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Abstract

We study the possible cooperation between nonelites exerting an unobservable effort and elites unable to commit to direct transfers and, thus, always assure the nonelites' participation. The elites can, however, incentivize investment by granting to the nonelites strong property rights to the input and a more inclusive political process, which entrusts them with control over fiscal policies. Adverse production conditions force the elites to enact strong nonelites' political and property rights to convince them that a sufficient part of the returns on joint investments will be shared via public good provision. These reforms assure cooperation. When, instead, the expected investment return is large, the elites keep control over fiscal policies but refrain from weakening the nonelites' property rights, while strengthening their own, if the production conditions are sufficiently opaque. Then, the expected cost of providing the extra public good guaranteeing the nonelites' participation is too large. These predictions are consistent with novel data on 44 major Mesopotamian polities observed for each half-century from 3050 to 1750 BCE. While a lower growing season temperature favored a larger division of the decision-making power and stronger farmers' use rights to land, only the latter are related to the diffusion of the very opaque viticulture. In addition, only the inclusiveness of the political process fostered the provision of public and ritual buildings as well as conscripted armies. Crucially, our results are robust to considering the trade potential, the severity of conflicts, and the degree of urbanization.
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1 Introduction

Overwhelming evidence suggests that strong nonelites' political and property rights are the state institutions most relevant for long run economic development and that they are correlated with each other (Besley and Persson, 2009). Documenting, however, that these two institutional arrangements are economically meaningful and reinforce each other does not help detect the forces producing each and identify their interaction (Guerriero, 2020; 2021). To contribute to filling this gap in the literature, we build on the two most influential strands of theoretical research on state-building, and we construct a "time inconsistency" model of endogenous political and property rights incorporating the main intuition of the "appropriability" theory of state formation (Boranbay and Guerriero, 2019; Guerriero, 2021; Mayshar et al., 2017). We test the implications of our model on novel data on the first stable state institutions recorded in Greater Mesopotamia during the Bronze Age.[1]

Initially characterized by states of nature lacking institutionalized decision-makers, protection of property rights, and public good provision, Greater Mesopotamia witnessed five key institutional discontinuities. First, the droughts—i.e., cold and dry spans [Weiss 2017, p. 94]—of the urban revolution period (3800-3300 BCE) magnified consumption risk and the value of irrigation infrastructures, pushing the traditional landholding groups to give up their exclusive control over resources and empower priestly figures who, due to their religious leadership, possessed precious organizational skills. Exploiting this new role, the temples gained, during the proto-states period (3300-3100 BCE), the control over public good provision. Second, the severe drying up of the city-states period (3100-2550 BCE) further reduced the farming returns, forcing the temples to share their power with rising palatial ranks, who succeeded in involving a larger population share in farming by offering tenure-for-service agreements in exchange for the participation in stable armies. The conscripted workers gained several key risk-sharing activities. Third, the kingdoms period (2550-2350 BCE) witnessed a milder climate, which curbed the palace's need to share its

[1] Building on Liverani (2014, table 1.1), we label with "Lower" ("Upper") Mesopotamia the regions of Southern (Northern) Iraq and Southwestern Iran (Northern Israel, Northeastern Syria and Southeastern Turkey) and with "Greater" Mesopotamia the union of Lower and Upper Mesopotamia. Moreover, the proto(city)-states era corresponds to the Late Uruk (Jemdet Nasr and Early Dynastic) period(s), whereas the kingdoms (empires) era coincides with the Pre-Sargonic (Akkadian, Ur III and Old Babylonian) period(s).

power with the temple. Fourth, an extended period of harsh climate and the consequent expansion of long-distance trade as an alternative economic activity encouraged, during the empires period (2350-1750 BCE), the religious and palatial elites of the polities, who anticipated the largest payoff from cooperating in trade, to involve merchant guilds in policy making. Finally, during all five periods, adverse climate shocks and the diffusion of the very opaque viticulture were accompanied by the rise of strong farmers' rights to land.

To elucidate the incentives behind these events, we study the possible cooperation between an "elite" and a "nonelite" in a joint investment, e.g., either a farming project or a long distance trade.[2] Without loss of generality, we focus on a farming activity, and we assume that it delivers a valuable harvest only if the nonelite embraces a costly and unobservable investment and the imperfectly observable farming conditions are "favorable," e.g., the temperature is suitable. An exogenous factor that might limit the observability of the farming conditions is the random diffusion of a crop whose domestication is opaque (Fleck and Hanssen, 2006), e.g., grapevine. The elite keeps the untaxed output and cannot commit to direct transfers and, thus, always assure the nonelite's participation. She can, however, lean on two other instruments. First, she can grant the nonelite a more inclusive political process, which allows him to select the tax rate and organize public good provision. Second, she can punish the nonelite for suspected shirking by weakening his use rights to land, e.g., by evicting him. By weakening the nonelite's property rights, the elite strengthens her own use rights to land (Guerriero, 2021). When the expected investment return is small, the nonelite cooperates only when his property rights are strong and under the more inclusive political institution, which allows him to fully tax the output and produce his preferred public good. When the expected investment return is intermediate, the elite keeps control over fiscal policies and can implement partial taxation. However, the nonelite's property rights must be strong to assure participation. This is because his individual rationality constraint is more stringent than his incentive compatibility constraint and, thus, punishment cannot be used as an enforcement mechanism to decrease taxation. When the investment return is large, however, the elite can also weaken the nonelite's property rights when her expected cost of providing the extra public good needed to guarantee his participation is

[2]We refer to the elite as "she", to the nonelite as "he" and to a generic party as "it."

more than compensated by her expected payoff from stronger use rights. This is more often the case when the farming conditions are more observable, and thus, the expected value of the nonelite's compensation is small. Our model entails three implications. First, the strength of the nonelite's political and property rights must be higher the smaller is the expected farming return and, thus, the more severe are the time inconsistency issues faced by an elite lacking commitment. Second, only the legal protection of the nonelite's property is related—and in a positive manner—to the opacity of farming. Finally, only the inclusiveness of the political process shapes—and in a positive way—the nonelite's expected utility.

We assess the model implications by analyzing a panel of 44 major Mesopotamian polities, spanning each half-century from 3050 to 1750 BCE. To proxy the expected farming return, we rely on the growing season temperature averaged over a 30 km radius around the coordinates of the city around which a polity evolved and, as any other non-institutional variable, over the previous half-century. The maximum distance between the cultivated fields and the settled center was 30 km. Judging from paleobotanical and extra statistical evidence, our proxy is the most suited to capture the geographic factors easing the domestication of the most diffused crops. Accordingly, it is strongly and significantly correlated with the coeval cereals yields in liters per hectare conditional on half-century fixed effects, the extent of rainfall, and our proxy for the opacity of farming. Turning to the latter, we consider the exogenous spread of viticulture. Being wine very costly to trade but greatly appreciated by the elites, the domesticated grapevine spread through inter-elite noncommercial exchanges of living vines and horticultural expertise among neighboring polities increasingly distant from its native habitat. Regarding the nonelites' expected utility, we closely follow the model assumption that they only enjoyed public good consumption, and we gather information on the number of public and ritual buildings and the presence of a conscripted army. While the former eased both the organization of economic activities and the elites' propaganda, the latter was a key risk-sharing mechanism for the nonelites and, arguably, their preferred public good (see also Ticchi and Vindigni, [2008]). To construct these and the remaining variables, we build on historical analyses of the single periods and polity-specific secondary sources informed by either land or trade contracts and/or royal inscriptions. Turning to the inclusiveness of the political process and the strength of the farmers' property rights, we

build on the events in a 40-year window around each time period. We proxy the former with a five-point score rising with the division of the decision-making power and the latter with a six-point index increasing when the land exploitation by the elites was indirect—and, thus, the nonelites' land tenure was longer—rather than direct and/or when entitlements were enforced *de jure* rather than *de facto*. Since both variables are rule-based rather than subjectively coded, there is no arbitrariness in our measurement of institutions.

Conditional on polity and half-century fixed effects, OLS estimates imply that a lower growing season temperature favored both a larger division of the decision-making power and stronger farmers' use rights to land, whereas only the latter are related—and in a positive manner—to the diffusion of viticulture. Finally, public good provision is disconnected from the protection of the farmers' property but significantly and positively linked to the inclusiveness of the political process and, more so, when the common good is the organization of a conscripted army. Even if these results are consistent with the model predictions, they might be attenuated by measurement errors or they may be capturing reverse causality and/or unobserved heterogeneity. We evaluate these issues in three steps.

First, we obtain similar results when we deal with measurement error by either considering alternative proxies for the expected farming return and institutions or treating the nonelites' rights as ordinal. To perform this last check, we study institutional formation using either fixed effects ordered Logit models or fixed effect Logit models with dependent variables dummies equal to one when some form of protection of either the nonelites' political or property rights existed. We assess the impact of these dummies on public good provision using OLS fixed effects models. Second, the independence from human effort and institutional decisions of the proxies for the expected return on farming and its opacity excludes reverse causation in our analysis of institutional formation, whereas the fact that the supply of public goods is unrelated to future institutions is inconsistent with public good provision driving coeval nonelites' rights. Finally, we follow a two-step strategy to assess the role of unobserved heterogeneity. First, we control for the other determinants of institutions and public good provision identified by the extant literature, i.e., expected return on long distance trades (Acemoglu et al., 2005; Barjamovic et al., 2019), environmental circumscription (Mayoral and Olsson, 2019), severity of external and internal conflicts (Besley and Pers-

son, 2009; Acemoglu and Robinson, 2000; Chaney, 2013), and urbanization (Inglehart and Welzel, 2005). Considering these observables either step-wise or together leaves our results almost intact. We reach similar conclusions when we also evaluate the extent of rainfall and severity of climate volatility (Boranbay and Guerriero, 2019), strength of political and property rights prevailing in neighboring polities (Fleck and Hanssen, 2013), presence of merchant institutions (Greif, 1992), political instability driven by the ascent to the throne of a young king (Cassidy et al., 2015), irrigation potential (Bentzen et al., 2016) and great rivers' avulsion (Heldring et al., 2020). Second, we calculate how much greater the influence of unobservables, relative to that of all the observables considered in the main specifications, would need to be to explain away the links among geography, institutions and public good provision. We find that it would have to be on average more than eleven times greater than the influence of all observables, which seems unlikely. Ultimately, these robustness checks make it difficult to envision that our estimates are driven by mechanisms different from those we model. Hence, we take our results as consistent with, if not proving, causality running from geography to the nonelites' rights and from the latter to public good provision.

Our paper is closely related to four strands of the vast literature on the formation and evolution of the state. First, we provide a formal framework to think about the link between geography and state formation in ancient societies emphasized by a long historical tradition (Wittfogel, 1957; Adams, 1981; Nissen, 1988; Hole, 1994; Kennett and Kennett, 2006; Staubwasser and Weiss, 2006), debunking, moreover, the conjectures that these early states emerged as a result of the production of food surplus (Smith, 1978; Childe, 1936) and that they relied solely on coercion (see also Blanton and Fargher, [2016]). Second, we share with North and Weingast (1989), Barzel and Kiser (1991) and Myerson (2008) the idea that time inconsistency issues created by the elites' inability to commit to direct transfers and, thus, always assure the nonelites' participation are key determinants of democratization.[3] Unlike these contributions and similar to Boranbay and Guerriero (2019),[4] we highlight that public good provision is the main commitment device in the elites' hands, documenting its empir-

[3]Bentzen et al. (2016) claim that the elites lack the incentive to democratize when they control the access to water resources, Ciccone and Ismailov (2022) report a U-shaped link between democratization and rainfall.
[4]Albeit this model assumes that investment never prevails under less inclusive political institutions, it produces, as our own setup, the prediction that cooperation is maximized for limited investment returns.

ical relevance for the first time. While doing so, we also provide a formal justification for the empirical regularity that democratization episodes tend to be preceded by a temporary dip in income (Acemoglu et al., 2019). Third, we incorporate into our model the Mayshar et al.'s (2017) and Ahmed and Stasavage's (2020) intuition that the elites' inability to elicit cooperation in an opaque activity could force them to grant strong nonelites' political and property rights.[5] In contrast to these papers, we theoretically and empirically demonstrate that punishment cannot be used as an enforcement mechanism and, thus, the opacity of the production process is unrelated to the inclusiveness of political institutions and is linked to nonelites' property rights only when the elites prefer to exchange more taxation for stronger use rights. The key theoretical dimension justifying these differences is that the appropriability literature overlooks the relevance of the elites' time inconsistency by assuming that they can always garner the nonelites' participation by committing to direct transfers. From an empirical point of view, instead, the appropriability literature differs from our approach because it focuses on hierarchy and statehood rather than the strength of the nonelites' political and property rights, does not observe panel variation on ancient societies and does not exploit historical climate changes. Finally, we also compare the explanatory power of our framework with that of the "circumscription" and "conflict" theories (Acemoglu and Robinson, 2000; Acemoglu et al., 2005; Boix, 2015; Chaney, 2013).

Our analysis delivers three key contributions. First, we stress the primacy of time inconsistency issues as determinants of institutions. Second, we confirm the model predictions by gathering novel data on the best recorded ancient society.[6] Unlike similar databases on medieval and modern societies (Guerriero, 2020), our data set displays large variation across time and space on economies sufficiently simple to credibly link geography to institutions, it includes polities demarcated by well-defined, narrow, and stable boundaries, it gathers detailed information on public goods, and it is unaffected by the European colonization.

