0.463)	(-0.890)	(-0.997)	(-0.928)	(-0.933)	(-1.865)
R-squared	0.652	0.772	0.678	0.775	0.706	0.824
Observations	87	70	87	70	87	70
Continent dummies	Yes	Yes	Yes	Yes	Yes	Yes
All control variables	Yes	Yes	Yes	Yes	Yes	Yes

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 continent dummies are Africa, America, Asia and Europe with Oceania as the excluded group. For brevity, estimates for all the control variables used in column (4) of Table 1 are not reported here.

It is evident that, in all cases, the coefficients of the 1000 BC distance variable are very precisely estimated at the 1% significance level, suggesting that initial opportunity for economic interaction across borders is significantly associated with subsequent state development. Moreover, consistent with the findings in Table 1, years since the transition to agriculture and the extent of military prowess are not related to the age of the state in any economically and statistically significant manner. In one instance, an early agricultural transition is found to be associated with less statehood (column (5)). On the whole, this exercise suggests that the above estimates are not sensitive to the inclusion or exclusion of any particular early development indicators. However, caveats should be exercised when interpreting these results, given that a specification such as that employed in the paper is very unlikely to be informative about any causal relationships. In particular, as outlined earlier, the positive association between state antiquity and geographic proximity to the frontier could be plagued by unobserved heterogeneity bias. Thus, we cannot place any causal interpretation on this coefficient.

The results so far suggest that agricultural transition is unrelated to state formation, a finding that goes largely against the proposition of Diamond (1997), and the empirical findings of Petersen and Skaaning (2010), Boix (2011) and Borcan et al. (2013). The insignificance of the coefficients of agricultural transition may in part be due to the failure to account for the fact that transition timing is endogenous, an issue that will be addressed below.

4.2 Endogeneizing agricultural transition

In Table 3 we provide more credible evidence on the relevance of agricultural transition by introducing distance to the Neolithic frontiers as the key instrument. Column (1) considers only the relevance of agricultural transition while excluding other key covariates and control variables. Control variables are included in column (2) and the other two measures of early development are introduced in column (3) along with all controls. The inclusion of these control variables enhances the plausibility of satisfying the exclusion restrictions since the instruments are likely to be correlated with some geographic characteristics, especially the geographical antecedents of the Neolithic Revolution emphasized by Diamond (1997), which may affect state antiquity through channels other than the timing of agricultural transition. For this reason, we report the estimates of these Diamond variables in the table.

In all cases, the 2SLS coefficients of agricultural transition are found to be statistically insignificant. If interpreted causally, the results would suggest that the timing of the Neolithic transition has no effect on statehood. Validity of the instrument is checked using the *F*-test for the significance of the excluded instrumental variable in the first-stage regression. The *F*-statistics are well above the rule of thumb of 10, thus providing credence to the view that the instrument is valid. This, along with the significance of the coefficient of distance to the Neolithic frontiers in the first-stage regressions, provides strong support for the hypothesized first-stage mechanism.

The first three columns of Table 3 use only distance to the Neolithic frontiers as the instrument and therefore these models are just identified. To perform tests of identifying restriction, the index of biogeographic endowment is introduced as an additional instrument in columns (4) to (6). These tests suggest that the exclusion restrictions are not violated. The first-stage estimates indicate that biogeography is not a strong instrument for agricultural transition whereas distance to the Neolithic frontiers continues to provide a valid source of exogenous variation for identifying the variation in the timing of the agricultural transition. This is also reflected in the significant drop in the magnitudes of the *F*-statistic whereby in one case its value is below 10 (column (6)). Thus, on econometric grounds, biogeography turns out to be a weak instrument in this case, although its use is justifiable on a priori reasoning.

Although it is widely suggested that an *F*-statistic above 10 would not subject the estimates to the criticism of weak instruments, which can generate substantial biases, Angrist and Pischke (2009) argue that this is not an empirical prerequisite and such a rule should not be mechanically applied. Following their suggestion, we also check the 2SLS results for the over-identified model using the Limited Information Maximum Likelihood (LIML) estimator. While the LIML is less precise it is also less biased compared to 2SLS. The results reported in the last three columns show that the LIML estimates are indeed very similar to the 2SLS results with standard errors only marginally above the 2SLS estimates, thus suggesting that instrument relevance is not an issue here.

