History's Masters

The Effect of European Monarchs on State Performance*

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This version: 12 January 2022

Abstract

We create a novel reign-level dataset for European monarchs, covering all major European states between the 10th and 18th centuries. We first document a strong positive relationship between rulers' intellectual ability and state-level outcomes. To address endogeneity issues, we exploit the facts that i) rulers were appointed according to hereditary succession, independent of their ability, and ii) the wide-spread inbreeding among the ruling dynasties of Europe led over centuries to quasi-random variation in ruler ability. We code the degree of blood relationship between the parents of rulers, which also reflects 'hidden' layers of inbreeding from previous generations. The 'coefficient of inbreeding' is a strong predictor of ruler ability, and the corresponding instrumental variable results imply that ruler ability had a sizeable effect on the performance of states and their borders. This supports the view that 'leaders made history,' shaping the European map until its consolidation into nation states. We also show that rulers mattered only where their power was largely unconstrained. In reigns where parliaments checked the power of monarchs, ruler ability no longer affected their state's performance. Thus, the strengthening of parliaments in Northern European states (where kin marriage of dynasties was particularly wide-spread) may have shielded them from the detrimental effects of inbreeding.

JEL: D02, D73, N43, P14, P16.

Keywords: Leaders, State Performance, Institutions

*We would like to thank Paola Giuliano, Petra Moser, Thilo Huning, Casey Petroff, Marta Reynal-Querol, Romain Wacziarg, Melanie Wasserman, as well as seminar audiences at UCLA, the RIDGE Virtual Forum 2020, the Armenian Economic Association, HSE, the NBER Political Economy Summer Institute, Northwestern, and UC Berkeley for helpful comments and suggestions. Thomas Groesbeck, Angelo Krüger, and Logan Spencer provided outstanding research assistance. Corresponding author: Nico Voigtländer (nico.v@ucla.edu)

"It was a time ... 'when the destinies of nations were tied to bloodlines'."

– Robert Bartlett ("Blood Royal: Dynastic Politics in Medieval Europe," 2020, p.432)

1 Introduction

A growing literature points to the importance of leaders for the performance of their firms and organizations (c.f. Bertrand and Schoar, 2003; Malmendier and Tate, 2005). Likewise, local political leaders have substantial effects on public goods provision and conflict in the region or community under their control (c.f. Chattopadhyay and Duflo, 2004; Logan, 2018; Do et al., 2020; Eslava, 2020). However, identifying such effects at the *national* level is difficult. The question whether national leaders can shape their countries' fortunes has been widely debated in the social sciences over the past two centuries. Early advocates proposed the strong view that the "history of the world is but the biography of great men" (Carlyle, 1840, p. 47). Subsequent qualitative analyses of biographies and comparative studies have lent support to an important role played by individual leaders.[1] On the other hand, a literature in the Marxist tradition has argued that underlying structural demographic and economic forces determine both a state's performance and the endogenous emergence of its leaders. Scholars in this strand view leaders as "history's slaves" (Tolstoy, 2007, p. 605); in the words of Braudel and Reynolds (1992, p. 679): "Men do not make history, rather it is history above all that makes men."[2]

Economists have brought identification to this debate. Jones and Olken (2005) show that random leadership transitions due to natural death or accidents are followed by changes in economic growth over the post-WWII period, providing convincing evidence that leaders do indeed matter. Besley, Montalvo, and Reynal-Querol (2011) expand the underlying data to 1875-2004, documenting that random departures of educated leaders cause particularly strong reductions in growth. While these results are an important step forward in identifying a causal effect of leader capability on state performance, some open issues remain: The actual "quality" of leaders is unobserved; it is estimated as average economic growth a few years before and after a random death, and it therefore also captures other factors. In this context, Easterly and Pennings (2020) point out that the

[1] See for example Kennedy (1988) and Gueniffey (2020). A literature in political psychology has also underlined the importance of leaders' intellectual capabilities (c.f. Simonton, 2006). Horowitz, Stam, and Ellis (2015, p. 11) conclude that "leaders do matter in systematic ways that we can understand."

[2] In his magnum opus War and Peace, Russian writer Lev Tolstoy attested to leaders that "every act of theirs...is...predestined from eternity" (Tolstoy, 2007, p. 605). Karl Marx wrote: "Men make their own history, but they do not make it as they please; they do not make it under self-selected circumstances, but under circumstances existing already, given and transmitted from the past. The tradition of all dead generations weighs like a nightmare on the brains of the living" (Marx, 1907, p. 5). Friedrich Engels elaborated: "But that in default of a Napoleon, another would have filled his place, that is established by the fact that whenever a man was necessary he has always been found: Caesar, Augustus, Cromwell, etc." (Engels, 1968, p. 704). This alternative view, cautioning the interpretation of history through the biography of individuals, is well alive in the modern debate as well. March and Weil (2009, p. 97) assert that "it is not at all clear ... that major differences in the success of organizations reflect differences in the capabilities of their leaders, or that history is the product of leaders' actions."

high volatility in growth makes it difficult to distinguish between random spikes and actual effects of individual leaders. In addition, while the timing of the transition is exogenously determined by death, the appointment of the subsequent leader is endogenous. Finally, the necessary annual GDP data is only available for the modern period, so that the causal role of leaders in history (where it has been debated most intensely) has not been examined. To make progress on these fronts, the ideal experiment would feature a sequence of randomly appointed leaders with varying, observed capabilities who govern over a long horizon. While this is empirically unattainable, Europe's monarchies over the late medieval and early modern period provide a context that, in some ways, resembles such a setting.