[5]Mayshar et al. (2022) relate pre-colonial state centralization to the harvest appropriability as proxied by the productivity advantage of cereals over tubers, whereas Ahmed and Stasavage (2020) link the opacity of the farming process, as driven by variation in potential agricultural suitability, to council governance. Mayoral and Olsson (2019) also report correlations between environmental circumscription and political stability.

[6]The secondary sources that we use to build our data set rely on the remains gathered by the thousands of archaeological campaigns conducted in the last two centuries and the best-preserved—because of the use of clay tablets—corpus of ancient writing [Barjamovic 2013, p. 120-122], i.e., 176,000 administrative documents, 19,000 royal and monumental inscriptions and 8,000 legal texts (see https://cdli.ucla.edu/).

These innovations draw the attention of economists to ancient societies and the attention of archaeologists and historians to institutional economics. By allowing these scholars to co-operate, not only will similar projects produce otherwise unfeasible data, but they will also deliver deeper theoretical and policy insights (Benati and Guerriero, 2022b,c). Finally, by showing that fiscal policies link time inconsistency issues to the political order, we identify an understudied determinant of the state's fiscal capacity (Guerriero and Righi, 2021).

The paper proceeds as follows. In section 2, we review several historical facts about Bronze Age Mesopotamia consonant with the three key implications of the theoretical framework that we illustrate in section 3. Next, we state the model testable predictions in section 4, and we discuss our empirical test in section 5. Finally, we conclude in section 6, and we report figures and tables (data construction and extra tables) in the (Internet) appendix.

2 State Formation in Bronze Age Mesopotamia

In the following, we summarize the economic and institutional evolution of Greater Mesopotamia over the Early and Middle Bronze Ages, signaling via the bold letters [**a**], [**b**] and [**c**] the stylized facts consistent with the three key implications of our model, which also constitute the main results of our empirical exercise: [**a**] drops in the expected farming return forced the elites to grant strong political and property rights to nonelites with complementary skills; [**b**] nonelites involved in a more opaque farming activity—i.e., viticulture—enjoyed stronger use rights to land; and [**c**] reforms towards stronger nonelites' rights were accompanied by a larger provision of public goods, especially those preferred by the nonelites.

Urban revolution (3800-3300 BCE) and proto-states (3300-3100 BCE) periods.—Initially "characterized by the limited hierarchy of the [...] Neolithic communities, the modest influence of political and cultic leadership, the low density of the population [and] the local dimension of production and of family relations" [Liverani 2014, p. 44], Greater Mesopotamia gradually developed the first recorded forms of stable state institutions [Liverani 2014, p. 43-45]. To start with, the drying up of the second half of the 4th millennium induced the collapse of the urban sites in Upper Mesopotamia and the reclamation of the marshy alluvium in Lower Mesopotamia [Liverani 2014, p. 53-61; Riehl et al. 2014, p. 3]. In the Alluvium, the smaller water supply together with its mismatch with the agricultural cycles

magnified the returns on artificial irrigation infrastructures and, in turn, the organizational skills necessary for their construction and maintenance [Brooke 2014, p. 203]. These precious inputs were provided by priestly figures, who favored the transition from "earlier generic worldviews about uncontrollable forces guiding nature and fertility, in favor of established divine characters" [Liverani 2014, p. 58] on behalf of which they "toiled [...]. [Thanks to their leadership,] the community [gained the] economic proceeds from the operations of the whole enterprise " [Steinkeller 2019, p. 113]. Such an organizational role established the temple as the first institutionalized decision-maker. First, the temple households transferred increasingly larger estates from the traditional landholding groups to the specialized, and especially literate, workers in exchange for corvée and/or a share of the produce [Liverani 2014, p. 51-69; Englund 1998, p. 176-181]. While hired workers remained rightless, allotting gradually imposed private property and tenured farmers' *de facto* rights to cultivated land [**a**] [Gelb et al., 1991; Wilcke 2007, p. 25-26]. Second, the temples extended their control over vital public tasks like gathering taxes [**a**], managing the construction of the first large-scale infrastructures [**c**], supporting short-distance trade, animal husbandry and handcraft and providing risk-sharing activities, i.e., hosting orphans, storing goods, supplying grain in times of famine, regulating interest charges, accommodating those in need with loans and paying ransoms for soldiers captured in battle [Liverani 2014, p. 61-82; Charpin, 2017].

City-states period (3100-2550 BCE).—The 3200-2850 BCE droughts obstructed, without impeding, farming in the Alluvium [Liverani 2014, p. 89; Ristvet 2017, p. 38-40], pushing the religious ranks to share their political power with a rising military class [**a**], who had left the temple to establish the "palace" under the kingly figures of the *en*, *lugal* and *ensi* [Staubwasser and Weiss 2006, p. 379-380; Marchesi and Marchetti 2011, p. 90-100; Garfinkle 2013a, p. 108-110; Steinkeller 2019, p. 122-123]. These palatial households succeeded in involving a larger share of the population in the farming activities by offering leasing and renting contracts as well as tenure-for-service—i.e., *sŭku*—agreements eventually more appealing than those proposed by the temple [**a**] [Cripps 2007, p. 12-20]. To elaborate, not only did farmers participate in valuable civil engineering projects, such as canals and fortifications, but they also gained the unique benefits of serving in stable armies [**c**] , i.e., they had access to irrigation facilities, food and draft animal power, in times of peace, and

to the booty after military victories [Richardson 2011, p. 17-36; Steinkeller 2018, p. 10-11]. Meanwhile, in Upper Mesopotamia, the severe but not prohibitive post-2700 BCE climate favored the rise of extended royal families [**a**], who were supported by religious ranks and elders' councils [Archi 2015, p. 570-591; Ristvet 2017, p. 40]. While lands were entrusted to rightless hired laborers as well as tenured farmers enjoying *de facto* property rights [**a**] [Widell et al. 2013a, p. 63-64], the introduction of stronger nonelites' rights was accompanied by a larger provision of public and ritual buildings as well as conscripted armies [**c**].

Kingdoms period (2550-2350 BCE).—Thanks to the mix of the intensified warfare and the milder climatic conditions, the royal households imposed their political supremacy by limiting the temple's ability to tax and enslave its debtors in the South and by curbing the power of the religious ranks and elders' councils in the North [**a**] [Liverani 2014, p. 99-122]. Meanwhile, the spread of the domesticate grapevine via inter-elite noncommercial exchange strengthened the use rights of the very appreciated winemakers [**b**] (Miller, 2008). Wine, indeed, covered a key role in cultic and social rituals and was very costly to import [Powell 1996, p. 103-112; Benati 2016, p. 156-157; Barjamovic and Fairbairn, 2018]. Similarly, the *sŭku* system started to assure to tenured farmers—*de jure*—use rights [**a**], which were heritable and alienable [Cripps 2007, p. 70-77; Wilcke 2007, p. 26-27, 67-70]. Contemporaneously, the construction of public and ritual buildings as well as the organization of conscripted and professional armies intensified [**c**] [Hamblin 2006, p. 48-72; Liverani 2014, p. 99-100, 108-114].

Empires period (2350-1750 BCE).—After having consolidated their control over Lower Mesopotamia, the Akkadian kings conquered large portions of the Fertile Crescent [Sallaberger and Schrakamp 2015, p. 105-112]. While the formerly independent Southern city-states were—at least at first—left to local rulers in exchange for tributes, the other annexed states were managed by governors appointed by the king and assisted by both royal functionaries and local temple households [Wilcke 2007, p. 31-41; Liverani 2014, p. 138]. The Akkadian kings' power was, however, fragile, and the cold and dry spell that hit the entire Mesopotamian region between 2200 and 1900 BCE favored, first, the expansion of *de jure* farmers' rights to land, even to that directly controlled by the crown, and the collapse of the Akkadian state itself later [**a**] [Wilcke 2007, p. 70-72; Cookson et al., 2019].

Only after a phase of political fragmentation were the Ur III kings able to reunify, be-

tween 2120 and 2000 BCE, much of Greater Mesopotamia [Barjamovic 2013, p. 124-125; Liverani 2014, p. 155-160]. This dynasty divided the empire into core provinces administered by co-opted governors and peripheral regions controlled by military officials and crown functionaries, who gained large estates [Garfinkle 2013b; Liverani 2014, p. 161]. The farmers, moreover, received land in exchange for corvée and, even if these plots were inalienable, their *de facto* property rights were strictly enforced [**a**] [Liverani 2014, p. 197-198].

A series of new severe droughts contributed to the collapse, around 2000 BCE, of the Ur III kingdom in Lower Mesopotamia [Yoffee 2005, p. 145-146] and to population decline and political instability in Upper Mesopotamia [Ristvet 2017, p. 49]. This uncertainty was soon exploited by the semi-nomadic Amorite populations, which, over the period 2000-1850 BCE, extended their control over competing polities [Liverani 2014, p. 175-181]. To manage this quarrelsome landscape, the Amorite kings negotiated with both tribal leaders and councils of elders and offered to the population tenured and safe land in exchange for military services [**a**], i.e., *ilkum* [Fleming 2004, p. 33, 75; Ziegler 2008, p. 50; Liverani 2014, p. 224].

More important, the falling farming returns, together with the diffusion of metal tools in all households, paved the way for a trade revolution that, from 2000 BCE, determined the formation of a new exchange landscape around two interlocking circuits [Liverani 2014, p. 163, 190, 212-218; Barjamovic 2018, p. 121-125], i.e., the Old Assyrian network carrying textiles and tin from Ashur to Kanesh and bringing back precious metals and the Old Babylonian network exchanging metals and textiles between Shush and Hazor (see figure 1). In contrast to the fourth and third millennium exchange trade circuits, which were organized by both agents of the institutionalized decision-makers and merchant families, the second millennium trade networks were dominated by private entrepreneurs who were able to accumulate increasing political power [**a**] [Van de Mieroop 2015, p. 89-92; Liverani 2014, p. 163, 190, 212-218; Barjamovic 2018, p. 128; Yoffee and Barjamovic 2018, p. 816]. To illustrate, the temple and palatial households of the polities foreseeing the largest payoff from cooperating in long-distance trades—i.e., Ashur, Emar, Sippar and Tuttul—substituted the merchant guilds for the Ur III provincial administrators [**a**] and supported limited custom duties and the provision of trade-related public goods [**c**], i.e., securing trade routes and inter-polity exchange agreements [Postgate 1992, p. 221; Garfinkle 2010, p. 186-193; Van de Mieroop 2015,

p. 89-92; Barjamovic 2018, p. 123-128; Palmisano 2018, p. 22]. The trade revolution was completed under the Old Assyrian (Isin-Larsa and Old Babylonian) kingdom(s) that dominated Upper (Lower) Mesopotamia during the extremely dry 1950-1780 (2017-1763) BCE period [Liverani 2014, p. 192-218]. These regional powers favored the expansion of *de jure* farmers' rights [**a**], the adoption of edicts remitting debts and abolishing debt-based slavery, additional construction of public and ritual buildings and the organization of conscripted and professional armies [**c**] [Westbrook 2003, p. 362-407; Richardson 2011, p. 21-32; Liverani 2014, p. 187-188]. Only the accession to the Babylonian throne of Hammurabi (1810-1750 BCE), who unified the Alluvium in 1755 BCE, blocked these institutional dynamics by empowering the "palace [at] the expenses of the private sector as well as the temple," which lost its power to manage justice and organize trade [Liverani 2014, p. 242].

3 Theory

Next, we illustrate our model of endogenous political and property rights.

3.1 *Model Setup*

The economy.—We consider a representative elite interested in maximizing the farming output obtained by cooperating with a representative nonelite. To elaborate, the output Y is a function of the imperfectly observable state of the world $\theta \in \{G, B\}$ and the unobservable nonelite's effort $e \in \{l, h\}$, and it equals $V > 0$ if θ is good and the nonelite exerts the high effort and zero otherwise. We maintain that $\theta = G$ with probability $p \in (0, 1)$ and e entails a cost 0 if low and $\gamma > 0$ if high. After the selection of effort, everybody observes a public signal $\sigma \in \{g, b\}$ on θ whose accuracy $q \in [0.5, 1)$ is such that $Pr\,(g \mid G) = Pr\,(b \mid B) = q$ and $Pr\,(g \mid B) = Pr\,(b \mid G) = 1-q$. Hence, q represents the degree of transparency of the farming conditions. A q approaching 1 implies that the signal almost perfectly reveals the state of the world, whereas $q = 0.5$ entails, instead, that the signal is completely uninformative.

Both nonelite and elite are risk neutral and have an outside option that we normalize to zero. To elaborate, the nonelite's expected utility—i.e., $U_{r,d}$—equals the expected payoff from public good consumption net of both the effort cost and the expected loss from weaker use rights determined by punishment, whereas the elite's expected payoff—i.e., $\pi_{r,d}$—equals

the sum of untaxed output, expected payoff from public good consumption and expected gain from stronger use rights following punishment. While the index r picks the political regime, the index d captures the punishment regime. Two are the crucial hypotheses underlying this payoff structure. First, as Boranbay and Guerriero (2019), we maintain that the elite always keeps control and transfer rights to the input, leaving to the nonelite only the use rights. Hence, she pockets the entire untaxed output. This assumption captures the prevailing distribution of property rights during our sample and the fact that the elites appropriated virtually all the untaxed surplus [Cripps 2007, p. 11-22; Garfinkle 2013a, p. 112-113; Steinkeller 1999, p. 290]. Second, and contrary to Mayshar et al. (2017), we assume that the elite lacks the ability to always assure the nonelite's participation by committing to direct transfers. This hypothesis builds on a long literature on the time inconsistency issues inherent to politics (North and Weingast 1989; Barzel and Kiser, 1991; Myerson, 2008; Boranbay and Guerriero, 2019), and it is, primarily, justified in our case by the fact that contracts were enforced by courts controlled by the very same elite members promising not to renege on future transfers (Acemoglu, 2003).[7] The elite, however, can rely on two other instruments to incentivize the nonelite. First, she can grant to the nonelite a more inclusive political institution, which allows him to guide taxation and public good provision. Second, she can punish suspected shirking via the restriction of the nonelite's use rights to the input.