Table 3: Instrumental variable estimates

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	LIML	LIML	LIML
Dep. var. = Statehood (51 to 1950 AD)	*Panel A: Second-stage regressions*								
Initial state presence	0.377***	0.205**	0.145*	0.361***	0.215***	0.142*	0.361***	0.213***	0.142*
	(7.126)	(2.508)	(1.915)	(6.464)	(2.661)	(1.878)	(6.458)	(2.613)	(1.865)
Agricultural transition	-0.006	0.022	0.039	-0.001	0.014	0.042	-0.001	0.016	0.042
	(-0.446)	(0.736)	(0.789)	(-0.090)	(0.486)	(0.856)	(-0.091)	(0.538)	(0.865)
Military technology			0.028			0.027			0.027
(1000 BC)			(0.346)			(0.334)			(0.331)
Geographic proximity			0.279**			0.272**			0.271**
(1000 BC)			(2.035)			(1.992)			(1.975)
Absolute latitude		0.324	1.265***		0.305	1.271***		0.310	1.272***
		(0.781)	(3.352)		(0.740)	(3.352)		(0.750)	(3.350)
Climate		0.014	0.019		0.020	0.018		0.019	0.017
		(0.376)	(0.539)		(0.548)	(0.495)		(0.502)	(0.484)
East − West orientation		0.038	0.011		0.034	0.013		0.035	0.013
		(0.533)	(0.160)		(0.471)	(0.188)		(0.486)	(0.194)
Size of continent		-0.003	-0.004		-0.003	-0.004		-0.003	-0.004
		(-1.204)	(-1.567)		(-1.089)	(-1.576)		(-1.113)	(-1.578)
Intercept	0.090	-0.362	-1.271***	0.082	-0.333	-1.284***	0.082	-0.340	-1.286***
	(0.983)	(-0.774)	(-2.785)	(0.880)	(-0.718)	(-2.804)	(0.880)	(-0.731)	(-2.804)
R-squared	0.591	0.640	0.803	0.596	0.645	0.801	0.596	0.644	0.800
Observations	143	87	70	135	87	70	135	87	70
Continent dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Other control variables	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Dep. var. = Agricultural Transition	*Panel B: First-stage regressions*								
Distance to the Neolithic frontier	-0.055***	-0.045***	-0.037***	-0.054***	-0.049***	-0.039***	-0.054***	-0.049***	-0.039***
	(-12.443)	(-6.895)	(-3.338)	(-10.436)	(-6.614)	(-3.294)	(-10.436)	(-6.614)	(-3.294)
Biogeography				0.292	-0.965	-0.537	0.292	-0.965	-0.537
				(0.738)	(-1.120)	(-0.551)	(0.738)	(-1.120)	(-0.551)
R-squared	0.855	0.928	0.930	0.848	0.929	0.931	0.848	0.929	0.931
Observations	143	87	70	135	87	70	135	87	70
Continent dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Other control variables	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
	Panel C: Diagnostic check								
First-stage F-statistic on the excluded instrument(s)	154.839	47.542	11.142	69.278	24.494	5.636	69.278	24.549	5.636
Overidentifying restrictions	-	-	-	0.839	1.981	0.085	0.839	1.978	0.085
(p-value)				(0.359)	(0.159)	(0.771)	(0.361)	(0.165)	(0.772)
Endogeneity test (p-value)	0.227	1.618	1.634	0.046	0.980	1.859	0.046	0.980	1.859
	(0.635)	(0.208)	(0.207)	(0.831)	(0.326)	(0.179)	(0.831)	(0.326)	(0.179)

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 continent dummies are Africa, America, Asia and Europe with Oceania as the excluded group. For brevity, estimates for the full set of control variables used in column (4) of Table 1 are not reported here. In columns (1) to (3), agricultural transition is instrumented by distance to the regional Neolithic frontiers. This variable and the first principal component of the availability of domesticable plants and animals are used as the instruments for agricultural transition in columns (6) to (9).

Overall, the estimates from columns (3), (6) and (9) demonstrate that the significant correlation between geographic proximity and state antiquity continues to hold, whereas the association between agricultural transition and military technology adoption continues to be lacking. These results are qualitatively very similar to the baseline OLS estimates in column (4) of Table 1, although as expected the estimates are less precise. Overall, these findings suggest that our results are unlikely to be plagued by endogeneity due to agricultural transition, as also confirmed by the Hausman's endogeneity tests reported in the last row of the table. Consequently, all subsequent analyses are based only on OLS.

4.3. State presence up to 500 AD, 1000 AD and 1500 AD and since 1500 AD

To gain some understanding of how these early development indicators are related to the accumulation of state experience over time, we consider state history for five, ten and fifteen centuries since 51 AD as alternative dependent variables. These estimates are reported in the first three columns of Table 4. Geographic proximity to the frontier is found to be significantly correlated with state history when the latter covers up to 1000 AD and 1500 AD. Hence, the results suggest that geographic barriers to development did not matter during the process of early state formation. Their importance only became apparent after 500 AD.

Table 4: Alternative periods of state history

	(1)	(2)	(3)	(4)	(5)	(6)
$Dep. var. =$	Statehood: 51-500AD	Statehood: 51-1000AD	Statehood: 51-1500AD	Statehood: 1501-1950AD	Statehood: 1651-1950AD	Statehood: 1851-1950AD
Initial state presence	0.876***	0.533***	0.302**	0.117	0.128	0.071
	(7.292)	(3.882)	(2.603)	(0.843)	(0.938)	(0.613)
Agricultural transition	-0.202	-0.216	-0.198	-0.202	-0.218	-0.110
	(-1.528)	(-1.138)	(-0.833)	(-0.605)	(-0.697)	(-0.437)
Military technology (1000 *BC*)	0.081	0.098	0.115	-0.051	-0.085	-0.122
	(0.867)	(0.993)	(0.901)	(-0.251)	(-0.452)	(-0.898)
Geographic proximity (1000 *BC*)	0.058	0.277***	0.435***	0.304**	0.260*	0.210*
	(0.600)	(2.734)	(4.181)	(2.121)	(1.921)	(1.894)
R-squared	0.895	0.862	0.841	0.675	0.684	0.763
Observations	70	70	70	70	70	70
Continent dummies	Yes	Yes	Yes	Yes	Yes	Yes
All control variables	Yes	Yes	Yes	Yes	Yes	Yes

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 continent dummies are Africa, America, Asia and Europe with Oceania as the excluded group. For brevity, estimates for all the control variables used in column (4) of Table 1 are not reported here.

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 (3) 1801-1950 AD. The results are reported in columns (4) to (6) in Table 4. Interestingly, geographical distance to the frontier is found to be most significantly related to statehood during the sub-period 1501-1950 AD. The strength of this connection weakens when more recent sub-periods are considered, suggesting that geographical proximity is less relevant for the formation of states since 1650 AD. This result is perhaps unsurprising given that the technologies of transportation and telecommunications have gradually improved over time, thus overcoming the prevailing geographic barriers that deterred economic interaction.

5. Robustness Checks

5.1 Alternative measures of geographic proximity

Our findings so far indicate that geographic proximity is the only significant covariate that matters for the accumulation of state experience. It would therefore be necessary to ensure that the results are not driven by the way it is measured. To this extent, we consider several alternative measures of geographic proximity to the frontier.