We study European monarchs over the period 990-1795, assembling a novel dataset on ruler ability and state performance at the *reign* level. To identify a causal effect of ruler ability, we exploit two imminent features of ruling dynasties: first, hereditary succession – the pre-determined appointment of offspring of the prior ruler as the next rulers, independent of their ability; second, variation in ruler ability due to the widespread inbreeding of dynasties. Importantly, the negative effects of inbreeding were not understood until the 20th century; if anything, rulers believed that inbreeding helped to preserve 'superior' royal traits. In addition, the full degree of consanguinity (genetic similarity) was unknown due to complex, interrelated family trees over generations. Together, these features deliver quasi-random variation in ruler ability.

We collect data on the ability of 336 monarchs from 13 states, building on the work by historian F.A. Woods (1906), who coded rulers' intellectual capability and character traits based on reference works and state-specific historical accounts. While Woods explicitly aimed to assess ruler's intellectual capability and character traits independent of the performance of their state, this coding nevertheless raises endogeneity concerns. We thus instrument for ruler ability with the coefficient of inbreeding of rulers. We collect this variable for all rulers with the necessary information on family lineages from a rich genealogical database. The coefficient of inbreeding is a strong and robust predictor of ruler ability. To assess state performance during a ruler's reign, we use three different outcome variables. First, a coding of state performance that is based on several underlying metrics and summarizes the work by numerous historians (Woods, 1913). Because there are natural concerns with this subjective coding, we use two additional, objective measures. Our second outcome variable measures changes in land area during each ruler's reign. We derive this variable from Abramson (2017), who provides European state borders at five-year intervals over the period 1100-1795. Finally, we also calculate the change in urban population within the (potentially changing) area ruled by each monarch, combining border changes with the urban population data of Bairoch, Batou, and Chèvre (1988).

We find that ruler ability is strongly associated with all three measures of state performance, and our IV results suggest that this relationship is causal. A one-standard-deviation (std) increase in ruler ability leads to about a one-std higher state performance, to an expansion in territory by about 17 percent, and to an increase in urban population by 19 percent. In exploring possible mechanisms, we find that inbreeding affected state-level outcomes via rulers' ability (both cognitive and non-cognitive), but not via physical attributes such as longevity, number of offspring, or body height. Less inbred, capable rulers tended to improve their states' finances, commerce, law and order, and general living conditions. They also reduced involvement in international wars, while at the same time expanding their territory into urbanized areas. This suggests that capable rulers chose conflicts 'wisely,' resulting in expansions into valuable, densely populated territories.

We also study the institutional circumstances under which individual rulers mattered particularly strongly. We construct a novel state-year specific measure of historical constraints on rulers, combining definitions of the modern Polity IV score with historical sources on factors such as the power of parliaments. To bypass endogeneity issues, we use constraints on rulers in the year just before they were appointed, and we only focus on our two 'objective' outcome variables because historians' subjective assessment of state performance may be influenced by the state's institutions. We find that the ability of unconstrained leaders had a strong effect on state borders and urban population in the reign, while the capability of constrained rulers made almost no difference.

We run a battery of checks to confirm the robustness of our results and the validity of our IV strategy. Our baseline regressions include state fixed effects and are thus driven by variation in ruler ability and state performance *within* states over time, filtering out time-invariant features and differences in average state performance across Europe. Our results are robust to numerous alternative specifications such as using dummies for different levels of ruler ability, using ordered Probit, as well as clustering at the state, dynasty, and century level. Our findings are unaffected when we exclude episodes of governments by regents (for example, when rulers were minor at the time of their appointment), when excluding episodes of foreign rule, or those when the same monarch governed more than one state. We also verify and extend Woods' (1906) and (1913) coding of ruler ability and state performance, showing that our results are robust to using only our own assessments, to extending the sample period until 1914, to adding Poland and Hungary to the 13 states in our baseline sample, and even to a conservative coding that specifies ambiguous cases in Woods' coding so that they work against our main finding. Finally, we confirm the robustness of our results in alternative pair-level regressions in differences that compare concurrent rulers *across* states, filtering out not only state fixed effects but also time trends specific to the period of the reigns.[3]

Our IV results, in particular, are robust to excluding cases of high inbreeding coefficients and

[3]We identify for each monarch all rulers from other states that had at least a one-year overlap in their reigns. We then run pair-level regressions in differences, also controlling for reign-specific fixed effects. We find that differences in inbreeding across concurrently ruling monarchs are a strong predictor of differences in their ability, which in turn drives differences in state performance.

to a battery of additional robustness checks. We also discuss potential threats to the exclusion restriction (i.e., that inbreeding affected ruler ability but was not related to state performance via other channels). For instance, such a threat would arise if monarchs made strategic decisions on kin marriage for reasons that were correlated with the *prospects* for state performance under their heir's reign. We address this possibility by excluding the component of inbreeding that resulted from each ruler's parents, exploiting only the *hidden* component of inbreeding that resulted from the complex networks of kin marriage over previous generations.[4] We confirm our IV results based on this restrictive measure of inbreeding. We further show that past state performance predicts neither current state performance nor ruler ability, and our IV results are robust to controlling for lagged state performance.[5] In addition, we address other potential confounders such as strategic marriage for territorial expansions, the relationship between family ties and conflict, as well as 'founders vs. descendants' effects within dynasties. Table A.32 at the end of the online appendix summarizes our discussion of identifying assumptions and threats to identification, and it provides links to our historical and empirical evidence that addresses these.