Political institutions.—The public good technology is linear in the tax revenues $pV\delta_{r,d}$. The tax rate $\delta_{r,d}$ is selected by the elite under the autocratic regime $r = A$ and by the nonelite under the more inclusive political institution $r = I$, and it depends on the punishment regime d. We maintain that a supply $g_{r,d}$ of public good delivers a sub-utility $\rho g_{r,d}$ to the group selecting $\delta_{r,d}$ and directing public good provision and a sub-utility $\beta g_{r,d}$ to the other group and that $0 < \beta < \rho < 1$. While $\rho < 1$ entails that the public good is less valuable than the private one, $\beta < \rho$ captures the degree of heterogeneity in the groups' preferences for the common goods and the lower ability of each of them to provide the one preferred by the other group (Boranbay and Guerriero, 2019).[8] In our case study, the nonelite (elite) preferred the risk-sharing activities assured by the participation in a conscripted army over

[7] Only at the beginning of the second millennium BCE, courts started to be populated by nonelites representing merchants guilds, elder councils and city assemblies [Wilcke 2007, p. 35-41; Westbrook 2003, p. 365-368].

[8] Implicitly, we also assume that elite cannot commit to contract away the inefficiency of public good provision.

the construction of public and ritual buildings (the way around) (see sections 2 and 5.1.3).

Nonelite's property rights.—We focus, for simplicity, on a non-probabilistic punishment strategy such that the stick d is embraced whenever the elite receives a signal that the lack of production is due to low effort by the nonelite. We interpret the punishment regime $d = 1$ as a case of weak nonelite's property rights to the input—i.e., an insecure land tenure (Mayshar et al., 2017)—and $d = 0$ as a scenario of *de facto* and, possibly, *de jure* nonelite's use rights to land. Consistent with an expanding literature on endogenous property rights (Guerriero, 2021) and different from Mayshar et al. (2017), we assume that punishment in the form of weaker nonelite's use rights must correspond to a strengthening of the elite's property rights to the input. Since, however, the elite must also substitute a dismissed nonelite, we maintain that her payoff from eviction is not too large and, in particular, smaller than the nonelite's cost from being dismissed. Formally, the elite's gain from replacing the nonelite $x > 0$ and the nonelite's cost $\alpha > 0$ from being evicted are such that $x < \hat{x} \equiv min\{\frac{\gamma\beta}{\rho(1-p-q+2pq)}, \frac{\gamma(\rho-\beta)}{\beta(1-p)(1-q)}\}$, $\alpha > \hat{\alpha} \equiv \frac{\gamma(\rho-\beta)}{\beta(1-p)(1-q)}$ and, thus, $\alpha > x$. These conditions capture three key facts about our historical experiment. First, tenure-for-service agreements allowed the household to inherit the land conditional on the tenured farmer having properly fulfilled his duties [Cripps 2007, p. 24-27]. Second, turnover costs were limited by the ability of either unskilled slaves or waged workers to produce a less valuable product [Steinkeller 2015, p. 20-24], and the elites greatly valued dispossessed land as a bargaining chip to use with rising nonelites.[9] Finally, the peasants' costs from being evicted were enormous and included the immediate exclusion from the risk-sharing activities organized by the institutionalized decision-makers as well as the possible loss of the returns from future public good provision because of enslavement [Wilcke 2007, p. 53-58]. These three pieces of evidence suggest that the nonelite's disutility from dismissal is larger than the positive and not too large difference between the elite's payoff from stronger use rights and her turnover costs. As clarified below, if the elite's payoff from replacing the nonelite was negative, punishment would never arise in equilibrium.

Timing of events.—At time t_0, the elite picks the political regime r. At time t_1 and for

[9]Two examples are illuminating. After having conquered large tracts of the Alluvium, the Akkadian kings assigned the confiscated domains to a rising class of local dignitaries [Foster 2016, p. 39-40]. Similarly, Hammurabi of Babylon, after having subjugated the reign of Larsa (1763 BCE), redistributed the conquered land to his retinues under tenure-for-service agreements [Fiette 2018, p. 19].

$r = I$, the nonelite selects the tax rate $\delta_{I,d}$ and the elite decides the punishment level d. For $r = A$ instead, the elite picks both $\delta_{A,d}$ and d. At time t_2, the elite decides whether to entrust the land to the nonelite who, in turn, chooses whether to participate in the production process and an effort level e. At time t_3 and under the tenancy agreement, the state of the world θ is realized, everybody receives the public signal σ, the output Y is observed, private and public goods are possibly produced and the payoffs are realized.

Discussion.—In evaluating our setup, several remarks should be heeded. First, as discussed in section II of the Internet appendix, group formation should be seen as determined by unforeseen organizational, military and production shocks endowing the nonelites with skills complementary to those of the elites and leaving to the latter the control over the scarce resources and the institutional design (Benati and Guerriero, 2021). The elites "were the landholders during the urban revolution period, religious ranks during the proto- and city-states periods and the temples and palaces during the kingdoms and empires periods, whereas [the nonelites were] the temples during the urban revolution period, military ranks during the city-states period and merchants during the empires period" [Benati and Guerriero 2022a, p. 34-35]. Second, during the empires period, V captures the returns on long-distance trades and falls with the distance from the trading partners, θ is the transportation risk and e picks the costs of securing trade routes, settling trade-related disputes and offering financial services. Third, our results will be similar should we allow the decision-maker to select the type of public good (Boranbay and Guerriero, 2019). Fourth, the assumptions that the elite does not always punish the nonelite for $\theta = B$ and that she adopts a non-probabilistic punishment strategy can be relaxed at the cost of a more cumbersome algebra (Mayshar et al., 2017). Finally, our analysis will be similar should we allow the elite to expropriate—instead of owning—$pV(1 - \delta_{r,d})$, commit to direct transfers and/or offer a sharecropping contract (see section 3.2 and footnote 13 for the last two robustness exercises).

3.2 *Endogenous Political Institutions and Property Rights*

Since the outside options are zero, the nonelite participates only to exert the high effort, whereas an elite willing to produce punishes only if sure of the nonelite's participation and if the stick curbs taxation and/or sufficiently raises the expected value of stronger use rights.

Once the elite has enacted the more inclusive political process, a nonelite foreseeing to participate selects a $\delta_{I,d}$ maximizing his net utility from redistributing through public spending the production value, subject to assuring the elite's participation. The elite picks d to maximize her payoff. For $e = h$, the nonelite obtains $p\rho\delta_{I,d}V - \gamma - (1-p)(1-q)\,d\alpha$ and the elite gets $p\left[(1-\delta_{I,d})V + \beta\delta_{I,d}V\right] + (1-p)(1-q)\,dx$. Since the elite always participates, the nonelite maximizes his payoff by selecting $\delta^*_{I,d} = 1$. Therefore, he cooperates under strong property rights when $pV \geq \frac{\gamma}{\rho} \equiv \tilde{\Omega}$ and under weak use rights when $pV \geq \frac{\gamma+(1-p)(1-q)\alpha}{\rho}$. Because of the first inequality in the $x < \hat{x}$ condition,[10] the elite will use the stick in the second scenario and when $pV < \tilde{\Omega}$. In both instances, punishment does not discourage full taxation, but it increases the elite's expected payoff from stronger use rights. Ultimately, if $r = I$ and $pV \geq \tilde{\Omega}$, two possible scenarios arise: 1. when $\tilde{\Omega} \leq pV < \frac{\gamma+(1-p)(1-q)\alpha}{\rho}$, $d = 0$, $\delta^*_{I,0} = 1$, $e = h$, $U_{I,0} = p\rho V - \gamma \geq 0$ and $\pi_{I,0} = p\beta V > 0$; 2. when $pV \geq \frac{\gamma+(1-p)(1-q)\alpha}{\rho}$, $d = 1$, $\delta^*_{I,1} = 1$, $e = h$, $U_{I,1} = p\rho V - \gamma - (1-p)(1-q)\,\alpha \geq 0$ and $\pi_{I,1} = p\beta V + (1-p)(1-q)\,x > 0$.

After having kept autocracy, an elite willing to produce chooses both d and $\delta_{A,d}$ to maximize her expected payoff subject to satisfying all individual rationality constraints and the nonelite's incentive compatibility. Formally, her strictly concave problem is

$$\max_{d,\delta_{A,d}\in[0,1]} \quad p\left[(1-\delta_{A,d})V + \rho\delta_{A,d}V\right] + (1-p)(1-q)\,dx \quad s.t.: \tag{1}$$

(IR) $\quad p\beta\delta_{A,d}V - \gamma - (1-p)(1-q)\,d\alpha \geq 0;$

(IC) $\quad p\beta\delta_{A,d}V - \gamma - (1-p)(1-q)\,d\alpha \geq -pqd\alpha - (1-p)(1-q)\,d\alpha.$

It is immediate to see that the nonelite's (IC) constraint is redundant and the elite maximizes her payoff inclusive of the possible returns on stronger use rights, conditional on satisfying the nonelite's (IR) constraint. This holds for $e = l$ and $d = 0$ and fails for $e = l$ and $d = 1$, $e = h$ and $d = 0$ if $pV < \frac{\gamma}{\beta} \equiv \hat{\Omega}$ and $e = h$ and $d = 1$ if $pV < \frac{\gamma+(1-p)(1-q)\alpha}{\beta} = \overline{\Omega}$ with $\tilde{\Omega} < \hat{\Omega} < \overline{\Omega}$. For $e = h$, $d = 0$ and $pV \geq \hat{\Omega}$ and $e = h$, $d = 1$ and $pV \geq \overline{\Omega}$, instead, the nonelite's (IR) constraint holds for any $\delta_{A,d}$ weakly larger than $\delta^*_{A,d} = \frac{\gamma+(1-p)(1-q)d\alpha}{p\beta V}$, which is the elite's preferred tax rate because she favors the private good over the public one.

Since the threshold over which cooperation prevails under democracy and punishment is

[10] Whenever the inequality $x < \frac{\gamma\beta}{\rho(1-p-q+2pq)}$ holds and $pV \geq \tilde{\Omega}$, $\pi_{I,0}$ is larger than the elite's utility from punishing and discouraging production, which equals the value $(1-p-q+2pq)\,x$.

larger than the threshold over which it arises under autocracy and strong nonelite's property rights, and since the elite prefers the second arrangement to the first one if $pV > \hat{\Omega}$,[11] three scenarios prevail. When $\hat{\Omega} < (=) \, pV < \overline{\Omega}$, the elite grants strong use rights to the nonelite, selects $\delta^*_{A,0} = \frac{\gamma}{p\beta V} < (=) \, 1$ and gains $\pi_{A,0} = pV - \frac{\gamma(1-\rho)}{\beta} = p\left[\left(1-\delta^*_{A,0}\right)V + \rho\delta^*_{A,0}V\right]$. The payoff $\pi_{A,0}$ is larger than $p\rho V$ and, *a fortiori*, than the elite's payoff under democracy and strong nonelite's property rights, i.e., $\pi_{I,0} = p\beta v$. For $pV \geq \overline{\Omega}$, the elite protects the nonelite's property and picks $\delta^*_{A,0}$ when $\pi_{A,0} \geq \pi_{A,1} = pV - \frac{\gamma(1-\rho)}{\beta} - \frac{(1-p)(1-q)\alpha(1-\rho)}{\beta} + (1-p)(1-q)x$, which is the case if $x \leq \frac{\alpha(1-\rho)}{\beta}$. If instead $pV \geq \overline{\Omega}$ and $x > \frac{\alpha(1-\rho)}{\beta}$, which is possible for $x < \hat{x}$, the elite selects punishment and $\delta^*_{A,1} = \frac{\gamma+(1-p)(1-q)\alpha}{p\beta V} \leq 1$. Hence, punishment is optimal only when the elite's expected payoff from stronger use rights $(1-p)(1-q)x$ surpasses her expected cost $\frac{(1-p)(1-q)\alpha(1-\rho)}{\beta}$ from the extra public good needed to assure the nonelite's participation and for $pV \geq \overline{\Omega}$, i.e., more often the more observable the state of the world is. Thus, the negative effect of q on the nonelite's use rights is not due to the higher effectiveness of punishment as enforcement mechanism (Mayshar et al., 2017), but to its negative impact on the expected value of the extra public good provision necessary to entice the nonelite.