First, we consider the migratory distance variables of Ashraf and Galor (2013). Their approach takes into consideration the previous evidence on prehistoric human migration patterns that humans did not cross large bodies of water during their exodus from East Africa. This is done by imposing at least one of the following five intermediate waypoints: Cairo (Egypt), Istanbul (Turkey), Phnom Penh (Cambodia), Anadyr (Russia), and Prince Rupert (Canada). *Homo sapiens* are assumed to have taken these paths before arriving at various new settlements across the globe. Distance is calculated using the Haversine formula, and to facilitate the comparison of this measure with our results all migratory variables are expressed in proximity form, using the approach described earlier. It should be noted that there is very little overlap between the cities chosen by Ashraf and Galor (2013) and those frontiers selected in this study. This exercise therefore serves as a useful check on the sensitivity of the estimates to the proximity measures used.

Column (1) in Table 5 shows the results of using migratory proximity from Addis Ababa as the alternative indicator for our geographic proximity measure. Its coefficient, however, is insignificant at the conventional levels. This is likely to reflect the fact that Addis Ababa was not one of the global frontiers in 1000 BC, although it was the cradle of humankind.

Next, in columns (2) to (4), we consider Tokyo, Mexico City and London as alternative global frontiers, using the data provided by Ashraf and Galor (2013). In this case we find all coefficients of the migratory proximity measures to be highly significant. In column (5) we consider these cities as the representative frontiers in their continents, and construct a new migratory proximity variable which is relative to the regional frontiers rather than one single global frontier (Oceanic countries are assumed to have an Asian frontier, i.e., Tokyo). This concept is more in line with the way we measure geographic proximity earlier. It is evident that its coefficient is very precisely estimated. Column (6) includes this variable along with our geographic proximity variable in the regressions, but only the coefficient of the latter is found to be statistically significant. The results (unreported) are similar when each of the migratory measures in columns (1) to (4) is used instead.

Table 5: Alternative geographic proximity measures

$Dep.var. =$ $Statehood$ (51 to 1950 AD)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$Initial\ state\ presence$	0.211*	0.132	0.144	0.209*	0.127	0.175	0.190**	0.197*
	(1.807)	(1.412)	(1.561)	(1.874)	(1.225)	(1.587)	(2.338)	(2.013)
$Agricultural\ transition$	0.024	0.015	0.003	-0.004	0.031	-0.015	-0.032	-0.023
	(0.734)	(0.539)	(0.092)	(-0.110)	(1.148)	(-0.431)	(-1.281)	(-0.703)
$Military\ technology$ (1000 BC)	0.096	0.066	0.053	0.051	0.111	0.060	0.023	0.038
	(0.819)	(0.640)	(0.524)	(0.443)	(0.909)	(0.525)	(0.261)	(0.374)
$Migratory\ proximity$ $-Addis\ Ababa$	-0.144							
	(-0.408)							
$Migratory\ proximity\ -Tokyo$		0.844***						
		(3.757)						
$Migratory\ proximity$ $-Mexico\ city$			1.382***					
			(4.160)					
$Migratory\ proximity\ -London$				0.822***				
				(2.748)				
$Migratory\ proximity\ -\ various$ $origins$					0.581***	0.196		
					(2.719)	(0.611)		
$Geographic\ proximity$ (1000 BC) $-baseline\ measure$						0.356**		
						(2.224)		
$Geographic\ proximity$ (1 AD)							0.522***	
							(5.453)	
$Geographic\ proximity$ (1000 BC) $-excluding\ the\ frontiers$								0.402***
								(3.488)
$Intercept$	-0.645	-1.381**	-1.247**	-0.825	-1.181*	-1.111*	-1.166**	-1.103
	(-0.834)	(-2.340)	(-2.083)	(-1.110)	(-1.858)	(-1.705)	(-2.069)	(-1.626)
R-squared	0.776	0.822	0.823	0.799	0.806	0.830	0.863	0.824
Observations	70	70	70	70	70	70	70	68
Continent dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
All control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

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 continent dummies are Africa, America, Asia and Europe with Oceania as the excluded group. For brevity, estimates for all the control variables used in column (4) of Table 1 are not reported here.

In column (7), we measure geographical proximity to the frontier in 1 AD. This variable is constructed in the same way as its 1000 BC counterpart used in previous tables, except that the frontiers are identified using population density data for 1 AD, along the line of Ashraf and Galor (2011, 2013). Furthermore, the chosen regional leaders in 1000 BC are likely to have accumulated some significant state experience and so their inclusion in the regressions may generate some pseudo correlation between the dependent variable and the geographic proximity measure. Therefore, we exclude the regional leaders in the estimation in column (8). In both cases the results do not change in any significant manner. On the whole, the results here suggest that the correlation between statehood and geographic proximity to the frontier found earlier is not sensitive to the way the latter is measured.

5.2 Other sensitivity checks

Several other 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 previous ones, and this may excessively downplay the importance of early state history. Column (1) of Table 6 provides the estimates with no discounting applied to the state history variable. The results, however, do not show any significant variation qualitatively.

Secondly, the inclusion of the initial state variable may mask the importance of other covariates, particularly if it is predicted by early agrarian development, thus rendering the coefficient of agricultural transition insignificant. We check this possibility by excluding initial state presence in column (2). The results clearly show that the influence of agricultural settlements remains insignificant. This is also the case when either one or both of the instruments discussed earlier are used (results unreported).

Thirdly, 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 (3) are remarkably stable.

Fourthly, countries within the same continents tend to have similar early historical conditions and state performance, and these arbitrary correlations may bias our results. To address this concern standard errors are clustered by continent to allow for these patterns within but not across continents. That is, the observations are assumed to be independent across continents but not within continents. The estimates in column (4), however, remain largely insensitive to this consideration.

Next, 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 (see, e.g., Johnson and Earle, 2000). 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.

Column (6) controls for the effects of colonialism. 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. However, it is found to be insignificant.

Columns (7) and (8) consider two additional measures of early development, i.e., the timing of the first city formation and the historical duration of human settlements, respectively, which may also have a bearing on the formation and development of states. The first indicator captures how many thousands of years before 2000 AD was a city first formed in a particular country. The second measures the date of the first settlement by modern humans since prehistoric times. The results show that the inclusion of these variables does not affect our earlier findings in any significant manner. To the extent that ethnically heterogeneous societies are harmful for the successful and persistent formation of states, the significance of the duration of human settlements supports the thesis of Ahlerup and Olsson (2012) that early civilizations are positively correlated with ethnic diversity.