Our paper makes novel contributions both in terms of data collection and empirical results. We are the first to track the performance of all major European states at the *reign* level over a horizon of several centuries, accounting for the frequent changes in borders. In contrast, previous seminal papers have typically used today's country borders as their unit of analysis, and they have relied on (half-) century level outcomes such as GDP per capita or urbanization (c.f. Acemoglu, Johnson, and Robinson, 2005; Nunn and Qian, 2011; Dittmar, 2011). Our dataset thus opens a new dimension to study Europe's history. Using this novel dataset, we contribute to a large literature that has debated the role of rulers for nationwide outcomes. We analyze a period that has been at the center of this debate since its beginning in the 19th century.[6] Our paper is the first to provide

[4]This 'hidden' coefficient of inbreeding could only be assessed with methods in genetics that emerged in the early 20th century. Benzell and Cooke (2018) similarly exploit variation in the pedigree of nobility that was not a direct choice of the nobles themselves, studying how changes in kinship ties between alive ruler pairs (due to random deaths in the family network) affected conflict. In related work, Becker et al. (2020) use the gender of first-born children of nobles to predict conflict between German cities and study its effect on local institutions.

[5]For our first, subjective, measure of state performance, the exclusion restriction could also be violated if inbreeding affected the *assessment* of state performance by historians – for example, if they hypothesized negative effects of inbreeding on rulers, and in turn of bad rulers on states. This is unlikely because Woods was a proponent of 'Social Darwinism,' viewing history as a process of natural selection. Woods' (1913) hypothesis was that moral and intellectual ability is inheritable, so that kin marriage among successful dynasties would produce *better* rulers. This introduces a bias *against* our findings. In addition, the negative effects of inbreeding on fitness were not accepted in biology until the second half of the 20th century (see Wolf, 2005, for detail on this debate). Correct measures of inbreeding were first developed by Wright (1921). When these measures eventually became available, Asdell (1948) showed that Woods' Social-Darwinist hypothesis was wrong, using Woods' (1906) own coding of ruler ability.

[6]For proponents of the "rulers matter" view see for example Carlyle (1840), Weber (1921), William (1880), and Spencer (1896). For the opposite view that "history makes men" see Marx (1907), Engels (1968), Braudel and Reynolds (1992). More recent contributions to this theoretical and empirical debate include March and Weil (2009), Simonton (2006), and Xuetong (2019), as well as Acemoglu and Jackson (2015), Alston (2017), and Alston, Alston, and Mueller (2021).

causal identification of the importance of European rulers over the late medieval and early modern period. State performance during this period had long-lasting consequences, as the foundations for the modern nation states were laid across Europe. Our findings suggest that the territorial organization of Europe as we know it is at least in part the result of chance, embodied in the ability of individual rulers.

We also contribute to a strand of the literature that has underlined the importance of individual characteristics of leaders in both managerial and political settings.[7] In the managerial literature, Clark, Murphy, and Singer (2014) have documented that CEOs matter less when they are constrained by a well-defined governance structure, echoing the findings on constrained politicians by Jones and Olken (2005) and Besley et al. (2011). Similarly, Besley and Reynal-Querol (2017) document higher economic growth under hereditary (as compared to non-hereditary) leaders when constraints on them were weak, using data from 1875 onwards. Besley and Reynal-Querol (2017) interpret these correlations as evidence that hereditary leaders have a longer time horizon, improving policy choices.[8] Our results focus *only* on hereditary leaders, showing that their ability (which is not observed by Besley and Reynal-Querol, 2017) had strong effects on state performance – unless it was checked by institutional constraints. This latter finding is particularly interesting because inbreeding became more severe in the 17th and 18th century, after centuries of accumulated intermarriage. By that time, parliaments across Northern Europe had expanded their power, constraining national rulers (Van Zanden, Buringh, and Bosker, 2012). Thus, our results suggest that parliaments protected (some) European states from the adverse effects of their ruling dynasties' inbreeding.

The paper is organized as follows. Section 2 introduces the historical background of European monarchs. Section 3 discusses our data sources and coding. Section 4 shows our main empirical results, discusses our identification strategy, and sheds light on possible mechanisms. Section 5 examines heterogeneity by institutional constraints on rulers. Section 6 concludes.

2 Historical Background: Europe under Dynastic Rule

This section briefly reviews the historical background of European monarchs in the late medieval and early modern period. We pay particular attention to those features that render the setting a rich testing ground for identifying the causal effect of national leaders on state performance.

[7]C.f. Bertrand and Schoar (2003), Malmendier and Tate (2005), Bloom and Van Reenen (2007), and Becker and Hvide (2013) for the importance of managerial traits; and Ferreira and Gyourko (2014), Yao and Zhang (2015), Logan (2018), Assouad (2020), Dippel and Heblich (2021), and Carreri and Payson (2021) for work on traits of political leaders and their effects.

[8]A related literature studies political dynasties in modern democracies, where some prominent families repeatedly have members *elected* to important offices (c.f. Dal Bó, Dal Bó, and Snyder, 2009; George and Ponattu, 2018). In contrast, in our setting, succession was guaranteed by law, and dynasties were the central governing bodies over the course of centuries.

2.1 Rulers and State Performance

A plethora of studies in a variety of fields have argued that national leaders affect the fortunes of their countries. For example, the literatures in historiography and political science are full of cases linking the fate of countries to their rulers' actions and abilities.[9] One often-cited case is the series of able rulers accompanying Prussia's rise from small polity to great power.[10] Similarly, Kennedy (1988) notes that one of the factors aiding Sweden's "swift growth from unpromising foundations" was "a series of reforms instituted by Gustavus Adolphus and his aides," increasing the efficiency of administration and allowing Sweden under Gustavus to play an outsized role in the Thirty Years War, despite the fact that Sweden "militarily and economically [...] was a mere pigmy" when Gustavus ascended to the throne. Conversely, the *shortcomings* of individual monarchs have been linked to political failures, such as in the case of John I of England (1199-1216), whose personal incapability in military matters resulted in Britain losing most of its continental possessions. In the words of (Bradbury, 1999, p. 349): "The explanation of the defeat ... rests between John's fault as a commander and his faults as a man."