Whenever $pV \geq \tilde{\Omega}$,[12] the expected output pV determines both the nonelite's political and property rights, whereas the degree of observability of the state of the world q only affects the latter. If $\tilde{\Omega} \leq pV < \hat{\Omega}$, granting the more inclusive political institution and strong property rights is the only way to elicit the high effort level. If, instead, pV weakly exceeds $\hat{\Omega}$, the elite keeps the autocratic regime, embracing, moreover, a stick for both $pV \geq \overline{\Omega} > \hat{\Omega}$ and $x > \frac{\alpha(1-\rho)}{\beta}$. The following proposition summarizes our analysis:

Proposition: *For $0 < \beta < \rho < 1$, $x < \hat{x}$, $\alpha > \hat{\alpha}$, and $pV \geq \frac{\gamma}{\rho}$; 1. When the expected investment return is such that $\frac{\gamma}{\rho} \leq pV < \frac{\gamma}{\beta}$, the elite grants strong nonelite's political and property rights, whereas the nonelite selects both the high effort level $e = h$ and the maximum tax rate $\delta^*_{I,0} = 1$; 2. When $\frac{\gamma}{\beta} < (=) \, pV < \frac{\gamma+(1-p)(1-q)\alpha}{\beta}$, the elite keeps the autocratic regime, grants strong nonelite's property rights and fixes a tax rate $\delta^*_{A,0} = \frac{\gamma}{p\beta V} < (=) \, 1$, whereas the nonelite selects $e = h$; 3. When $pV \geq \frac{\gamma+(1-p)(1-q)\alpha}{\beta}$ and $x \leq \frac{\alpha(1-\rho)}{\beta}$, the elite keeps*

[11] While $\alpha > \hat{\alpha}$ implies $\frac{\gamma+(1-p)(1-q)\alpha}{\rho} > \hat{\Omega}$, $x < \hat{x}$ entails $\pi_{A,0} > \pi_{I,1}$ for $pV > \hat{\Omega}$ since $\pi_{A,0} > p\rho V$ and the sufficient condition $p\rho V > p\beta V + (1-p)(1-q)x$ holds for $x < \frac{\gamma(\rho-\beta)}{\beta(1-p)(1-q)}$ and $pV > \frac{\gamma}{\beta}$.

[12] If $pV < \tilde{\Omega}$, production is unfeasible under any political regime and the elite prefers to punish the nonelite.

the autocratic regime, grants strong nonelite's property rights and fixes a tax rate equal to $\delta^*_{A,0} < 1$*, whereas the nonelite selects* $e = h$*; 4. When* $pV > (=) \frac{\gamma+(1-p)(1-q)\alpha}{\beta}$ *and* $x > \frac{\alpha(1-\rho)}{\beta}$*, the elite keeps the autocratic regime, restricts the nonelite's property rights and fixes a tax rate* $\delta^*_{A,1} = \frac{\gamma+(1-p)(1-q)}{p\beta V} < (=) 1$*, whereas the nonelite selects* $e = h$*; 5. The nonelite's expected utility rises with the inclusiveness of political institutions and is independent from the strength of the nonelite's property rights, i.e., it is* $p\rho V - \gamma \geq 0$ *for* $r = I$ *and 0 otherwise.*

In a world of inefficient public good provision, a reform towards a more inclusive political process and stronger nonelite's property rights makes possible a cooperation otherwise unattainable given time inconsistency issues for $\tilde{\Omega} \leq pV < \hat{\Omega}$. When such alternative arrangements are unavailable, an elite preferring production to stronger use rights can entice the nonelite only by credibly committing to transfers. To illustrate, she would offer to the nonelite ϵpV, with $\epsilon > \beta$, as either a direct transfer or an incentive within a sharecropping contract. Such a payment induces cooperation for $\frac{\gamma}{\epsilon} < pV < \hat{\Omega}$.[13] When, instead, time inconsistency issues are mild because of the large expected investment return—i.e., $pV \geq \hat{\Omega}$, the elite prefers to direct fiscal policy, decrease taxation and, possibly, embrace the stick. Yet, constraining the nonelite's property rights is optimal only for an expected output and a degree of transparency sufficiently large and, notably, such that the elite's expected payoff from stronger use rights surpasses the expected extra cost of convincing through public good provision the nonelite to participate despite punishment. If this is not the case, the elite must optimally strengthen the nonelite's property rights—contemporaneously weakening her own—to curb the ex post misallocation of valuable resources (Guerriero 2016a; 2021).

4 Empirical Predictions

In the most plausible scenario of $0 < \beta < \rho < 1$, $x < \hat{x}$, $\alpha > \hat{\alpha}$, and $pV \geq \frac{\gamma}{\rho}$ (see section 2), the model implications can be restated as the following testable predictions:

Testable Predictions: *1. The inclusiveness of political institutions decreases with the expected farming return, and it is unrelated to the opacity of farming. 2. The strength of the nonelite's property rights weakly falls with the expected farming return and weakly rises with*

[13] Should transfers be possible under any r, an elite willing to produce will promise them only for $\frac{\gamma}{\epsilon} < pV < \tilde{\Omega}$ and $\epsilon > \rho$ since they are pure losses and, thus, inferior to public good consumption. Hence, the assumptions assuring the monotonicity in the testable predictions are those on the elite's lack of commitment, x and α.

the opacity of farming. 3. The nonelite's expected utility increases with the inclusiveness of political institutions and is unrelated to the strength of the nonelite's property rights.

5 Evidence

We focus on the 44 polities that are best documented for each half-century between the Early Bronze Ages I-IV and the Middle Bronze Age I [Liverani 2014, table 1.1], i.e., 3050-1750 BCE. The logic underlying this approach is twofold. First, we have selected, as cross-section identifiers, polities displaying settlement continuity and steady political importance as implied by their experience with the first recorded forms of stable political institutions and property rights protection (Barjamovic, 2013; Garfinkle, 2013a). Whether dominated or independent states/kingdoms/empires, these polities evolved around one major city [Westenholz 2002, p. 26]. While the names of these historical cities and the present-day archaeological sites are reported in table 1, their locations are displayed in figure 1 and directly collected from the Ancient Near East Placemarks.[14] Second, the institutional evolution of the period preceding the invention of the logo-graphic writing and, in turn, our sample is still ill-understood [Liverani 2014, p. 62-77], whereas the rise of the Hittite empire at the end of our sample induced a shift of the political core towards the Anatolian and Levantine regions, the consequent reduction in written sources over our sample and the formation of regional Babylonian and Assyrian states obscuring the evolution of the single polities [Liverani 2014, p. 271]. By relying on the "middle chronology," it is, instead, possible to accurately link historical to archaeological data and, thus, document three key transitions in our sample, i.e., from proto- and city-states to kingdoms and, possibly, empires (Manning et al., 2016). Crucially, the information reported in the Ancient Near East Placemarks and middle chronology is widely accepted by the predominant literature (see the Internet appendix).[15]

Since the maximum distance between the cultivated fields and the settled center was 30 km [Liverani 2014, p. 106], we average geographic variables over a 30 km radius around the polity coordinates (see also figure 2). Moreover, we average the data underlying our non-institutional (institutional) variables over the half-century preceding (a 40-year window

[14]This data set is available from https://www.lingfil.uu.se/research/assyriology/earth

[15]The only possible exception concerns the location of Abarsal [Winters 2019, p. 155-160]. Yet, considering the proposed alternative coordinates does not affect our conclusions (see table II of the Internet appendix).

around) each time period (Acemoglu et al., 2005; Guerriero, 2020).

5.1 *Measurement*

5.1.1 *Expected Return on Farming and Its Opacity*

Expected farming return.—Cereals were the dominant crops in Greater Mesopotamia, whereas olive oil became, because of its use as cooking and perfume-making ingredient, the farming output most exchanged over the second millennium BCE [Paulette 2013, p. 102-103]. Extensive botanical evidence suggests that wheat and barley (olive) farming needs a temperature ranging between 5 and 37 (higher than 4) degrees Celsius, suffers from water scarcity and requires an altitude between 0 and 3050 m (Serna-Saldivar, 2010; Oteros et al., 2013). Yet, the growing season temperature is, by far, the most influential determinant of agricultural production (Zhao et al., 2017).[16] Hence, we capture the expected farming return with the temperature in Celsius averaged over the months between April and September of the previous half-century, i.e., *Temperature* (see tables 2 and I of the Internet appendix for the definition and sources of the variables that we use). The climatic data are devised by the Transient Climate Evolution—i.e., TRACE—project for each of the last 22,000 years and the entire planet at a 3.75-degree spatial resolution. The model underlying these estimates combines discrete equations for fluid motion with grid-specific information on land, soil and plant characteristics to simulate the interactions among atmosphere, oceans, land surface and ice [He 2011, p. 16]. This process produces observations significantly more accurate than proxy data, which are, instead, based on a handful of sources of variation (He, 2011). Yet, the correlation between *Temperature* and the proxy data obtained from isotope analyses of speleothems located close to nine of our polities and reported by Bar-Matthews et al. (1997), Sinha et al. (2019) and Altaweel et al. (2019) is, conditional on half-century dummies, 0.76 and significant at one percent. Four remarks confirm the solidity of our measurement choice.

First, the correlation between *Temperature* and the available data on coeval cereals and, especially, barley yields in liters per hectare—i.e., *Cereals-Yield*—is 0.50 and significant at

[16] Importantly, lower winter temperatures extended the period of dormancy of plants greatly reducing the effectiveness of seasonal floods [Hole 1994, p. 127], and cereals were planted in February and first harvested in March [Widell et al. 2013b, p. 86]. Accordingly, our conclusions will be similar should we either average the temperature between October and March or consider yearly means (see table III of the Internet appendix).

one percent, conditional on our proxy for the opacity of farming, extent of rainfall and half-century fixed effects (see upper left graph in figure 3). Coeval yields are obtained from secondary sources based on administrative cuneiform texts (see the Internet appendix).

Second, the vast majority—68.2%—of the *Temperature* observations is within the ideal 12-26 degree Celsius range and the remaining observations are below 28.04 degree Celsius. Hence, the relationship between the growing season temperature and the expected farming return can be considered linear (Hosseini et al., 2017). Consistent with this view, *Temperature* squared is an insignificant predictor of *Cereals-Yield*, conditional on the farming opacity, extent of rainfall, irrigation potential, great rivers' avulsion and half-century fixed effects.[17]

Third, our conclusions are the same when we consider much more granular proxies for the expected farming return.[18] These are Storie indexes, range between 0 and 100 and are defined as the product of *Temperature*, a rating curve assuming larger values as the terrain slope gradient falls and a land suitability index for either wheat, barley, olive or their maximum, i.e., *Wheat*, *Barley*, *Olive* and *Crops*, respectively (see table III of the Internet appendix).[19] Both the terrain slope gradient and the land suitability measures are developed by the Global Agro-Ecological Zones—i.e., GAEZ—project at a 5 arc-minute resolution for the entire globe. The construction of the land suitability indexes, however, makes these alternative proxies for the expected farming return significantly less efficient than *Temperature*. To elaborate, the land suitability scores measure the ability of the soil to retain and supply nutrients and water to enable crops to maximally utilize the climatic resources of a given location (Serna-Saldivar, 2010; Oteros et al., 2013), are available for two categories of water supply—i.e., rain-fed and irrigation—and three levels of inputs—i.e., high, medium and low, and combine information on present-day agro-edaphic conditions, such as soil water holding capacity, soil depth and textural class, and/or agro-climatic conditions—i.e., radiation and temperature—subsequent

[17] The relative coefficient is -33.21 with a standard error of 21.27.

[18] The granularity of the TRACE data should not be considered an issue since: a) the between variation of *Temperature* accounts for 90% of its overall variation; b) each TRACE cell captures one of five internally homogeneous climate zones, i.e., Southern Anatolia, Coastal Levant, Inner Syria, Zagros Piedmont and Southern Alluvium (Wilkinson and Hritz, 2013); c) the average distance between any two polities is 515.3 km, which is larger than the side of each TRACE cell at the average 34.5 degree latitude, i.e., 375 km.

[19] These indexes pick the nonlinear impact on the expected farming return of the landscape conditions, which are the growing season temperature, the soil profile development and texture, which we proxy with the land suitability index, and the terrain slope (O' Geen et al., 2008). Crucially, any linear impact of the terrain slope is absorbed in our empirical analysis by the polity fixed effects.

1960. Since agro-edaphic conditions can reflect human intervention contemporaneous or consecutive to institutional formation, the extant literature has focused on the scores based only on agro-climatic conditions under low-input agriculture, which, therefore, should be independent from human decisions (Bentzen et al., 2016; Litina, 2016; Mayshar et al., 2022). Yet, this approach is based on the assumption that historical climatic conditions can be efficiently proxied by present-day ones. As the upper right graph of figure 3 suggests, this hypothesis is unreasonable in our sample whereby the potential barley yield under low-input use in tons per hectare calculated through agro-climatic conditions only—*Barley-PY*—is uncorrelated with *Cereals-Yield*, conditional on the extent of rainfall, opacity of farming and half-century fixed effects. This evidence reflects the fact that the post-1960 global warming has substantially altered the farming productivity ranking in the sample by improving the climatic conditions of Upper Mesopotamia while worsening those of Lower Mesopotamia.[20] The bottom graphs in figure 3 reveal that *Crops* and *Barley* suffer similar disadvantages. To illustrate, these proxies, which combine agro-climatic and agro-edaphic conditions, do not provide any extra power in explaining historical cereals yields once *Temperature*, opacity of farming, extent of rainfall and half-century fixed effects are controlled for.[21]

Finally, our estimates remain stable when we control for the growing season large scale and convective precipitation in mm, i.e., *Rainfall*.[22] This is consistent with the main findings on the organization of farming over our sample. While Upper Mesopotamia enjoyed rainfall sufficient to rely on rain-fed-based farming operated over flat tablelands around each settlement [Hole 1994, p. 137], the scarcity of precipitation induced Lower Mesopotamia to embrace irrigation-based farming operated on the outer slopes of the levees of the great rivers (see figure 2; Widell et al., [2013a]).[23] Here, an extended canal system was completed as a public-private partnership between the fourth and the mid of the third millennium and directed the winter rains and the spring snow coming from the Iranian and Turkish moun-

[20] While Ebla and Ugarit, among the least productive rain-fed based farming polities, display a large *Barley-PY* value, Girsu, the most productive irrigation based farming polity, exhibits an average *Barley-PY* value.