Table 6: Robustness of results (standardized estimates)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
$Dep. var. = Statehood$ $(51\ to\ 1950\ AD)$	No depreciation for statehood	Exclude initial state presence	Robust regression	Clustered standard errors	Add Population density	Add Colony	Add timing of first city formation	Add historical settlement duration	Add genetic distance to the frontier	Include all controls from col. (5) to (9)
Initial state presence	0.428***		0.162	0.259	0.266**	0.254**	0.228*	0.247**	0.258**	0.245**
	(3.76)		(1.58)	(1.87)	(2.12)	(2.25)	(1.90)	(2.20)	(2.17)	(2.22)
Agricultural transition	-0.214	-0.053	0.094	-0.216	-0.196	-0.140	-0.268	-0.170	-0.215	-0.103
	(-1.01)	(-0.19)	(0.43)	(-0.71)	(-0.73)	(-0.56)	(-1.01)	(-0.74)	(-0.81)	(-0.42)
Military technology $(1000\ BC)$	0.086	0.120	0.070	0.064	0.040	0.057	0.068	0.085	0.066	0.043
	(0.73)	(0.73)	(0.51)	(0.41)	(0.27)	(0.40)	(0.48)	(0.78)	(0.44)	(0.37)
Geographic proximity $(1000\ BC)$	0.364***	0.432***	0.328***	0.422***	0.444***	0.355***	0.403***	0.326***	0.423***	0.252***
	(3.92)	(3.55)	(2.74)	(6.58)	(4.48)	(3.43)	(3.91)	(3.43)	(4.06)	(3.10)
Population density $(1\ AD)$					-0.124					-0.066
					(-1.09)					(-0.63)
Colony						-0.318*				-0.313**
						(-1.96)				(-2.22)
Timing of first city formation							0.137			0.022
							(1.08)			(0.17)
Historical duration of human settlements								-0.472***		-0.517***
								(-4.09)		(-3.80)
Genetic proximity									0.005	-0.067
									(0.04)	(-0.57)
R-squared	0.871	0.801	0.815	0.828	0.834	0.840	0.832	0.852	0.828	0.869
Observations	70	70	70	70	70	70	70	70	70	70
Continent dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
All control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

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 continent dummies are Africa, America, Asia and Europe with Oceania as the excluded group. The estimated coefficients are standardized beta coefficients. For brevity, estimates for all the control variables used in column (4) of Table 1 are not reported here.

Column (9) considers the role of human genetic proximity relative to the global frontier in the process of state experience accumulation. This variable measures the ease of cross-border cultural diffusion and is likely to be associated with a stronger history of statehood through the facilitation of state experience diffusion due to the low adoption and imitation costs. However, we do not find any evidence that genetic proximity has an additional role to play, over and above the reduction in barriers arising from geographical proximity. The last column includes all additional control variables considered in columns (5) to (9) in the same specification. Our previous results continue to prevail.

It is important to note that while genetic proximity is measured for 1 AD using population data in the same year to identify the regional frontiers, genetic 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 were fairly limited during the pre-colonial era.[6] Given that the validity of this assumption is questionable and that the actual measure of genetic proximity in 1 AD is unobservable, the regressions may produce spurious estimates, and hence the evidence presented here does not conclusively show that genetic proximity is unrelated to state history.

Finally, in the core analyses conducted in sections 4.1 and 4.2, we have allowed the sample size to vary across the specifications. While this approach incorporates as much information as possible in a given specification, it is not able to correctly assess the statistical stability of the point estimates of interest when the sample size changes following the inclusion of additional control variables in the specification. To address this concern we hold the regression sample constant across specifications by using 70 countries for which data for all variables are available. This alternative approach enables us to assess if changes in the point estimates of interest are driven by changes in omitted variable bias as more control variables are included in the specification. Tables A5 to A7 in the appendix reproduce the estimates of Tables 1 to 3, respectively, using a common sample of 70 countries. As is evident, our results are insensitive to this consideration.

6. 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, financial underdevelopment, poor growth rates, etc. This scrutiny 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 literature, however, has paid little attention to understanding the deep historical origins behind the rise of statehood. 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, and geographical proximity to the frontier in the formation and persistent development of state government. Our results indicate that a longer duration since agricultural transition and higher adoption

[6] There are, however, some exceptions, such as the the "Bantu Expansion" in sub-Saharan Africa, the westward movement of Turkic peoples across Eurasia, and the "Barbarian Invasion" of the Roman Empire.

rates of military technology are uncorrelated with a longer state history. However, the estimates indicate that countries which are located far from the frontier tend to suffer from a lack of state experience. The size of the correlation detected between geographic proximity to the frontier and statehood is equivalent to 42% of one standard deviation of state history. The results are remarkably robust to a series of sensitivity checks.

Nevertheless, it should be highlighted that this study merely provides estimates of statistical association, given that there are good arguments that one is not measuring the causal effects of the early development indicators on the age of statehood. In particular, the estimates could be plagued by reverse causality whereby the rise of statehood necessitates building up military strength and influences the location choice of frontier and follower countries. The results could also be subject to unobserved heterogeneity bias in which the observed association merely reflects a correlation of both statehood and the covariates with some unobserved characteristics, thus confounding the relationships found.

In an attempt to address the issue of endogeneity, we follow established identification strategies in the literature by using distance to the Neolithic frontiers and biogeographic endowments as instruments for the timing of agricultural transition. Notwithstanding this consideration, the coefficients of the timing of the transition to sedentary agriculture remain insignificant at the conventional levels. The same strategy, however, cannot be applied to the other two covariates due to the difficulties associated with finding valid instruments and establishing credible identification strategies for satisfying the exclusion restriction assumptions.