A Tale of two Carloses

In our baseline empirical analysis, we exploit the variation of ruler ability over time within the same states. In what follows, we provide an illustrative example: Carlos II was King of Spain from 1665 to 1700. Hailing from a line of successive marriages of relatives from the Spanish and Austrian Habsburgs, he was highly inbred and commonly described as an incapable ruler with little effective power. While his parents technically were 'merely' uncle and niece, the build-up of consanguinity over previous generations due to marriage among relatives resulted in Carlos II's parents sharing as many genes as siblings would. As the pedigree in Figure 1 shows, all of Carlos II's grandparents descended from Joanna and Philip I of Castile. Repeated marriage between cousins as well as between uncles and nieces ultimately led to the majority of Carlos II's inbreeding being 'hidden' in the deeper layers of the pedigree: His coefficient of inbreeding was 25.36, of which 12.5 was due to his parents being uncle and niece, with the remainder being a 'hidden' component due to accumulated inbreeding over previous generations. The degree of inbreeding was of no concern

[9] Biographies published by historians consistently emphasize the importance of certain individuals and their leadership qualities in shaping the nations they ruled – see for example Roberts (2018) and MacCulloch (2018) for the effects of Cromwell's and Churchill's actions and convictions upon their native England. Nicholas (2021) writes: "In any age and time a man of Churchill's force and talents would have left his mark on events and society."

[10] In particular, Frederick William I. (the "Soldier King," who reigned 1713-1740) and his son, Frederick II (the "Great," 1740-1786), facilitated the rise of Prussia into the rank of a Great Power of Europe with their administrative reforms and military decisiveness. And even if – by his father's achievements – "Frederick the Great came into a rich inheritance, [...] the favorable circumstances do not in the least explain his great success" (Woods, 1913, p. 159). The often idiosyncratic decisions of earlier rulers also shaped Prussia, as for instance that of Elector John Sigismund to convert to Calvinism in 1613 (Clark, 2007, p. 115).

(not even the 'visible' uncle-niece dimension) when Carlos II's parents married in 1649.[11]

The "inbreeding depression" resulting from intermarriage over generations left Carlos II hostage to physical and mental fragility.[12] He only started talking at age 4, and walking at age 8. Alvarez, Ceballos, and Quinteiro (2009) describe him as "physically disabled, mentally retarded and disfigured." As Carlos II became king of Spain when he was 4 years old, his mother Mariana became regent and influenced his policies until he turned 18.[13] When he eventually took over as ruler, Charles II's inability sent Spain into decline (Mitchell, 2013). As Hamilton (1938, p. 174) notes: "Diseased in mind and body from infancy, and constantly preoccupied with his health and eternal salvation, Charles II was incapable not only of governing personally but of either selecting his ministers or maintaining them in power." Woods' (1906) assessment of Carlos II is brief, characterizing him as an "imbecile" with negative virtues. Carlos II died without an heir, marking the end of the Spanish Habsburg dynasty.

The power struggles that followed Carlos II's death brought a new dynasty to the Spanish throne – the Spanish Bourbons. The ranks of the Bourbon dynasty first led to two relatively undistinguished monarchs.[14] Thereafter, the highly capable Carlos III came to inherit the throne in 1759 through hereditary succession from his half-brother, who had left no heirs. Carlos III's parents were cousins of third degree, and the accumulated 'hidden' component of inbreeding was also small, resulting in a degree of inbreeding of only 3.9 – significantly smaller than that of his predecessors. 1906 characterized Carlos III as "enlightened, efficient, just, and sincere. Not brilliant, but had a very well-balanced mind." Spain flourished under Carlos III's reign, and contemporaries and historians hold him in high regards: He "was probably the most successful European ruler of his generation. He had provided firm, consistent, intelligent leadership [...and] had chosen capable ministers" (Payne, 1973, p. 371). Consequently, Carlos III's reign saw the "continued improvement in financial and commercial conditions, including agriculture and the useful arts" (Woods, 1913, p. 331).

[11] As we discuss below, restrictions on cousin marriage were not enforced among the European nobility. Knowledge about the adverse effects of inbreeding only emerged in the early 20th century and was not widely accepted even in academic circles until the second half of the 20th century. In addition, the 'hidden' degree of inbreeding in Carlos II's pedigree was, if anything, interpreted as a positive feature, signaling a 'clean' royal bloodline (Van Den Berghe and Mesher, 1980; Scheidel, 1995).

[12] While population biology strongly suggests that inbreeding was responsible for Carlos II's mental fragility, such assertions cannot be proven definitely for historical cases, because genetic samples are not available.

[13] Accordingly, we follow Woods (1906) and distinguish two separate reigns, one from 1665 to 1679 where mostly Carlos II's mother served as a Queen regent, and one under his direct reign until his death in 1700. Both ruler ability of Mariana and state performance under her reign are coded separately.

[14] Philipp V (ruled from 1700 to 1745) and Ferdinand IV (1745-1759) "[B]oth were undistinguished rulers frequently incapacitated by near lunacy (Philip V dined at 5 a.m. and went to bed at 8 a.m., refusing to change his clothes)" (Carr, 1991, p. 131). Philipp V's coefficient of inbreeding was 9.27, and that of his successor, Ferdinand VI, was 9.55 – both were thus more inbred than first-degree cousins (6.25), but significantly less than Carlos II. In both reigns, Spain's economic fortune improved moderately, starting off from the low levels left behind by Carlos II.