[21] *Wheat*, *Barley* and *Crops* turn insignificant if we consider *Temperature* (table IV of the Internet appendix).

[22] In table X of the Internet appendix, we also consider the climate volatility since it is closely linked to a culture of cooperation and, in turn, a more inclusive political process (Boranbay and Guerriero, 2019).

[23] Our results are similar when we distinguish between rain-fed- and irrigation-based farming polities using for the former (latter) the growing season (winter-spring) temperature (of the headwaters of the nearest between the Tigris and Euphrates), i.e., *Temperature-T* (see table III of the Internet appendix).

tains towards the Southern fields, pouring the excess water in the marshy plain [Hole 1994, p. 138; Garfinkle 2013a, p. 100; Liverani 2014, p. 65-67, 93, 232; Wilkinson et al., 2015]. The abundance of rainfall in the North together with the Southern canalization system made the returns on farming more heavily shaped by temperature than by the extent of rainfall.

Opacity of the farming process.—Turning to the opacity of farming, we rely on the dummy *Vine*, which equals one if the polity cultivated the domesticated grapevine over the previous half-century. To construct *Vine*, we combine cuneiform studies on elites' exchanges with data on paleobotanical remains—i.e., carbonized seeds and grapes—from the ADEMNES database (see the Internet appendix). Over the entire year, viticulture requires significantly opaque activities such as planting, layering, grafting, manuring, pruning and watering the vines, managing the trenches, canopies and trellises and avoiding pests and diseases [Jennings et al. 2005, p. 285]. During our sample, wine was so costly to trade and so appreciated by the elites that the expensive expedition of horticultural experts and living vines,[24] both necessary to transplant viticulture [Greene 1996, p. 327], took hold as an invaluable non-commercial inter-elite exchange [Zohary 1996, p. 26; Powell 1996, p 101-110; Barjamovic and Fairbairn, 2018]. It was exactly through these diplomatic interactions among the ruling elites of neighboring polities increasingly distant from the domesticated grapevine native habitat of the Zagros, Caucasus and Taurus mountains that viticulture exogenously spread into the North, first, and the Alluvium, then [McGovern 2009, p. 104, 175]. Two extra pieces of empirical evidence support this conclusion. First, a regression of *Vine* on the distance between each polity and the domesticated grapevine native habitat,[25] *Temperature*, *Rainfall* and time dummies reveals that: a. the distance from the domesticated grapevine native habitat is negatively related to the spread of viticulture, is significant at one percent and explains alone the 37% of the observed R^2; b. the spread of viticulture is not significantly predicted by the geographic determinants of agricultural production summarized by *Temperature*. Second, if reverse causality from institutions to *Vine* was an issue, then one would expect even stronger correlations between current institutions and future values of the slow diffusion of viticulture (Angrist and Pischke, 2009). As table VII of the Internet appendix

[24]Living vines took the form of either grapevines with attached root systems or stems cut from a dormant plant and were kept moist and cool in their own soil during shipment [Greene 1996, p. 327].

[25]This is the Şanlıurfa-Adıyaman region near the Atatürk Dam (see figure 1 and Miller [2008, table 2]).

implies,[26] *Vine* lead one time period is not related to institutions (see also Stasavage, [2010]).

Crucially, the productivity advantage of cereals over the most diffused opaque alternative, which is considered by Mayshar et al. (2022) an obvious proxy for appropriability, is not a reasonable alternative to *Vine*. This proxy, which can be constructed for our sample as the normalized product of *Temperature* and the difference between the maximum land suitability for cereals and that for olive—i.e., *Cereals*, is based on both present-day agro-edaphic and agro-climatic conditions and is, therefore, both endogenous and inefficient in proxying historical farming productivity. Consonant with these remarks, *Cereals* is never statistically significant conditional on *Vine* (see table III of the Internet appendix).

5.1.2 *Political Institutions and Nonelites' Property Rights*

Political institutions.—Regarding the inclusiveness of political institutions, we follow a long literature on the relevance of the constraints on the elites' power for the success of open access orders (North et al., 2009), and we construct an indicator equal to one for polities mostly dominated by another political entity and to values between two and five otherwise, i.e., *Political-Institutions*. To elaborate, the index equals two in the absence of any of the three possible institutionalized decision-makers—i.e., temple, extended royal family and town elites, three when only one was active, four when two were controlling policy making, and five when the political power was contested among all three decision-makers. While a value of one indicates a dominated polity that completely lost the control over policy making and private rights in favor of a neighboring kingdom/empire,[27] a value of two points to a state of nature where at least natural rights can be assured (North et al., 2009). A value of three, instead, captures a limited access social order controlling anarchy through less inclusive political institutions, whereas scores equal to four and five pick societies increasingly more open to the political rise of new groups (North et al., 2009). Following the extant literature (Acemoglu et al., 2005; Guerriero, 2020), we build *Political-Institutions* on the basis of the main events in a 40-year window around each time period. These facts are extracted from historical analyses of the single periods and polity-specific secondary sources on the constraints on the elites imposed by accountability groups (see the Internet

[26]First and second lags and second lead of *Vine* are insignificant (see table VII of the Internet appendix).
[27]We do not consider as dominated politically independent polities forced to pay a tribute to a foreign power.

appendix). Accordingly, *Political-Institutions* is strongly—0.82—and significantly—at one percent—correlated with a one to six constraints on the elites' power index—i.e., *Constraints-on-Executive*—conceptually similar to the Polity IV score, conditional on expected return on farming, its opacity and half-century fixed effects. We obtain similar results if we substitute *Political-Institutions* with *Constraints-on-Executive* (see table V of the Internet appendix).

Nonelites' property rights.—Turning to the strength of the nonelites' use rights to land, we closely follow the model and we construct a measure of land tenure security. Operationally, our index captures the probability that, once a plot is directly or indirectly—through the action of the state—taken—e.g., invaded or expropriated—from another private party, it is, then, given back to the tenured farmer (Guerriero, 2016a; 2021).[28] Such probability rises with the length of the farmers' tenure, strength of the legal remedies available to them, efficiency of the public enforcement of these remedies and extent of alienability of the plot.

To capture these features for our sample, we gather information on the degree of control over the land exploitation by peasants and on whether use rights were enforced *de jure* rather than *de facto*. Starting from the second dimension, we define a right as being enforced *de jure* if it can be identified through a formal title protected by an institutionalized third party, e.g., written and, possibly, registered contracts safeguarded by statutes and/or common law enacted by an institutionalized decision-maker, who also supports contractual enforcement. Such formalized protection strengthens the peasants' legal remedies and eases the alienability of their entitlements compared to a scenario in which their property rights are recognized but not formally enforced (Guerriero 2016a; 2021). Turning to land exploitation,[29] the elites could either directly organize farming by relying on slaves and full-time waged laborers, possibly paid through a share of the produce, or lean on either leasing, renting or tenure-for-service contracts. Indirect exploitation prolonged tenure, reinforcing the peasants' legal remedies and facilitating the alienability of their entitlements. Ultimately, we employ an

[28] Not only is this definition consonant with Alchian's (1965) view that property rights are those of "individuals to the use of resources" but also avoids the confusion between likelihood and value of usage inherent in the Barzel's (1994) conceit that they correspond to the expected stream of net utility (Guerriero, 2016a; 2021).

[29] Indirect exploitation can reduce the overuse of land, magnify under-reporting of output and shift residual rights towards the more productive party (see footnote 13; Allen and Lueck, [2003]). To set aside these issues, we also experiment in the Internet appendix with *Property-Rights-A*, which only compares *de jure* and *de facto* rights and it is strongly—0.96—and significantly—at one percent—correlated with *Property-Rights*, conditional on the expected return on farming, its opacity and time dummies.

indicator equal to one for mostly dominated polities and to values between two and six otherwise, i.e., *Property-Rights*. To elaborate, *Property-Rights* equals two in the absence of any farmers' property right, three (four) if the land exploitation was direct and farmers had *de facto* (*de jure*) property rights to land and five (six) if the land exploitation was indirect and farmers had *de facto* (*de jure*) property rights to land. Again, a value of two is typical of a state of nature, whereas larger values can be found in increasingly open access social orders. *Property-Rights* still builds on the main events in a 40-year window around each half-century, but it is extracted from polity-specific secondary sources on the structure of the regional land tenure informed by land contracts attested as early as 3100 BCE.

Discussion.—Our measures of institutions might suffer from two methodological issues (Acemoglu et al., 2019). First, they might be subject to measurement error and changes in their cardinal values could only correspond to ordinal switches or, even, no institutional evolution. To show that this is not our case, we document that the estimates remain stable when we treat *Political-Institutions* or *Property-Rights* as ordinal by running either fixed effects ordered Logit models or fixed effect Logit models with dependent variables dummies equal to one when some form of protection of either the nonelites' political or property rights existed (see table VI of the the Internet appendix). To assess the impact of these dummies on public good provision, we employ OLS fixed effects models. Second, our institutional proxies might be picking institutional waves due to the risk of migration and/or unrest created by a reform in neighboring polities (Fleck and Hanssen, 2013). To evaluate this form of political circumscription, we show in table X of the Internet appendix that our results are robust to considering the average of *Political-Institutions* (*Property-Rights*) over the remaining polities weighted by the inverse distance to each of them, i.e., *Political-Inst-N* (*Property-Rights-N*).

5.1.3 *Public Good Provision*

Regarding the nonelites' expected utility, we build on the model reasoning that this group consumes only public good, and we consider two proxies based on polity-specific archaeological reports and post-2700 BCE monumental inscriptions (see the Internet appendix). Our first proxy for public good provision is the number of public and ritual buildings archaeologically attested over the previous half-century, i.e., *Public-Buildings*. These structures hosted

a variety of public interest activities, such as courts, prisons, schools, libraries, archives, festivals, banks, funeral homes, workshops, and, even, brothels but also helped affirm the elites' propaganda (Charpin, 2017). Our second proxy for public good provision is a dummy for whether the polity organized, over the previous half-century, a conscripted army, i.e., *Army*. This indicator identifies an organization through which soldiers had access to "irrigation, community membership, draft-animal power, and [...] mobility" [Richardson 2011, p. 20], regardless of warfare. As detailed in section II of the Internet appendix, other state-building theories see in the military elites the status quo keepers (Acemoglu and Robinson, 2012; Boix, 2015; North et al., 2009). Yet, large historical evidence shows that, over our sample, these ranks gained political and property rights by exchanging their cooperation in investment for public good provision and, accordingly, *Army* is positively and significantly—at one percent—correlated with the number of archaeologically and historically attested irrigation infrastructures built over the previous half-century,[30] conditional on the nonelites' rights, expected return on farming, its opacity and time dummies. Ultimately, we consider *Army* as our proxy for the nonelites' preferred public good,[31] and we acknowledge that both public good provision proxies capture very nosily the nonelites' expected utility.

5.2 *Estimating Equation*

A glance at figures 4 and 5 reveals that the model predictions square with our data. Four patterns are evident. First, the worsening of the climatic conditions between the proto- and the city-states eras and during the empires period reduced the farming returns, forcing the elites to grant strong political and property rights to nonelites with complementary skills. Second, the improved climatic conditions of the kingdoms era corresponded to a fall in the inclusiveness of the political process. Third, over the same period, the diffusion of viticulture contributed to the expansion of the farmers' rights to land in the communities most involved in this opaque activity. Finally, reforms towards stronger nonelites' rights were accompanied by a more intense provision of public goods and, especially, a conscripted army.

[30] The information on irrigation works are collected from the sources detailed in the Internet appendix.

[31] This assumption is also consistent with the classical Athenian shift from an "elite democracy" of the relative wealthier citizens to an "all-encompassing one" (Kyriazis et al., 2015). The eight century BCE introduction of the hoplites, first, and the 482 BCE "Naval Law" later conscripted the top income quintile of and the entire Athenian population, respectively. Both innovations forced the landholding elites to raise the military wage and extend the franchise to all the citizens actively defending the polity (Kyriazis et al., 2015).

A poster child of these patterns is the institutional evolution of Ashur and Emar. Initially organized as a city-state around the temple of Ishtar [Ristvet 2017, p. 47-48], Ashur witnessed during the 4200 BP mega-droughts both the transformation of the former Ur III governors into kingly figures and a series of pro-trade reforms [Palmisano 2018, p. 17-24]. To illustrate, the City Hall, which was dominated by merchant ranks and headed by annually appointed magistrates, created colonies along the caravan routes reaching Anatolia and affirmed itself as third institutionalized decision-maker [Yoffee and Barjamovic 2018, p. 817-818]. The subsequent improved climatic conditions diluted the elites' need to share their decision-making power with the nonelites (see left graphs in figure 6). A similar dynamics interested Emar, which during the early second millennium BCE was guided by a strong collective leadership and displayed even stronger nonelites' property rights because of the early introduction of the domesticated grapevine (see right graphs in figure 6).