While we have tried to address reverse causality by regressing accumulated state experience since 51 AD on initial military prowess and geographic proximity to the frontier in 1000 BC, we cannot rule out the possibility that these covariates are proxying some omitted influence that can lead them and statehood to vary in the same direction, even after controlling for initial state presence and a broad set of observable geographic characteristics. Consequently, we would observe spurious correlations between statehood and these covariates that are not causal, due to the difficulty in adequately accounting for unobservable characteristics. However, despite the difficulty in confronting the question of causality, this research adds to the growing literature on long-run comparative development and provides some basic understanding of the forces associated with the emergence of states and their persistent development. It is hoped that the issues of endogeneity can be more properly accounted for in future research.

An intriguing relationship uncovered in this paper is that initial state presence is positively correlated with the subsequent development of statehood. This finding can be interpreted as preliminary evidence suggesting the presence of increasing returns to state capacity in the sense that societies which initially possessed higher levels of state capacity were more able to deepen their state experience over time. This relationship, however, is found to have prevailed only during the first 1500 years of the Common Era; its strength gradually diminished and fully disappeared after 1500 AD. While it is not clear what the underlying mechanisms are in driving this change, this is an interesting reduced-form statistical relationship that warrants some further investigations.

Another issue worth highlighting is the fact that the findings in this paper do not necessarily negate the widely held view that the timing of agricultural settlement and the historical ability to create or adopt metallurgy and military innovations may have been crucial for state development due to two reasons. First, since our analysis mostly deals with the follower societies, which typically adopted farming techniques and military technology from a small set of regional leaders, it is necessarily silent about how states evolved in the "frontier" societies. It is plausible that the formation and development of states in these "frontier" societies is far more likely to be driven by agricultural settlements and military innovations than geographical proximity factors. Second, it may well be the case that the geographical proximity to the regional frontier and initial state presence indicators are serving as less noisy proxies for the timing of the adoption of agriculture and the ability to develop advanced metal-based military technologies than those used in the analysis to capture the influence of these variables. It is therefore plausible that once better measures of these variables become available, the propositions arguing for their role in state formation and persistence will become evident in the relationships.

Appendix

A. Summary statistics

Panel I in Table A1 provides the summary statistics of the key variables used in the empirical estimation. In line with our predictions, the correlations in panel II show that state antiquity is positively correlated with the timing of agricultural transition, the adoption rate of military technology, and geographic proximity to the regional technology frontier.

Table A1: Descriptive statistics and pair-wise correlations of key variables

[I] Descriptive statistics	Obs.	Mean	Std. Dev.	Min.	Max.		
State history from 51AD to 1950 AD	70	0.488	0.254	0.021	0.938		
Initial state presence (1 AD to 50 AD)	70	0.200	0.325	0.000	1.000		
Timing of agricultural transition ('000 years)	70	4.552	2.085	1.000	10.000		
Military technology adoption in 1000 BC (index)	70	0.307	0.354	0.000	1.000		
Geographical proximity to the frontier in 1000 BC (index)	70	0.511	0.254	0.000	1.000		
Distance to the Neolithic frontier (100 km)	70	0.307	0.354	0.000	1.000		
Biogeography	70	0.511	0.254	0.000	1.000		
[II] Pair-wise correlations	(a)	(b)	(c)	(d)	(e)	(f)	(g)
(a) State history from 51AD to 1950 AD	1.000						
(b) Initial state presence (1 AD to 50 AD)	0.557	1.000					
(c) Timing of agricultural transition ('000 years)	0.743	0.622	1.000				
(d) Military technology adoption in 1000 BC (index)	0.661	0.538	0.692	1.000			
(e) Geographical proximity to the frontier in 1000 BC (index)	0.490	0.480	0.629	0.359	1.000		
(f) Distance to the Neolithic frontier (100 km)	-0.018	-0.242	-0.231	-0.088	-0.604	1.000	
(g) Biogeography	0.697	0.464	0.769	0.678	0.457	-0.217	1.000

Notes: Statistics in the table include only the 70 countries used in the baseline regressions. Sources and definition of data are described in the text.

B. Construction of state antiquity

The state antiquity index of Putterman (2004) includes 39 periods of 50 years spanning from 1 to 1950 AD. It consists of the following three components:

$st^{EXISTENCE}$: Is there a government above the tribal level?
[*Yes* = 1; *No* = 0]

$st^{AUTONOMY}$: Is this government foreign or locally based?
[*Local* = 1; *In between* = 0.75; *Foreign* = 0.5]

$st^{COVERAGE}$: How much of the territory of the modern country was ruled by this government?
[*>50%* = 1; *25–50%* = 0.75; *10–25%* = 0.5; <10% = 0.3]

State history (S_t) in any particular 50 year period (t) is measured as the product of the scores on these components and 50. Consequently, a score of 0 indicates no presence of state, 25 reflects that a country has a supra-tribal authority but its entire territory is ruled by a foreign authority, and 50 indicates the presence of an autonomous nation, and so on.

$$S_t = st^{EXISTENCE} \ x \ st^{AUTONOMY} \ x \ st^{COVERAGE} \ x \ 50 \tag{A1}$$

$$0 \leq S_t \leq 50, t = 1, 2, \dots, 39$$

In our study, the length of state history, or state antiquity ($STATE$), is measured as the cumulative existence, autonomy and coverage of state by combining data over 38 periods since 51 AD, excluding the initial period 1-50 AD. A 5% discount rate is applied to allow for the fact that states formed in the more distant past have relatively less influence today. To ease interpretation the series is scaled into a range between 0 and 1 using its maximum possible value. Accordingly, state history for a particular country over the last two millennia (51 – 1950 AD) is calculated as follows:

$$STATE = \frac{\sum_{t=1}^{38}(1.05)^{1-t} \cdot s_t}{\sum_{t=1}^{38}(1.05)^{1-t} \cdot 50};\ 0 \leq STATE \leq 1 \quad \text{(A2)}$$

Table A2: Average values of state antiquity across continents (151 countries)

Continent	$STATE$	No. of countries
Africa	0.329	46
Asia	0.624	37
America	0.296	27
Europe	0.586	37
Oceania	0.070	4
All countries	0.452	151

Source: Putterman (2004).