2.2 Dynastic Rule and Hereditary Succession

The vast majority of European monarchs came to power according to fixed rules of succession. While these rules differed across states and time, hereditary succession became increasingly common, that is, rulers were the offspring of the prior ruler. In most cases, hereditary succession took the form of primogeniture, which determines that the eldest living offspring of the current ruler becomes the state's next ruler. This practice was common on the Iberian peninsula early on, from where it spread to other states quickly (to England in 1066 and France in 1222). It gradually replaced the two other common forms of successions – by siblings and other relatives of the current ruler, and election of rulers by feudal elites.[15] In most cases, agnatic primogeniture was practiced, implying that the eldest living male offspring was heir apparent.

In the absence of an heir (for instance, due to the premature death of the current ruler), the reign typically passed on to close relatives according to hereditary rules of succession. In general, the reign passed on to those individuals with the closest genealogical distance to the last male monarch.[16] For the majority of rulers in our dataset, there is explicit, unambiguous information for ascension to the throne by hereditary succession. Deviations from hereditary succession in our dataset are mostly due to interim reigns by regents when the heir apparent was still young.[17]

Due to hereditary succession, dynasties often stayed in power for centuries. For example, until the French Revolution, all kings of France were direct ancestors of Hugh Capet, who had ruled eight centuries earlier (from 987 to 996) and founded the "Capetian dynasty."[18]

2.3 Intermarriage Among Dynasties

Intermarriage among ruling dynasties was common, even *across* the states of Europe. The leaders of the Spanish and Austrian Habsburgs, for instance, practiced cousin marriage over multiple generations in the 16th century, culminating in Carlos II, as described above. Alvarez et al. (2009) argue that the frequent dynastic marriages ultimately resulted in the extinction of the Spanish Habsburgs. While the Catholic Church had formal restrictions on cousin marriage, these were rarely

[15] Tullock (1987) describes theoretically that both current monarchs and elites favor primogeniture over other forms of succession, as it delivers political stability. Kokkonen and Sundell (2014) provide empirical evidence for this theory during our sample period. Often, kings crowned their sons while they were still alive to ensure a stable succession (Bartlett, 2020, p. 93).

[16] Whether this included female lines of succession as well as the exact definition of genealogical distance differed by ruling dynasty according to their "house law." In some cases, such laws of ascension were incomplete and left multiple potential claimants to the throne, so that succession was determined by the former ruler, by parliaments, or by an usurpation of the throne. As in the case of the heirless death of Carlos II, such cases often resulted in succession crises, sparked conflicts, and, later, amendments to succession laws (Acharya and Lee, 2019; Kokkonen and Sundell, 2020).

[17] As we describe in detail below, Woods (1906) coded these reigns by regents separately. Overall, there are 65 such cases in our core dataset. Our results are robust to excluding these.

[18] While the direct line of succession broke twice when kings died heirless, the title always passed to someone related to Hugh Capet. This happened first in 1328 (triggering a succession crisis that resulted in the Hundred Years War), when the Valois dynasty came to power, and again in 1589 with the rise of the Bourbon dynasty.

enforced for European monarchs.[19] The pope could – and usually did – grant "dispensations" (exemptions) for Catholic rulers. As a result, intermarriage among royal dynasties actually *increased* throughout the early modern period (Benzell and Cooke, 2018), aided also by Protestantism lifting the cousin marriage ban entirely.

2.4 The Negative Effects of Inbreeding on Capability

A crucial feature of our identification strategy is that more inbred heirs to the throne were less likely to become capable monarchs. It is well-documented that inbreeding reduces genetic diversity and evolutionary fitness; it systematically increases the risk of genetic disorders, affecting physical and mental capability (c.f. Robert et al., 2009; Ceballos and Álvarez, 2013; Royuela-Rico, 2020). Children of first cousins have a five times higher risk of intellectual disability (Morton, 1978), and their intelligence is reduced by as much as 27 points (almost two standard deviations) on the IQ scale (Fareed and Afzal, 2014a). Similarly, the average IQ score for uncle-niece offspring is 37 points lower than that of non-inbred individuals (Fareed and Afzal, 2014a). Inbreeding further results in lower height and weight (Fareed and Afzal, 2014b), and it decreases fertility while raising child mortality (Fareed et al., 2017), thus lowering the probability of successfully producing heirs for the dynasty (Alvarez et al., 2009). Most important for our context, inbreeding depresses many individual psychological traits that are associated with successful leadership.[20]

European royal families did not defy the laws of biology. After the methodology for computing coefficients of inbreeding became available, Asdell (1948) showed that more inbred rulers had been assessed by Woods (1906) as systematically less capable – despite the fact that Woods had the opposite hypothesis (see footnote 5).[21]

3 Data

In this section we describe our dataset with observations at the level of individual reigns for ruler ability, state performance, inbreeding, constraints on ruler power, as well as control variables.

[19]Restrictions on cousin marriage had been put in place starting from the 8th century – but *not* because of concerns about the physical or mental effects of inbreeding. Instead, these restrictions were meant to weaken the political power of closed kinship networks and to inhibit their further formation (Ausenda, 1999; Schulz, 2016; Schulz et al., 2018); they also increased the likelihood that bequests would fall to the Church (Goody, 1983).

[20]The literature on leadership traits has emphasized the importance of cognitive capabilities for leadership (c.f. Judge, Colbert, and Ilies, 2004). Adams, Keloharju, and Knüpfer (2018) provide direct evidence, showing that cognitive and non-cognitive ability (measured during military tests in Sweden) are strong positive predictors of individuals assuming leadership roles – becoming CEO's – later in life. At the same time, there is a large literature documenting that inbreeding negatively affects these traits (Afzal, 1993; McQuillan et al., 2012; Fareed and Afzal, 2014b,a).