Having discussed extensive anecdotal evidence consistent with the model predictions, we now turn to multivariate analysis, and we run by OLS the following panel models

$$Y_{p,t} = \alpha_p + \beta_t + \gamma' \mathbf{X}_{p,t} + \delta' \mathbf{Z}_{p,t} + \varepsilon_{p,t}, \tag{2}$$

where $Y_{p,t}$ is either *Political-Institutions*, *Property-Rights*, *Public-Buildings* or *Army*. α_p encapsulates polity fixed effects controlling for time-independent determinants of $Y_{p,t}$. These are other geographic traits, such as the land suitability for agriculture and pasture (Litina, 2016), and predetermined shocks like the out of Africa exodus of humankind and the agricultural revolution (Ashraf and Galor, 2013; Olsson and Paik, 2016).[32] β_t incorporates half-century dummies picking up regional macro-shocks like epidemics, which might have modulated the incentives to escape the Malthusian trap (Voigtländer and Voth, 2009). Finally, $\mathbf{X}_{p,t}$ gathers *Temperature* and *Vine* if $Y_{p,t}$ is either *Political-Institutions* or *Property-Rights* and it includes *Temperature*, *Vine*, *Political-Institutions* and *Property-Rights* otherwise. Since theoretically we do not observe all the determinants of the expected return on farming and its opacity and, in turn, of the nonelites' rights, we allow *Political-Institutions* and *Property-*

[32] While Litina (2016) suggests that limited land productivity induces more intense cooperation, social capital and development, Ashraf and Galor (2013) document that prehistoric migratory distance from East Africa is related to genetic diversity and present-day trust. Olsson and Paik (2016) claim that an early Neolithic transition to agriculture is correlated with patriarchal values and a less inclusive political process.

Rights to directly shape the extent of public good provision, and we focus on the coefficients attached to these two variables to assess our third testable prediction. Finally, $\mathbf{Z}_{p,t}$ possibly includes—singularly or together—the extra controls discussed in section 5.4.2.

In evaluating our approach, two remarks are key. First, when we switch to a fixed effects Logit model to study the probability of observing a conscripted army, several observations are dropped because of limited within-variation, but our conclusions stand (see table VI of the Internet appendix). Second, to reckon with the within-polity correlation in $\varepsilon_{p,t}$ possibly driven by institutional persistence, we cluster the standard errors at the polity level.[33] In table IX of the Internet appendix, we also document that our conclusions survive when we deal with the spatial dependence in $\varepsilon_{p,t}$ possibly produced by the resolution of the geographic data by relying on either the Driscoll-Kraay or the Conley's (1999) standard errors.[34]

5.3 *Basic Empirical Results*

Table 3 displays the basic estimates, which are consistent with the main model predictions (see section 4). First, a one-standard-deviation rise in *Temperature* is associated with a significant 2.4-standard-deviation fall in *Political-Institutions* and a significant 1.79-standard-deviation decrease in *Property-Rights*. Second, the diffusion of viticulture induces a significant—at 5%—0.4-standard-deviation rise in the strength of the farmers' use rights, but it is unrelated to *Political-Institutions*. Finally, *Property-Rights* is not significantly linked to public good provision, whereas *Political-Institutions* is always positively related to it and, as expected, more significantly to *Army* than to *Public-Buildings*.

5.4 *Gaining More Insights About Causality*

Despite measurement error is not a major issue for our analysis since, as aforementioned, our results remain substantially similar when we consider either alternative measures of the dependent and independent variables or ordinal proxies for the strength of the nonelites' rights, the OLS estimates reported in table 3 might still be inconsistent because of reverse

[33] Our results survive when we switch to the Cameron et al.'s (2008) wild cluster bootstrapping to deal with a possible bias driven by the small number of clusters (see table VIII of the Internet appendix).

[34] Our Conley's (1999) standard errors with Bartlett kernel are constructed for three thresholds beyond which the correlation between error terms is assumed to be zero, i.e., 509, 515 and 1360 km. These figures correspond to, respectively, the mean, median and maximum distance between polities.

causality and/or unobserved heterogeneity. Next, we evaluate both issues in turn.

5.4.1 *Evaluating Reverse Causality*

Starting from the former, the independence from human effort and institutional decisions of the proxies for the expected return on farming and its opacity immediately excludes reverse causation in our analysis of institutional formation. A more direct test is, instead, necessary to rule out that the contemporary link between public good provision and institutions is driven by the former causing the latter. We follow Angrist and Pischke (2009), and we estimate equation (2) with either *Public-Buildings* or *Army* as dependent variable and both *Political-Institutions* and *Property-Rights* lead one time period as extra controls. If reverse causality was an issue, then one would expect even stronger correlations between current public good provision and future institutions because of the plausible lag with which the production of common interest goods would affect the nonelites' rights (see also Stasavage, [2010]). As detailed in table VII of the Internet appendix, this is not the case.

5.4.2 *Controlling for Observables*

Turning to the importance of omitted variables, we pursue a two-step strategy. First, we evaluate the impact on the main coefficients of considering the other key determinants of institutions and public good provision identified by the extant literature. Second, we calculate how much greater the influence of unobservable factors, relative to that of all these key extra controls, would need to be to explain away the main estimates. Three are the primary theories of institutional evolution alternative to our approach.

Expected return on long distance trades.—Acemoglu et al. (2005) provide evidence that the opening of the Atlantic routes empowered the merchant groups in England and the Provinces, allowing them to constrain the decision-making power of the monarchy. In a vein more similar to our model, Boranbay and Guerriero (2019) and Guerriero and Righi (2021) document that the medieval lords expanded the political rights of the merchants in polities with a direct access to the sea and whose distance to the commercial hubs was larger. Here, the return on long-distance trades was smaller. These results are consistent with a version of our first testable prediction applied to trade rather than farming investments. To confirm that this is also the case in our sample, we consider two proxies for the expected return on

long distance trades. The first one is a measure of trade potential calculated through a naive gravity trade model as the sum of the ratios of the product of each polity's estimated—as illustrated below—settled area over the previous half-century and that of another polity to the distance between the two (Barjamovic et al., 2019), i.e., *Trade-Potential*. Turning to our second proxy, we construct a measure of the payoff from sharing consumption risk with neighboring polities via trade. To illustrate, we calculate the ratio of the growing season temperature averaged over the previous half-century and the remaining polities and weighted by the inverse distance to each of them to the polity's value of *Temperature*, i.e., *Risk-Sharing*. *Risk-Sharing* might also be seen as an inverse measure of environmental circumscription, which is the difference between the productivity of the polity core and that of the surrounding areas and, thus, a deterrent to exit and unrest (Mayoral and Olsson, 2019). This interpretation is complicated by the fact that severe penalties for runaway workers and inter-polity treaties forbidding the harboring of fugitives limited their movement [Reid 2015, p. 581-600; Veenhof, 2013]. To cross-validate *Trade-Potential* and *Risk-Sharing*, we document that they are correlated positively and at the one percent statistical significance with a measure of trade expansion,[35] conditional on the nonelites' rights, expected return on farming, its opacity and half-century fixed effects. Considering this trade expansion measure does not change our conclusions (see table X of the Internet appendix).

We also obtain similar results when we incorporate in the analysis three specific features of the Old Assyrian and/or Old Babylonian trade circuits (see table X of the Internet appendix). First, almost all polities were involved in a single network by law [Barjamovic 2013, p. 128]. Second, the connecting nodes injected into the system goods produced by the nearest polities not laying on the routes [Liverani 2014, p. 216-217; Barjamovic 2018, p. 120-125]. Third, these nodes were divided in simple transit points and full-fledged hubs in which professional merchants organized the inter-hub exchange, i.e., Ashur, Babylon, Larsa, Kanesh and Sippar [Barjamovic 2018, p. 122-128; De Boer, 2022]. The hubs revolved around a *karum*, which contracted sworn agreements between nodes, settled trade-related disputes and offered financial services [Postgate 1992, p. 218-221, 300; Palmisano 2018, p. 22]. To

[35] *Imports* is the number of costly-to-obtain items imported over the previous half-century, i.e., soft, chipped and precious stones, metals, ivory, weights and shells (Wilkinson, 2014; Massa and Palmisano, 2018).

capture this peculiar structure, we experiment with the inverse distance between each polity and the two trade networks,[36] and we document that this alternative proxy for the expected return on long distance trades is negatively and significantly correlated with the strength of the nonelites' political and use rights. Considering also the presence over the previous half-century of a formal merchant institution, such as a karum, a port authority or a merchant court—i.e., *Merchant-Institutions*—leaves unchanged the conclusions of our analysis.[37]

State capacity.—A long economic tradition suggests that producing common interest goods, such as fighting external wars, is conducive to forceful private rights (Besley and Persson, 2009). Building on these remarks, we consider the number of external wars in which the polity participated over the previous half-century, i.e., *External-Conflicts*. A growing body of research suggests, instead, that inter-groups conflicts might impede the protection of private property or push the elites to grant more inclusive political institutions (Ashraf and Galor, 2013; Acemoglu and Robinson, 2000; Chaney, 2013). Hence, we consider a dummy equal to one if the polity experienced either an uprising against the institutionalized power/s or a rebellion against an external ruler over the previous half-century, i.e., *Internal-Conflicts*. To construct *External-Conflicts* and *Internal-Conflicts*, we build on monumental inscriptions and secondary sources on warfare (see the Internet appendix).

We obtain similar results when we turn to three alternative determinants of public good provision. First, we consider a measure of political instability defined as the average of a dummy for the ascent to the throne, over the previous half-century, of kings twenty or younger in the other polities weighted by the inverse distance to each of them, i.e., *Young-King*. Intuitively, an inexpert ruler is more vulnerable to external and internal attacks/requests. Consonant with this view, *Young-King* is negatively related to stronger nonelites' rights (Cassidy et al., 2015). Second, we evaluate the Wittfogel's (1957) idea that despotism was necessary to construct and manage large-scale irrigation systems by incorporating in $\mathbf{Z}_{p,t}$ the normalized—to range between zero and one—product of *Temperature* and the irrigation

[36] *Trade-Network* equals: a) zero if the polity did not have any access to the trade circuits and so its distance from them was infinite; b) the inverse distance to the nearest node of the networks to which the polity belonged if it was part of at least one trade circuit but not a node; and c) the inverse distance to the nearest hub of the networks to which the polity belonged if it was part of at least one trade circuit and a node.

[37] Notably, Greif (1992) documents how similar institutions surmounting commitment problems also supported both the expansion of trade and the rise of state's capacity during the medieval "commercial revolution."

impact score produced by GAEZ for the entire planet at a 5 arc-minute resolution, i.e., *Irrigation* (Bentzen et al., 2016).[38] Larger values of *Irrigation* detect larger elites' and nonelites' returns on embracing irrigation farming and, in turn, cooperating in joint farming investment. Consistent with this remark, *Irrigation* increases the likelihood of observing institutions easing such a cooperation. Finally, we test the idea that a shift over the previous half-century of the segment of either the Tigris or the Euphrates closest to the polity—i.e., *River-Shift*—created a demand for state institutions favoring public canalization (Heldring et al., 2020). Since, however, the system of artificial canals was mostly finalized by the mid of the third millennium and organized as a public-private partnership [Wilkinson and Hritz 2013, p. 23],[39] the impact of the 2800, 2400 and 1750 shifts on private rights is statistically insignificant. Moreover, the great rivers' avulsion is never statistically significant in explaining the diffusion of conscripted armies and public buildings which, different from canalization, were classical public goods that polarized social preferences (see section 2).

Modernization.—To evaluate the institutional effect of modernization (Inglehart and Welzel, 2005), we consider the estimated settled area of each polity over the previous half-century in hectares, i.e., *Polity-Size*. This figure is obtained by observing walled area, distribution of pottery fragments and extension of settlement remains over archaeological sites, and it is correlated with population density and urbanization [Colantoni 2017, p. 95-106].

Empirical results.—As clarified by panels A and B of table 4, controlling for the aforementioned main confounding variables either singularly or together leaves unchanged the message of our analysis. Conditional on all observables, four are the key patterns in the data. First, the sign, magnitude and statistical significance of the coefficients on *Temperature* and *Vine* and the links between both *Political-Institutions* and *Property-Rights*, on the one hand, and both *Public-Buildings* and *Army*, on the other hand, remain almost unchanged. Second, conflicts predict only public good provision. This evidence is somehow consistent with Besley and Persson (2009) but at odds with Acemoglu and Robinson

[38] The irrigation impact score equals one for areas unsuitable to agriculture, two for those such that additional water does not increase yields, five for areas in which irrigation can more than double yields and values between two and four for cases intermediate between the one and five scenarios. Being based on fixed present-day agro-edaphic conditions, this index is likely determined by historical institutions.

[39] Notably, the construction and management of irrigation infrastructure was publicly centralized, usually by a royal figure, only in 10.2% of the observations of our sample.

(2000).[40] Third, the coefficient on *Polity-Size* does not support a modernization effect of economic development. Finally, the possibility of sharing consumption risk with neighboring polities is the only other main factor driving the nonelites' political and property rights. To illustrate, the negative coefficients on *Risk-Sharing* in columns (5) and (6) of panel B of table 4 are inconsistent with either a negative impact of environmental circumscription on the nonelites' rights or a trade-related opening of the social order (Acemoglu et al, 2005; Mayoral and Olsson, 2019). On the contrary, they are consonant with the application of our model to long distance trades whereby larger returns on such investments should curb both the elites' need to incentivize the merchants' cooperation and, because farming becomes a fading economic activity, the elites' urge to strengthen the agrarian nonelites' rights to land.

5.4.3 *Using Selection on Observables to Assess the Bias from Unobservables*

Despite our attempts to control for observables, the estimates presented so far may still be biased by unobservable factors. To evaluate this issue, we calculate the index proposed by Bellows and Miguel (2009) to measure how much stronger selection on unobservables, relative to selection on observables, must be to explain away the entire estimated effects. To see how the index is calculated, consider a regression with a restricted set of controls and one with a full set of controls. Next, denote the estimate of the coefficient attached to the variable of interest from the first regression γ^R, where R stands for "restricted," and that from the second regression γ^F, where F stands for "full." Then, the index is the absolute value of $\gamma^F/(\gamma^R - \gamma^F)$. The intuition behind the formula is as follows. The lower the absolute value of $(\gamma^R - \gamma^F)$ is, the less the estimate of the coefficient attached to the variable of interest is affected by selection on observables, and the stronger selection on unobservables needs to be to explain away the entire effect. Similarly, the higher the absolute value of γ^F is, the greater is the effect that needs to be explained away by selection on unobservables.