The distribution of $STATE$ for the total sample of 151 countries is given in Table A2. It is evident that states in Asia and Europe are nearly twice as old as those in Africa and America. Austria, Cambodia, China, Ethiopia, France, Hong Kong, Japan, South Korea, Nepal and Turkey are among the nations that have accumulated the highest levels of state experience (average $STATE$ = 0.887). Countries in Oceania, such as Fiji ($STATE$ = 0.042), New Zealand ($STATE$ = 0.069) and Papua New Guinea ($STATE$ = 0.021), and African nations such as the Central African Republic, Gabon, Kenya, Liberia, Sierra Leone, Togo and Zimbabwe (average $STATE$ = 0.058) are among those countries that have the youngest states. Table A3 illustrates how the state history index is constructed for some of the oldest states in each continent.

Table A3: Examples of state history construction for experienced states in each continent

Egypt (Africa)	1-850 AD: (1, 0.5, 1) under Roman's occupation; 851-900 AD: (1, 1, 1) establishment of the Tulunid dynasty; 901-950 AD: (1, 0.5, 1) became a foreign-based caliphal province; 951-1000 AD: (1, 0.77, 1) the Fatimid Caliphate was established in 973; 1001-1150 AD: (1, 1, 1) under the rule of the Egypt-based Fatimids; 1151-1200 AD: (1, 0.855, 1) the Ayyubid dynasty became allegiant to the foreign-based Abbasid Caliphate in 1171; 1201-1250 AD: (1, 0.75, 1) became quasi-independent under the Ayyubids; 1251-1500 AD: (1, 1, 1) under the autonomy of the Mamluk dynasty; 1501-1550 AD: (1, 0.67, 1) conquered by the Ottomans in 1517; 1551-1800 AD: (1, 0.5, 1) under the Ottomans' rule; 1801-1850 AD: (1, 0.75, 1) allowed partial autonomy under the Ottomans and the French; 1851-1900 AD: (1, 0.66, 1) under the British occupation in 1882; 1901-1950 AD: (1, 0.78, 1) independent from Britain in 1922.
China (Asia)	1-200 AD: (1, 1, 1) ruled by the Han dynasty; 201-600 AD: (1, 1, 0.75) the Han empire was split into several warring states; 601-750 AD: (1, 1, 1) unified under the Sui and, later, the T'ang dynasties; 751-800 AD: (1, 1, 0.75) central regime broke down, followed by some political chaos; 801-900 AD: (1, 1, 1) the T'ang power was restored; 901-1000 AD: (1, 1, 0.75) centralized order collapsed again and multiple kingdoms emerged; 1001-1250 AD: (1, 1, 1) power was united under the Sung dynasty; 1251-1300 AD: (1, 0.895, 1) the Yuan dynasty was established in 1279; 1301-1350 AD: (1, 0.75, 1) under the quasi-local Mongol rule; 1351-1400 AD: (1, 0.91, 1) the Yuan dynasty collapsed and was replaced by the Ming dynasty in 1368; 1401-1900 AD: (1, 1, 1) the Chinese rule was integrated under the Ming and Ch'ing dynasties; 1901-1950 AD: (1, 1, 0.875) The Ch'ing rule ceased in 1911 and was replaced by the Republic of China, but the nation was politically fragmented.
Peru (America)	1-600 AD: (0, 0, 0) non-existence of states; 601-700 AD: (1, 1, 0.5) the Huari state existed in the southern part; 701-800 AD: (1, 1, 1) Huari grew to become an empire; 801-1450 AD: (1, 1, 0.75) the Huari empire collapsed and the area was ruled by a number of smaller states; 1451-1500 AD: (1, 1, 1) the Inca empire united the entire area; 1501-1550 AD: (1, 0.82, 1) conquered by the Spanish in 1532; 1551-1800 AD: (1, 0.5, 1) under Spanish colonial rule; 1801-1850 AD: (1, 0.79, 1) gained independence in 1821; 1851-1950 AD: (1, 1, 1) under independent rule.
France (Europe)	1-450 AD: (1, 0.5, 1) Gaul was under the Roman's rule; 451-750 AD: (1, 1, 0.75) controlled by multiple Germanic kingdoms; 751-800 AD: (1, 1, 0.895) rule was unified by Charlemagne in 771; 801-850 AD: (1, 1, 1) under unified domestic rule; 851-1250 AD: (1, 1, 0.75) rule was divided among several Frankish kingdoms; 1251-1350 AD: (1, 1, 1) under centralized rule and area expanded to nearly its current size; 1351-1450 AD: (1, 0.75, 0.75) a large part of the area was held by the English during the Hundred Years War; 1451-1550 AD: (1, 1, 1) the Hundred Years War ended and territory was regained; 1551-1600 AD: (1, 1, 0.75) rule was divided by domestic religious wars; 1601-1950 AD: (1, 1, 1) mostly under unified control.

Australia (Oceania)	1-1800 AD: (0, 0, 0) non-existence of states; 1801-1850 AD: (1, 0.75, 1) British settlement; 1851-1950 AD: (1, 1, 1) gained independence from Great Britain.

Notes: The values in each parenthesis reflect ($st^{PRESENCE}$, $st^{AUTONOMY}$ and $st^{COVERAGE}$). For instance, $st^{PRESENCE}$ is 1, $st^{AUTONOMY}$ is 0.5 and $st^{COVERAGE}$ is 1 for Egypt in every 50-year period from 1 to 850 AD. Source: Putterman (2004).