[21]A recent literature has argued that – in modern data – the size of the negative effects of marriages among first cousins may be confounded by poverty (Hamamy et al., 2011; Bittles, 2012; Mobarak et al., 2019). In contrast, our results do not depend on first-cousin marriage, as consanguinity due to complex intermarriage over generations (and beyond first cousins) drives our first stage. Furthermore, this literature largely considers health and socio-economic consequences of inbreeding. In contrast, we emphasize cognitive and non-cognitive abilities, and control for the physical consequences of inbreeding (such as lower body height and life expectancy) in our robustness checks.

3.1 Ruler Ability and State Performance

Ruler ability. Our measure of ruler ability builds on the work of Frederick Adam Woods. A lecturer in biology at MIT at the beginning of the 19th century, Woods took an interest in heredity and, ultimately, history. To understand the heredity of moral and mental ability across generations, Woods turned to the royal families of Europe.[22] In his 1906 publication on "Mental and Moral Heredity in Royalty" (Woods, 1906), he "graded" more than 600 individual members of royal families based on their mental and moral qualities. This grading was based on adjectives used in written sources that describe these individuals. For each ruler, Woods provided a brief summary underlying his assessment and references (see for example his assessment of Carlos II and III that we mentioned above). Based on his sample of royal family members, Woods concluded that mental and moral ability were i) strongly correlated with each other and ii) heritable.[23]

State performance. Subsequently, in his endeavor to test for the heredity of mental and moral status, Woods ventured beyond the realm of biology to the "Great Men" debate in history (Carlyle, 1840). Woods noticed a correlation between mentally able rulers and favorable political and economic conditions in the state they ruled. In Woods' (1913) publication "The Influence of Monarchs," he extended his 1906 tabulation of the ability of rulers and also added a systematic coding of their states' performance for 13 states, ranging from their foundation until the French Revolution. This publication is a central data source for our empirical analysis. It contains the ability of rulers and state performance for more than 300 European reigns. Figure 2 shows the covered states in different time periods.[24] Similar to Woods's earlier work, this grading is largely based on the assessment of historians and contemporaries, as distilled by Woods from reference works and state-specific histories. In terms of state performance, Spain under Carlos II is characterized by "misery, poverty, hunger, disorders, decline, especially in agriculture, finances, and strength of the army" while a century later, Carlos III's reign saw "continued improvement in financial and commercial conditions, including agriculture and the useful arts." As an additional example, consider Maria Theresa, who reigned over Austria from 1740 to 1780, and was judged by Woods as

[22] The appeal of this group of people to study heredity was manifold to Woods: The pedigrees of royal families were (and are) comparably well-documented over multiple generations. Further, for most of these individuals, their life, character, and achievements were documented from letters, court biographies, or other written sources.

[23] Woods was part of a (then active) research agenda in biology on heredity sparked by the publication of Darwin's "Origin of Species" in 1859 and Galton's "Hereditary Genius" in 1869. Social Darwinism, foremost that of Grant (1919), had an influence on the eugenics crusade in the United States and on the US Immigration legislation after World War I (Saini, 2019). Over the course of the 20th century, the scientific underpinnings of Social Darwinism were discredited, as was the concept of heritability of traits such as mental or moral qualities (at the level of societies). While heritability of intelligence at the individual level is sizable (Neisser et al., 1996; Devlin, Daniels, and Roeder, 1997), differences between population groups are resulting from other environmental differences (Lewontin, 1970). In an earlier systematic analysis of the data of Woods, Simonton (1983) analyzed the intergenerational transmission of individual differences.

[24] The states covered are Castile, Aragon (Spain), Portugal, France, Austria, England, Scotland, Holland, Denmark, Sweden, Prussia, Russia, and Turkey. Appendix Figure A.1 provides a timeline of coverage for each state.

"able and very industrious." Under her reign, "the various portions of the kingdom [were] unified and centralized" and "Austria gained slightly in territory and greatly in prestige," while "industry, commerce, and agriculture improved."

Core sample. Our core sample consists of 336 reigns for which both ruler ability and state performance are available from Woods' coding (Table A.1 lists the number of observations for the different variables in our analysis). Woods assigned a "+" to rulers with high intellectual ability, a "-" to incapable ones, and "±" to those not clearly capable or incapable. In his coding of state performance, Woods covered the following dimensions: "finances, army, navy, commerce, agriculture, manufacture, public building, territorial changes, condition of law and order, general condition of the people as a whole, growth and decline of political liberty, and the diplomatic position of the nation, or its prestige when viewed internationally," while purposefully *excluding* "literary, educational, scientific, or artistic activities" (Woods, 1913, p. 10). Woods coded a three-valued variable summarizing the political and economic performance of the state during each reign, using again the three-tier scale "+, ±, -." We transform these into "1," "-1," and "0" and create the variables *Ruler Ability* and *State Performance*, respectively. Out of 336 reigns for which we have information on both the monarch's ability and the performance of the state, 127 rulers are rated as clearly incapable, 122 as clearly capable, and 87 as neither; regarding state performance, 112 reigns are rated as clearly bad, 143 as clearly good, and 98 are neither.[25]

About one-fifth of our sample (65 reigns) are instances of regents ruling. In most cases, these occurred because of so-called "minorities" of the heir to the throne: While the heir could not perform the duties due to young age, close relatives or other influential persons at the court took over as regents. Often, these regencies were divided among more than one person. We follow Woods in specifying these as separate reigns and identifying the most important among the regents whenever possible. [++SO: Wouldn't the following NOT be in the sample in the first place, so we don't even need to mention this?++]Yet, in less than half of regencies, either we cannot specify an individual or those individuals' parents do not have any known relationship links in our genealogical data, implying they were likely not of royal ancestry themselves.