We consider the specifications without controls reported in table 3 as the restricted regressions and those incorporating all controls in columns (5) to (8) in panel B of table 4 as the full regressions, and we report the indexes calculated from the regressions with dependent variable *Political-Institutions*, *Property-Rights*, *Public-Buildings* and *Army* in columns (1) to

[40] Different from several successful palace conspiracies [Foster 2016, p. 8-10], all the major revolts ended up in mass murder and both deportation and subjugation of the population (Yoffee and Seri, 2019).

(4) of table 5, respectively. We focus on the variables testing the key model predictions. No index is lower than one, and their median (average) is 2.91 (11.54). Hence, to attribute the entire estimates to selection effects, selection on unobservables would have to be on average more than eleven times greater than selection on all observables, which seems unlikely.

6 Concluding Comments

We have developed a theory of endogenous nonelites' political and property rights based on the trade-off between the elites' inability to commit and effectively punish the nonelites and their rent-seeking incentives. Moreover, we have evaluated the model implications using a novel data set on the first stable state institutions recorded in Bronze Age Mesopotamia.

We conclude by highlighting avenues for further research. First, a key question unanswered by our empirical test is whether, due to the larger provision of public goods, reforms towards stronger nonelites' rights fostered economic development. Unlike the extant literature (Besley and Persson, 2009), our results suggest that the geographic determinants of the state's fiscal capacity should be employed to isolate its true impact (Guerriero and Righi, 2021). Second, a key issue for the design of economic and political unions is to evaluate whether the most politically developed dominated polities obstructed the market integration of the Mesopotamian empires, pushing the rulers to impose a complex bureaucracy on all of them and extractive policies on the less militarily relevant ones (Grafe, 2012; Altaweel and Squitieri, 2018; de Oliveira and Guerriero, 2018; Guerriero, 2020). Finally, economic success also depends on the ability of the legal system to implement the socially optimal punishment for deviant behaviors and to properly protect private property (North et al., 2009; Guerriero, 2016b; 2021). Building on cross-sectional data, Guerriero (2016a,b,c) documents that reforms from a decentralized legal order characterized by judicial precedents, procedural discretion, and strong protection of the original owners' property to a centralized one marked by legislation, bright-line procedural rules, and strong protection of the buyers' reliance on contracts, are related to a more inclusive political process. Given the large variation in the centralization of its legal orders (Roth, 1997), Bronze Age Mesopotamia constitutes a superb environment where these ideas can be more credibly tested by adding a time dimension.

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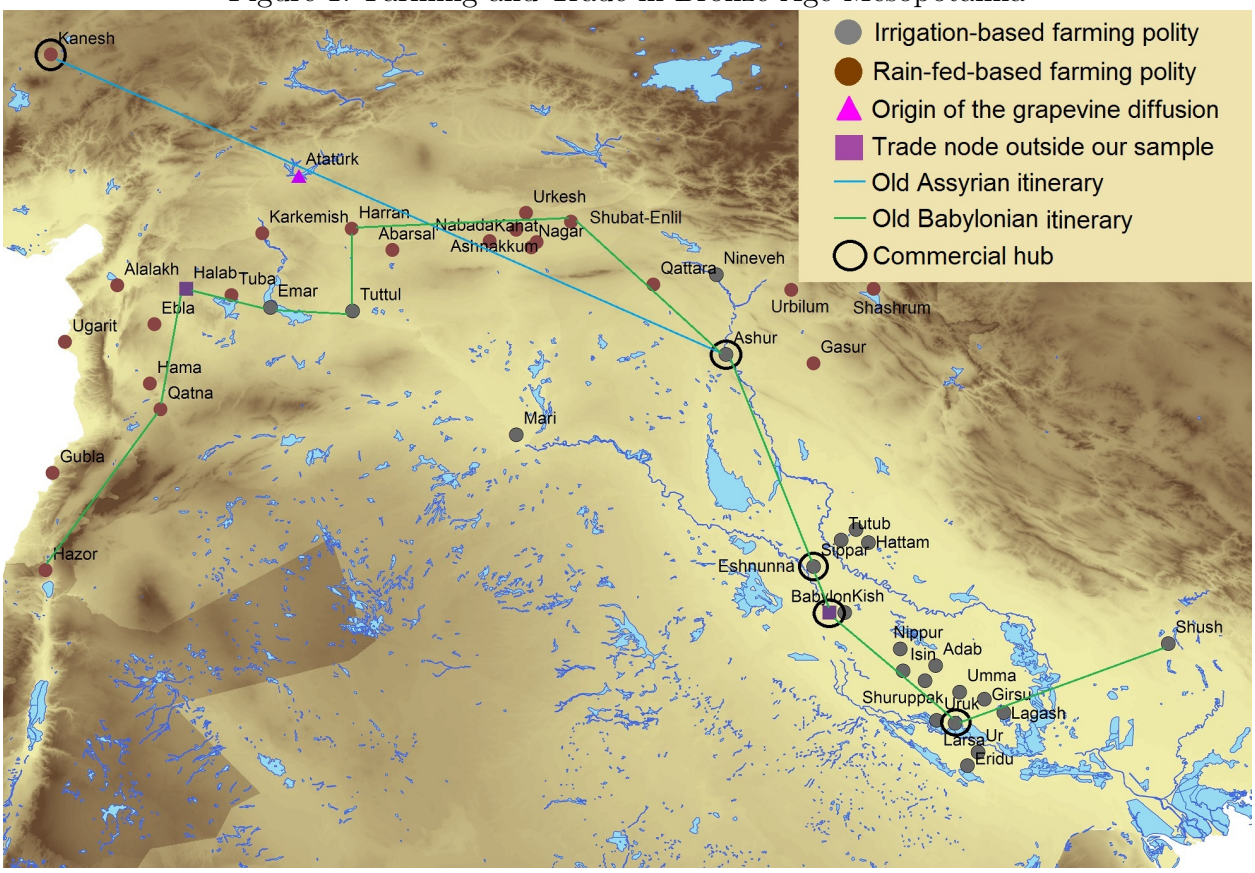
Tables and Figures

Table 1: The Sample — Major Bronze Age Mesopotamian Polities

RAIN-FED FARMING: Abarsal (*Tell Khuera*), Alalakh (*Tell Atchana*), Ashnakkum (*Chagar Bazar*), Ebla (*Tell Mardikh*), Gasur (*Yorgan Tepe*), Gubla (*Byblos*), Hama (*Hama*), Harran (*Harran*), Hazor (*Tell Hazor*), Kahat (*Tell Barri*), Kanesh (*Kultepe*), Karkemish (*Karkemish*), Nabada (*Tell Beydar*), Nagar (*Tell Brak*), Qatna (*Tell Mishrifeh*), Qattara (*Tell Rimah*), Shashrum (*Tell Shemshara*), Shubat-Enlil (*Tell Leilan*), Tuba (*Umm el-Marra*), Ugarit (*Ras Shamra*), Urbilum (*Erbil*), Urkesh (*Tell Mozan*). IRRIGATION FARMING: Adab (*Bismaya*), Ashur (*Qal'aat Sherqat*), Emar (*Tell Meskene*), Eridu (*Abu Shahrein*), Eshnunna (*Tell Asmar*), Girsu (*Tello*), Hattam (*Tell Agrab*), Isin (*Ishan Bahriyat*), Kish (*Tell Uhaimir*), Lagash (*Tell al-Hiba*), Larsa (*Tell Senkereh*), Mari (*Tell Hariri*), Nineveh (*Ninive*), Nippur (*Nuffar*), Shuruppak (*Fara*), Shush (*Susa*), Sippar (*Abu Habbah*), Tuttul (*Tell Bi'a*), Tutub (*Khafajah*), Umma (*Tell Jokha*), Ur (*Tell al-Muqayyar*), Uruk (*Tell al-Warka*).

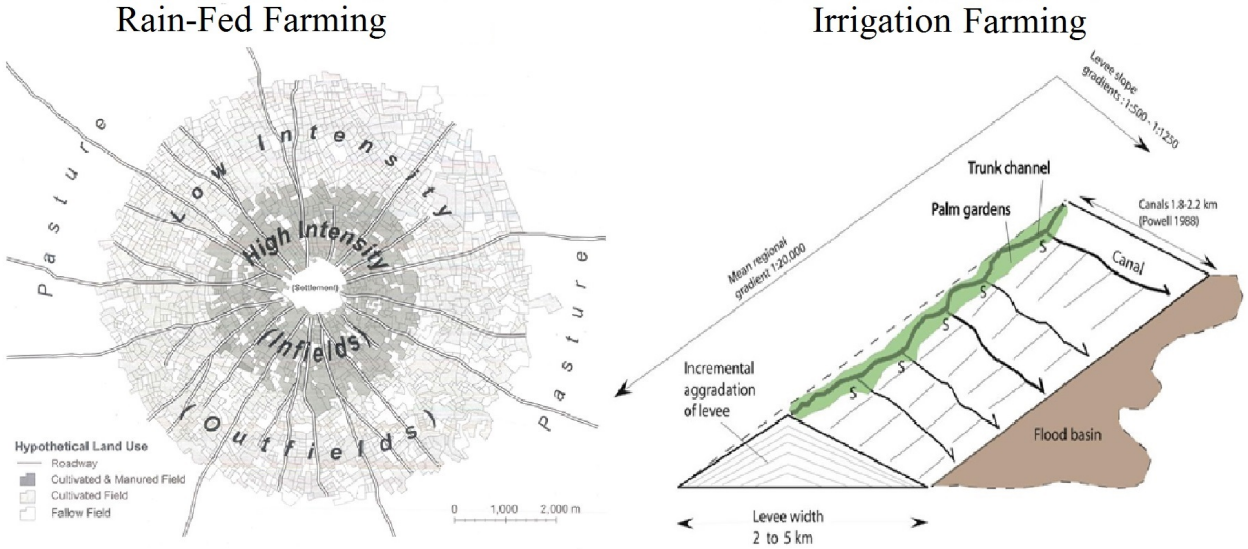
Note: 1. The historical names of the polities that constitute the cross-section identifiers are in regular lowercase type, and those of the present-day archaeological sites are in Italic lowercase font.

Figure 1: Farming and Trade in Bronze Age Mesopotamia



Note: 1. The figure depicts the location of the polities part of the sample, the origin of the domesticated grapevine and the structure of both the Old Assyrian and Old Babylonian trade networks. The latter is extrapolated from figure 12.4 in Liverani (2014).

Figure 2: Farming Technologies



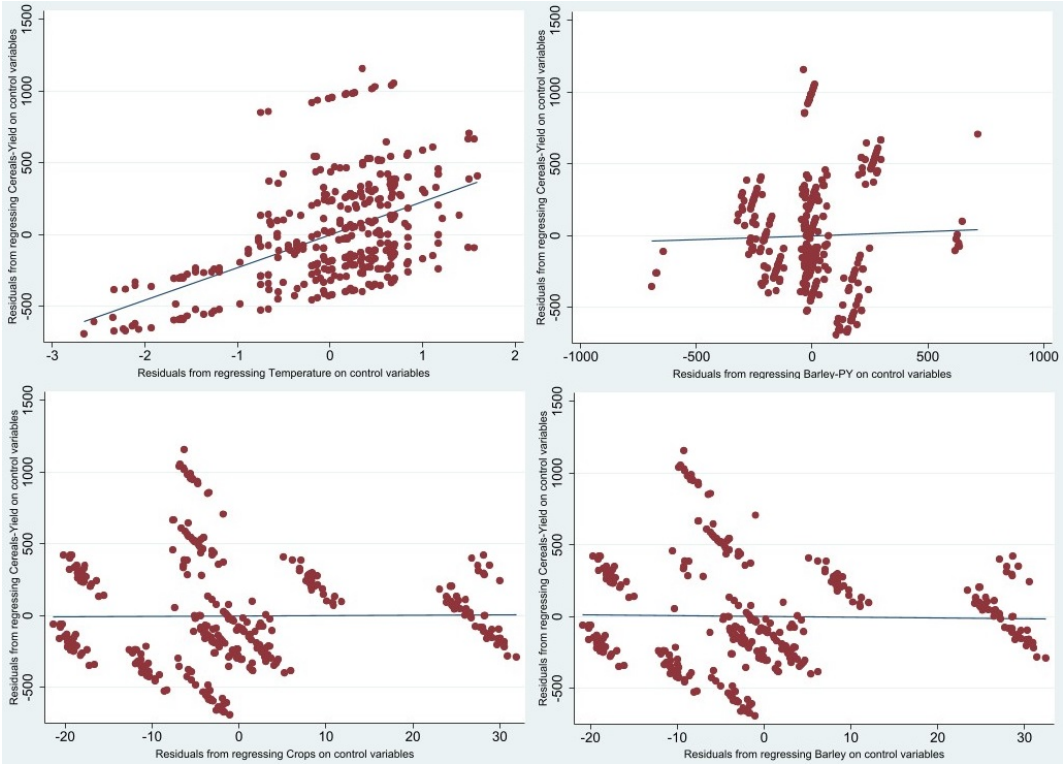
Note: 1. While the left figure is taken from Widell et al. (2013a) and depicts the land use in rain-fed based farming polities, the right figure is collected from Wilkinson et al. (2015) and illustrates the land exploitation in irrigation based farming polities.