C. Definition of variables and data sources

Table A4: Definition of variables and data sources

Variable	Description	Source
State antiquity	An index of state history covering the period from 51 AD to 1950 AD, scaled to take values between 0 and 1. The latest version, v3.1, is used.	Putterman (2004)
Years since agricultural transition	The number of years elapsed, in 2000 AD, since the transition to agriculture was estimated to occur (in thousand years).	Putterman (2006)
Military technology adoption	The average adoption rates of military technology in 1000 BC, covering the use of stone, bronze and iron tools in the ancient societies.	Comin et al. (2010)
Geographical proximity to the regional frontier	The 'Haversine' distance between the central points of a particular country and a regional leader based on their present territories. The 'Haversine' formula calculates the shortest distances between two points on the surface of a sphere from their longitudes and latitudes. It is measured as $1 - (Geog.Dist._{i,RF}/Geog.Dist._{Max})$ 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 frontiers in 1000 BC are chosen based on the size of the cities whereas those in 1 AD are determined by population density. The number of frontiers in each region is set to be two, but in cases where the second frontier cannot be identified only one frontier has been chosen. Specifically, the frontiers chosen in each continent for 1000 BC are Egypt (Thebes, Memphis) for Africa, Mexico (Olmec civilization) and Peru (Chavín civilization) for America, China (Xi'an, Luoyang) and Iraq (Babylon) for Asia, Greece (Mycenaean civilization) for Europe, and Australia for Oceania. For 1 AD the frontiers are Egypt and Tunisia for Africa, Mexico and Peru for America, China and Iraq for Asia, Greece and Italy for Europe, and Papua New Guinea for Oceania.	Central Intelligence Agency for longitudes and latitudes; Chandler (1987), Modelski (2003), Morris (2010) and TimeMaps (2013) for size of urban settlements; Worldmapper (http://www.worldmapper.org/) for population density.
Neolithic distance to the regional frontier	Measures the geographic distance between a country and its nearest Neolithic centre in the same continent. The Neolithic frontiers are identified based on the estimated archaeological sites for the centres of origin of agriculture reported in Diamond and Bellwood (2003). Geographical distance is calculated using the 'Haversine' formula.	Diamond and Bellwood (2003)
Biogeographic endowments	The first principal component of the availability of domesticable wild plants and animals about 12,000 years ago.	Olsson and Hibbs (2005)
Climate	Climate classification of 1 to 4 based on the Köppen's approach. A higher value indicates more favourable climate conditions for agriculture.	Olsson and Hibbs (2005)
Absolute latitude	Absolute value of the latitude of each country.	Olsson and Hibbs (2005)
East-West orientation	The East-West orientation of the axis, calculated as the longitudinal distance between the furthest eastern and western points in each continent divided by latitudinal distance.	Olsson and Hibbs (2005)

Size	Size of landmass to which a country belongs (in millions of square km)	Olsson and Hibbs (2005)
Land suitability of agriculture	An index of the suitability of land for agriculture based on several ecological indicators of climate and soil suitability for cultivation.	Michalopoulos (2012)
Soil suitability of agriculture,	An index of the suitability of soil for agriculture based on carbon density (organic content) and pH (nutrient content) of the soil.	Michalopoulos (2012)
Island	A dummy variable that equals 1 if a country is an island and 0 otherwise.	CIA World Fact Book
Landlockedness	A dummy variable that equals 1 if a country is fully enclosed by land and 0 otherwise.	CIA World Fact Book
Distance to the nearest coast or river	The mean distance of a country to the nearest coastline or sea-navigable river (in km)	Gallup et al. (2010)
Percentage of arable land	The fraction of a country's total land area that is suitable for growing crops.	WDI (2012)
Percentage of population living in tropical zones	The percentage of the population of each country living in tropical climate areas.	Gallup et al. (2010)
Percentage of population living in temperate zones	The percentage of the population of each country living in temperate climate areas.	Ashraf and Galor (2013)
Temperature	The average monthly temperature of a country over the period 1961-1990 (in degrees Celsius).	Ashraf and Galor (2013)
Precipitation	The average monthly precipitation of a country over the period 1961-1990 (in mm).	Ashraf and Galor (2013)
Terrain ruggedness	An index that quantifies small-scale terrain irregularities in each country.	Nunn and Puga (2012)
Elevation	The mean elevation of a country above sea level (in km).	Gallup et al. (2010)
Migratory proximity	The 'Haversine' distance from an origin of migration (Addis Ababa, Tokyo, Mexico and London) to a particular country's modern capital city along a land-restricted route forced through at least one of the five stopping points, including Cairo, Istanbul, Phnom Penh, Anadyr, and Prince Rupert. The variables are rescaled so that a higher value indicates greater proximity.	Ashraf and Galor (2013)
Population density	The population divided by land area.	Worldmapper (http://www.worldmapper.org/)
Colony	Colony dummy where 1 indicates a country was an ex-colony and 0 otherwise.	
Timing of first city formation	Measures how long before 2000AD a city was first formed in a country (thousand years).	Parker (1997)
Historical settlement duration	The historical duration of human settlement (in million years)	Ahlerup and Olsson (2012)
Genetic proximity to the frontier	The degree of historical relatedness for the population of a particular country relative to that of the regional frontiers in 1 AD (determined by population density). It is measured as $1-(F_{ST_{i,RF}}/F_{ST_{Max}})$, where $F_{ST_{i,RF}}$	

is the fixation index reflecting the genetic distance between the population of country i and the population of the regional frontier RF and $F_{ST_{Max}}$ is the largest genetic distance in the sample. Data on populations are matched to countries based on their ethnic composition as of 1500 AD.