Coding concerns and data checks. The fact that both ruler ability and state performance were coded by the same historian gives rise to obvious endogeneity concerns. We address these in a multitude of ways, including extensive checks of Woods' coding, our IV strategy, as well as the use of alternative outcome variables. We also note that if Woods did have a bias in coding, then this should have worked against our IV strategy: Woods believed that more kin marriage among

[25] Woods collected information for 366 reigns in total. Especially for early and short reigns, Woods did not provide an assessment. In instances of co-reign, as for Ferdinand and Isabella of Castile from 1479 to 1504, we generally take the assessment of one individual if it is only available for one of two rulers. When both are available, we use the assessment of the individual working against our hypothesis. In cases where Woods expressed a doubt by, say, "+ or ±," we use the average (in this example, 0.5). In a robustness check, we recode all these cases conservatively so as to work against our baseline findings.

"successful" dynasties produced *better* rulers (see footnote 5).

We discuss the quality and reliability of Woods' coding in Appendix A.2. For example, Thorndike (1936) had numerous research assistants "grade" the morality and intellect of more than 300 members of the European nobility.[26] This data quality assessment resulted in correlations of the intellectual grade across different graders (including Woods) ranging from 0.73 to 0.82. We similarly asked research assistants to assess the capability of individual rulers, as well as state performance, on a three-point scale based on articles in online encyclopedias (and without reference to Woods' coding). This exercise also largely confirms Woods' data (see Appendix A.2).

In principle, our extensive checks of Woods' data would allow us to run our empirical analysis based on our own coding. Nevertheless, we use Woods' original coding as our baseline, because Woods' hypothesis works against our IV strategy, providing a conservative baseline. In Appendix B.1 we report results based on our own coding of Woods' sample coverage.

Extended sample. In addition to our validation of Woods' coding, we also provide robustness checks with an extended sample – both in terms of time period (until World War I) and states covered (adding Hungary and Poland). We coded this extended sample using Woods' original sources, as well as modern encyclopedias. The two states and additional century of data add a total 95 reigns to our baseline sample (see Appendix A.4 for detail).

3.2 State Border Changes and Urbanization

Because our outcome variable 'state performance' is ultimately a subjective measure, we collect two additional outcome variables. First, we calculate changes in the size of a state's territory during the reign of each monarch. Abramson (2017) provides borders and the area of the independent polities of Europe at five-year intervals from 1100 to 1795. We link these to the beginning and end of each reign and calculate the percentage change in area ruled during a reign, $\Delta log(Area)$.[27] Figure 2 shows the evolution of state borders in our sample between 1200 and 1790.[28] For example, during the reign of Maria Theresa (1740 to 1780), Austria lost Silesia to Prussia, while it gained areas from Poland (see Appendix Figure A.3). In net terms, Austria increased its area by 7%.

Territorial expansions do not necessarily and unambiguously imply better state performance. For example, an expansion into thinly populated territory differs in important ways from conquering urbanized areas.[29] To address this issue, we also code changes in urban population in the

[26] Thorndike's student, Dr. Edith E. Osburn "read what was printed about each of about four hundred of the persons studied by Woods, in each of the six biographical dictionaries used by him. This occupied her about forty hours a week for about eight weeks. She then read through the entire set of references again" (Thorndike, 1936, p. 322). At the same time, Thorndike (who, like Woods, was a eugenicist) had five more research assistants independently do the same coding.

[27] We are grateful to Scott Abramson for kindly sharing his data on European state borders. We discuss how we link state borders to reigns in Appendix A.3.

[28] Note that many states started out small and came to dominate the map over time. Thus, territorial gains were positive on average over time (as opposed to a zero-sum game over the same territory).

[29] In fact, "overexpansion" may weaken the power of a state (Kennedy, 1988). However, Baten, Keywood, and

territory ruled by each monarch. We impute the total urban population within the boundaries of each state by combining the borders provided by Abramson (2017) with city population data from Bairoch et al. (1988).[30] For each reign, we calculate the total urban population within the state borders at the beginning and at the end of each reign. We then calculate the percentage change in total urban population $\Delta log(UrbPop)$. For an additional check, we also decompose this measure into an intensive margin (changes in city population within the existing borders) and extensive margin (conquering/losing cities).

3.3 Coefficient of Inbreeding for European Monarchs

The first correct measure of the degree of similarity in the genes of offspring due to common ancestors was developed by Wright (1921). This "coefficient of inbreeding" (henceforth, F) is the probability that both gene copies in an individual are identical by descent, i.e., from a common ancestor. Higher F thus means lower diversity in an individuals' gene pool. Diversity has a positive effect because humans are diploid, i.e., they have two copies (one from each parent), and for recessive disorders to appear, both copies need to be deleterious. Hence, the more related the parents of an offspring are – i.e., the more gene copies they inherited from the same ancestor(s) – the lower diversity, and the higher the risk of recessive gene disorders. This "dominance hypothesis" is the prevailing explanation for "inbreeding depression" in genetics (c.f. Charlesworth and Willis, 2009). Offspring of siblings or of parent-child couples have a coefficient of inbreeding of $F = 25$, while offspring of uncle-niece couples have $F = 12.5$, and offspring of first cousin couples have $F = 6.25$.[31]

We collect F for 256 monarchs from http://roglo.eu/, a crowd-sourced online data source of the genealogy of European noble families. For 235 of these monarchs, Woods assessed both state performance and ruler ability. We begin by identifying each monarchs' parents. For these, in turn,

Wamser (2021) show that expansions of territory go hand-in-hand with increases in taxes per capita, and thus use territorial expansions as a proxy for state capacity. We mainly use territorial changes as an objective (i.e., not coded by historians) and high-frequency measure of (an admittedly narrow aspect of) state performance, while our main measure of state performance (as assessed by Woods) is very broad. In fact, we find that our results are driven by many economic and political aspects of state performance (see Appendix D.2.1) and do not depend on the consideration of territorial expansions in assessing state performance (see Appendix C.3). Most other available measures of state performance – such as GDP per capita or urbanization rates – are only available for few states (with changing borders) and are typically measured at the century or half-century level.