Table 2: Summary of Variables

	Variable	Definition and Sources	Statistics
Institutions:	*Political-Institutions*:	Five-point score rising with the division of the decision-making power. Sources: see the references listed in the Internet appendix.	2.305 (1.052)
	Property-Rights:	Six-point index increasing with the strength of the farmers' use rights to land. Sources: see the references listed in the Internet appendix.	2.231 (1.036)
Geography:	*Temperature*:	Growing season temperature in Celsius averaged over previous half-century. Source: TRACE project last accessed on 09/2017, https://www.earthsystemgrid.org/project/trace.html	25.837 (1.647)
	Cereals-Yield:	Cereals and, especially, barley coeval yields, in liters per hectare. Sources: see the references listed in the Internet appendix.	1006.453 (423.544)
	Barley-PY:	Agro-climatic potential barley yields in tons per hectare. Sources: GAEZ project last accessed on 09/2017, http://www.gaez.iiasa.ac.at/	1837.159 (217.354)
	Crops:	Normalized product of *Temperature*, slope gradient rate and maximum land suitability under low (middle) input rain-fed (irrigation) farming. Sources: GAEZ and TRACE projects.	32.660 (16.966)
	Barley:	Normalized product of *Temperature*, slope gradient rate and land suitability for barley under low (middle) input rain-fed (irrigation) farming. Sources: GAEZ and TRACE projects.	32.315 (17.028)
	Vine:	Dummy for polities growing, over the previous half-century, the domesticated grapevine. Sources: http://www.ademnes.de and the references listed in the Internet appendix.	0.080 (0.271)
Extra Controls:	*Trade-Potential*:	Trade potential calculated through a naive gravity trade model. Source: Liverani (2014).	831.05 (1949.49)
	Risk-Sharing:	Proxy for the payoff from sharing consumption risk with neighboring polities via trade. Source: TRACE project.	1.009 (0.045)
	External-Conflicts:	Number of external conflicts over the previous half-century. Sources: see the references listed in the Internet appendix.	0.301 (1.469)
	Internal-Conflicts:	Dummy for uprisings and/or rebellions over the previous half-century. Sources: see the references listed in the Internet appendix.	0.029 (0.169)
	Polity-Size:	Estimated settled area of the polity in hectares over the previous half-century. Sources: see the references listed in the Internet appendix.	50.621 (79.871)
Public good provision:	*Public-Buildings*:	Number of public and ritual buildings built over the previous half-century. Sources: see the references listed in the Internet appendix.	1.085 (1.831)
	Army:	Dummy for polities that set up, over the previous half-century, a conscripted army. Sources: see the references listed in the Internet appendix.	0.414 (0.493)

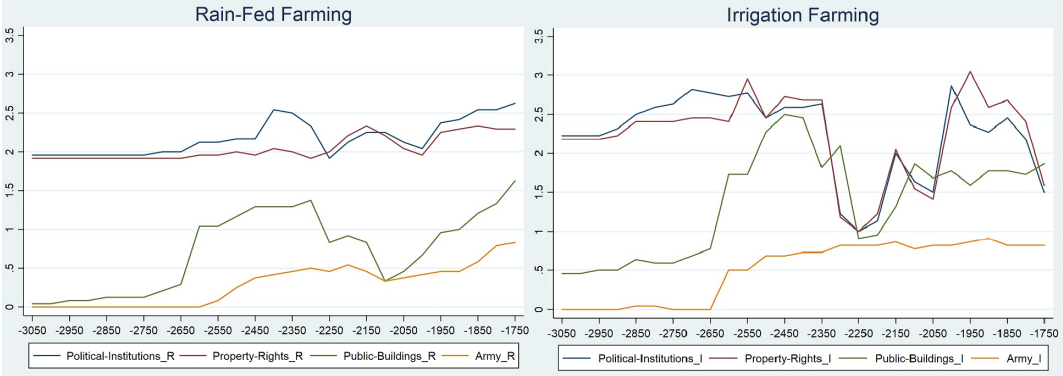
Note: 1. The last column reports the mean value and, in parentheses, the standard deviation of each variable. Both are computed building on the sample used in tables 3 to 5 except for *Cereals-Yield*, which is calculated for the available 351 observations.

Figure 3: Cereal Yields and Different Proxies for the Expected Farming Return



Note: 1. The graphs depict the correlations between the coeval cereal yields—i.e., *Cereals-Yield*—and four proxies for the expected farming return—i.e., *Temperature*, *Barley-PY*, *Crops* and *Barley*—conditional on rainfall—i.e., *Rainfall*, diffusion of viticulture—i.e., *Vine*, time dummies and, in the case of the bottom graphs, *Temperature*. The graphs are obtained from the 351 observations for which *Cereals-Yield* is observable. Table 2 and the Internet appendix detail the definition and sources of each variable.

Figure 4: Political Institutions, Property Rights and Public Good Provision

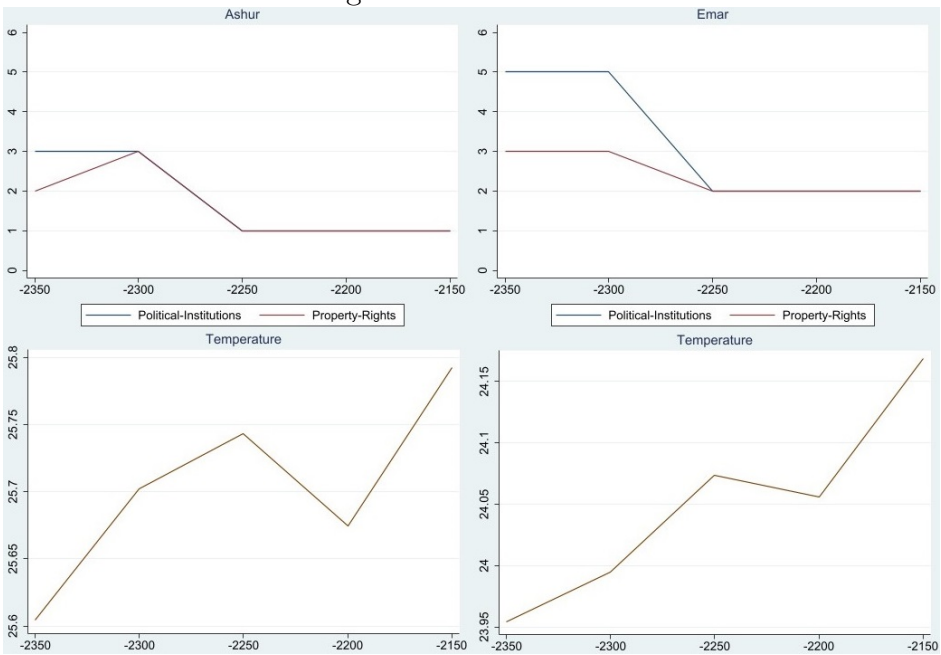


Note: 1. The left (right) graph illustrates the links among the inclusiveness of political institutions—i.e., *Political-Institutions*, strength of the farmers' use rights to land—i.e., *Property-Rights*, number of public and ritual buildings—i.e., *Public-Buildings*—and presence of a conscripted army—i.e., *Army*—in the subsample of rain-fed(irrigation)-based farming polities between 3050 and 1750 BCE. While table 1 lists the polities part of each group, table 2 and the Internet appendix detail definition and sources of each variable.

Figure 5: Expected Return on Farming and Its Opacity

Note: 1. While the upper left(right) graph depicts the evolution of the growing season temperature—i.e., *Temperature*—in the subsample of rain-fed(irrigation)-based farming polities between 3050 and 1750 BCE, the bottom left(right) graph illustrates the diffusion of viticulture—i.e., *Vine*—in the same subsample and over the same period. While table 1 lists the polities part of each group, table 2 and the Internet appendix detail definition and sources of each variable.

Figure 6: Poster Child



Note: 1. While the upper left(right) graph depicts the inclusiveness of political institutions—i.e., *Political-Institutions*—and strength of the farmers' use rights to land—i.e., *Property-Rights*—in Ashur (Emar) between 2350 and 2150 BCE, the bottom left(right) graph illustrates the evolution of the growing season temperature—i.e., *Temperature*—in the same polity over the same period. Table 2 and the Internet appendix detail definition and sources of each variable.

Table 3: Endogenous Institutions and Public Good Provision

	(1)	(2)	(3)	(4)
	The dependent variable is:			
	Political-Institutions	*Property-Rights*	*Public-Buildings*	*Army*
Political-Institutions			0.393	0.072
			(0.201)*	(0.031)**
Property-Rights			- 0.113	- 0.002
			(0.171)	(0.025)
Temperature	- 1.535	- 1.123	- 0.467	0.260
	(0.568)***	(0.667)*	(0.403)	(0.189)
Vine	0.407	0.420	0.321	0.060
	(0.292)	(0.189)**	(0.254)	(0.090)
	OLS			
Within R^2	0.10	0.09	0.18	0.51
Number of Observations	1188	1188	1188	1188

Notes: 1. Standard errors clustered at the polity level in parentheses. *** denotes significant at the 1% confidence level; **, 5%; *, 10%.
2. All specifications include polity and half-century fixed effects.

Table 4: Endogenous Institutions and Public Good Provision — Controlling for Observables

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Panel A. The dependent variable is:							
	Political-Institutions	*Property-Rights*	*Public-Buildings*	*Army*	*Political-Institutions*	*Property-Rights*	*Public-Buildings*	*Army*
Political-Institutions			0.389	0.071			0.401	0.071
			(0.205)*	(0.032)**			(0.200)**	(0.031)**
Property-Rights			- 0.130	- 0.012			- 0.182	- 0.005
			(0.167)	(0.028)			(0.157)	(0.026)
Temperature	- 3.927	- 3.449	0.889	1.594	- 1.598	- 1.144	- 0.378	0.240
	(0.846)***	(1.157)***	(1.204)	(0.336)***	(0.598)**	(0.700)	(0.413)	(0.185)
Vine	0.396	0.409	0.323	0.060	0.360	0.361	0.198	0.055
	(0.286)	(0.185)**	(0.247)	(0.093)	(0.291)	(0.190)*	(0.313)	(0.091)
Trade-Potential	0.00015	0.00017	0.00008	0.00005				
	(0.00003)***	(0.00004)***	(0.00007)	(0.00001)***				
Risk-Sharing	- 91.067	- 88.952	48.622	48.070				
	(24.617)***	(36.675)**	(36.262)	(10.147)***				
External-Conflicts					0.092	0.114	0.278	0.014
					(0.050)*	(0.054)**	(0.112)**	(0.007)**
Internal-Conflicts					0.262	0.118	- 0.460	0.057
					(0.265)	(0.290)	(0.514)	(0.037)
	OLS							
Within R^2	0.14	0.14	0.18	0.54	0.12	0.12	0.23	0.52
Number of Observations	1188	1188	1188	1188	1188	1188	1188	1188
	Panel B. The dependent variable is:							
	Political-Institutions	*Property-Rights*	*Public-Buildings*	*Army*	*Political-Institutions*	*Property-Rights*	*Public-Buildings*	*Army*
Political-Institutions			0.353	0.065			0.349	0.072
			(0.196)*	(0.030)**			(0.183)*	(0.031)**
Property-Rights			- 0.142	- 0.007			- 0.170	- 0.015
			(0.165)	(0.026)			(0.141)	(0.028)
Temperature	- 1.465	- 1.055	- 0.471	0.259	- 4.157	- 3.530	0.689	1.597
	(0.547)***	(0.639)*	(0.368)	(0.183)	(0.881)***	(1.183)***	(1.164)	(0.335)***
Vine	0.311	0.327	0.225	0.043	0.301	0.323	- 0.012	0.059
	(0.287)	(0.159)**	(0.244)	(0.089)	(0.291)	(0.178)*	(0.312)	(0.097)
Trade-Potential					0.00005	0.0001	- 0.0003	0.00005
					(0.00008)	(0.0001)*	(0.0001)**	(0.00003)*
Risk-Sharing					- 97.307	- 91.328	38.718	48.236
					(24.457)***	(36.273)**	(32.962)	(10.193)***
External-Conflicts					0.077	0.099	0.276	0.012
					(0.049)	(0.052)*	(0.113)**	(0.006)**
Internal-Conflicts					0.174	0.039	- 0.728	0.003
					(0.276)	(0.300)	(0.490)	(0.039)
Polity-Size	0.004	0.004	0.005	0.0009	0.003	0.002	0.010	- 0.0002
	(0.001)***	(0.001)***	(0.002)**	(0.0004)**	(0.002)	(0.002)	(0.003)***	(0.0008)
	OLS							
Within R^2	0.14	0.13	0.21	0.52	0.16	0.17	0.28	0.54
Number of Observations	1188	1188	1188	1188	1188	1188	1188	1188

Notes: 1. Standard errors clustered at the polity level in parentheses. *** denotes significant at the 1% confidence level; **, 5%; *, 10%.
2. All specifications include polity and half-century fixed effects.

Table 5: Using Selection on Observables to Assess the Bias from Unobservables

	(1)	(2)	(3)	(4)
	The dependent variable is			
	Political-Institutions	*Property-Rights*	*Public-Buildings*	*Army*
The index is calculated for				
Political-Institutions			7.93	71
Property-Rights			2.98	1.15
Temperature	1.59	1.47		
Vine	2.84	3.33		

Note: 1. The restricted set of controls includes those employed in the specifications reported in table 3, whereas the "full set" of covariates incorporates those used in the specifications listed in columns (5) to (8) of panel B of table 4. The sample size is always 1188.