Table A5: Determinants of state history from 51 to 1950 AD (sample size = 70 countries)

$Dep. var. = \ Statehood \ (51 \ to \ 1950 \ AD)$	(1)	(2)	(3)
$Initial \ state \ presence$	0.146*	0.177**	0.190*
	(1.765)	(2.280)	(2.004)
$Agricultural \ transition$	0.004	-0.015	-0.010
	(0.208)	(-0.725)	(-0.427)
$Military \ technology \ (1000 \ BC)$	0.107	0.092	0.107
	(1.045)	(0.954)	(0.862)
$Geographic \ proximity \ (1000 \ BC)$	0.208**	0.308***	0.317***
	(2.107)	(3.398)	(3.518)
$Absolute \ latitude$		0.056	
		(0.355)	
$Climate$		0.053	
		(1.654)	
$East - West \ orientation$		-0.037	
		(-0.925)	
$Size \ of \ continent$		-0.004**	
		(-2.648)	
$Land \ suitability \ for \ agriculture$			-0.196
			(-0.963)
$Soil \ suitability \ for \ agriculture$			0.024
			(0.085)
$Island$			0.297***
			(2.891)
$Landlocked$			0.048
			(0.704)
$Mean \ distance \ to \ nearest \ coast \ or \ river$			-0.285**
			(-2.369)
$\% \ of \ arable \ land$			-0.001
			(-0.589)
$\% \ of \ population \ living \ in \ tropical \ zones$			-0.008
			(-0.081)
$\% \ of \ population \ living \ in \ temperate \ zones$			0.078
			(0.790)
$Temperature$			0.006
			(1.011)
$Precipitation$			-0.000
			(-0.505)
$Terrain \ ruggedness$			-0.042
			(-1.300)
$Mean \ elevation$			0.110
			(1.578)
$Intercept$	-0.094	-0.099	-0.025
	(-1.352)	(-0.863)	(-0.077)
R-squared	0.715	0.763	0.780
Observations	70	70	70
Continent dummies	Yes	Yes	Yes

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 the standardized beta coefficients. In this case, the dependent variable and all regressors are "standardized" by subtracting their means then dividing by their standard deviations. Under these conditions, the standardized variables have a mean of 0 and a standard deviation of 1. The intercept estimate is zero, and so it is not shown. The continent dummies are Africa, America, Asia and Europe with Oceania as the excluded group. The column numbers correspond to those of Table 1.

Table A6: Alternative specifications (sample size = 70 countries)

$Dep. var. = Statehood$ (51 to 1950 AD)	(1)	(3)	(5)
Initial state presence	0.224*	0.185**	0.208**
	(1.872)	(2.096)	(2.241)
Agricultural transition	0.024		-0.025
	(0.781)		(-0.822)
Military technology (1000 BC)			
Geographic proximity (1000 BC)		0.372***	0.429***
		(4.334)	(3.897)
Intercept	-0.750	-1.129*	-1.026
	(-0.988)	(-1.875)	(-1.643)
R-squared	0.771	0.823	0.827
Observations	70	70	70
Continent dummies	Yes	Yes	Yes
All control variables	Yes	Yes	Yes

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 continent dummies are Africa, America, Asia and Europe with Oceania as the excluded group. For brevity, estimates for all the control variables used in column (4) of Table 1 are not reported here. The column numbers correspond to those of Table 2.

Table A7: Instrumental variable estimates (sample size = 70 countries)

	(1)	(2)	(4)	(5)	(7)	(8)
	2SLS	2SLS	2SLS	2SLS	LIML	LIML
$Dep. var. =$ $Statehood$ (51 to 1950 AD)	*Panel A: Second-stage regressions*					
Initial state presence	0.235**	0.250***	0.170*	0.238***	0.170*	0.239**
	(2.256)	(2.694)	(1.800)	(2.588)	(1.789)	(2.552)
Agricultural transition	0.022	0.007	0.036	0.016	0.036	0.015
	(0.702)	(0.165)	(1.222)	(0.358)	(1.216)	(0.327)
Military technology (1000 BC)						
Geographic proximity (1000 BC)						
Absolute latitude		0.803*		0.838*		0.835*
		(1.739)		(1.822)		(1.802)
Climate		0.045		0.040		0.040
		(1.176)		(1.058)		(1.049)
East − West orientation		-0.067		-0.059		-0.060
		(-0.815)		(-0.725)		(-0.725)
Size of continent		0.002		0.002		0.002
		(0.833)		(0.764)		(0.765)
Intercept	0.482***	-0.049	0.418**	-0.110	0.418**	-0.104
	(2.746)	(-0.092)	(2.548)	(-0.205)	(2.527)	(-0.192)
R-squared	0.610	0.716	0.677	0.718	0.677	0.718
Observations	70	70	70	70	70	70
Continent dummies	Yes	Yes	Yes	Yes	Yes	Yes
Other control variables	No	Yes	No	Yes	No	Yes
$Dep. var. =$ $Agricultural\ Transition$	*Panel B: First-stage regressions*					
Distance to the Neolithic frontier	-0.054***	-0.042***	-0.052***	-0.044***	-0.052***	-0.044***
	(-8.126)	(-5.442)	(-6.901)	(-4.743)	(-6.901)	(-4.743)
Biogeography			0.386	-0.454	0.386	-0.454
			(0.545)	(-0.472)	(0.545)	(-0.472)
R-squared	0.870	0.927	0.871	0.927	0.871	0.927
Observations	70	70	70	70	70	70

Continent dummies	Yes	Yes	Yes	Yes	Yes	Yes
Other control variables	No	Yes	No	Yes	No	Yes
			Panel C: Diagnostic check			
First-stage *F*-statistic on the excluded instrument(s)	28.115	16.912	13.682	8.485	13.682	8.485
Overidentifying restrictions (*p*-value)	-	-	0.408 (0.522)	1.383 (0.239)	0.408 (0.525)	1.383 (0.245)
Endogeneity test (*p*-value)	0.516 (0.475)	0.094 (0.759)	0.025 (0.872)	0.016 (0.897)	0.025 (0.872)	0.016 (0.897)

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 continent dummies are Africa, America, Asia and Europe with Oceania as the excluded group. For brevity, estimates for the full set of control variables used in column (4) of Table 1 are not reported here. In columns (1) to (3), agricultural transition is instrumented by distance to the regional Neolithic frontiers. This variable and the first principal component of the availability of domesticable plants and animals are used as the instruments for agricultural transition in columns (6) to (9). The column numbers correspond to those of Table 3.

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