[30] More precisely, we use the amended Bairoch et al. data from Voigtländer and Voth (2013). We use linear interpolation to obtain city population in five-year intervals (corresponding to the border data frequency) from the original century- and half-century data, assuming a linear growth rate. We geocode the location of each city to determine the polity it belonged to at each five-year interval.

[31] The coefficient of inbreeding ranges from 0 to 100 (%). Humans inherit one gene copy from each parent. Because humans carry two gene copies (alleles) on the same region (locus) of each of their two chromosomes, the probability to pass on a particular allele to a particular offspring is 0.5. Hence, the offspring of self-fertilization would have $F = 50$, as there is a one-half chance for each locus that the entire pair of alleles was passed on. Hypothetically, with repeated self-fertilization, F would approach 100. Offspring of completely unrelated parents have $F = 0$. We provide more detail on the calculation and an illustrative example in Appendix A.5.

http://roglo.eu/ calculates the coefficient of inbreeding for their offspring, relying on rich data on relationships between their ancestors.[32] Figure 3 shows a histogram of the coefficient of inbreeding for all monarchs in our dataset. The figure also provides two illustrative examples. Carlos II is the individual with the highest coefficient of inbreeding. With $F = 25.36$, he was more inbred than an offspring of siblings would be. Yet, his parents were "merely" uncle and niece (which in itself would imply $F = 12.5$). This points to an important feature of our setting: A sizable amount of the observed inbreeding is not the result of just one generation of consanguineous mating, but rather driven by a "build-up" of inbreeding over previous generations.[33] We use this 'hidden' component of inbreeding to support the validity of the exclusion restriction.

3.4 Constraints on Ruler Power

We collect data on the legal and de facto constraints on the power of monarchs from a variety of sources. Our baseline variable refines and extends the measure "constraints on the executive" following Acemoglu et al. (2005), which is available between 1000 CE and 1850 (first at the century level and after 1700 CE in fifty-year intervals). Acemoglu et al.'s measure was coded following the approach of the Polity IV project (Marshall, Jaggers, and Gurr, 2017) at the level of today's states. Using the same coding approach, we refine the coding of "constraints on the executive" on a *year-by-year* basis at the *historical state* level, guided by the Polity IV rating, and using the same primary sources as Acemoglu et al. (2005). Appendix E explains our methodology in detail.

Figure 5 illustrates our annual measure, using England during its turbulent 17th century. The black solid line shows the institutional score by Acemoglu et al. (2005), which is constant at 3, indicating "slight to moderate limitation on executive authority" from 1600 to 1700. Our measure (the dashed green line) is much more finely grained, reflecting the variability of constraints on the monarch during that century. Consider 1629, when the English parliament was dissolved and "Charles [I] governed without a parliament, raising money by hand-to-mouth expedients, reviving old taxes and old feudal privileges of the crown and selling mentarians contrary to the spirit of the constitution" (Stearns and Langer, 2001, p. 288). This is reflected by a sharp drop of our measure from "substantial limitations on the monarch's authority" (a score of 5) to "no regular limitations on the executive's actions" (score of 1). Constraints became stronger again during the "Long Parliament" from 1640-1660, as a consequence of the "Triennial Act [of 1641], requiring

[32]We cross-checked and validated the coefficients we obtained from http://roglo.eu/ extensively with other publications, among them Asdell (1948) and Alvarez et al. (2009). Turkey is not covered by this source and is thus not included in our IV results. For 43 rulers, no known relationship link was recorded. This could either imply that they were unrelated (i.e., $F = 0$), or simply that the information on distant family relationships did not survive. We thus exclude these cases from our baseline, but we show robustness to their inclusion in Appendix Table A.19.

[33]Consider again the pedigree of Carlos II (Figure 1). While Philipp IV, the father of Carlos II, married his niece, past consanguineous marriage weighed heavily in opening up many pathways to the common ancestors Joanna ("The Mad") and her husband Philip generations earlier.

the summoning of parliament every three years without an initiative of the crown. [This was] followed by [... a] bill to prevent the dissolution or proroguing of the present parliament without its own consent" (Stearns and Langer, 2001, p. 288).

Based on our year-reign specific measure for constraints on the executive, we define the variable *Constrained* if the constraints on the ruler in the year prior to the beginning of the reign were above a score of 4 (on a scale of 7), indicating "substantial limitations on executive authority." This cutoff is further defined as follows: "The executive has more effective authority than any accountability group but is subject to substantial constraints by them." In our core sample, this applies to 19 reigns, of which 10 were in England. Appendix E provides further detail and a list of all seven cutoffs.

As an alternative measure for constraints on the executive, we use parliamentary activity from Van Zanden et al. (2012), who compile the frequency of parliamentary meetings across European states from the 12th to the 18th century (at the century level). We use the measure of parliamentary activity in the year before the start of a reign and code rulers as *Constrained* if parliamentary activity was above the 95th percentile of the entire sample.[34] Unfortunately, this measure is not available at the sub-century (let alone annual) level. We thus use it as a (rough) consistency check of our findings.

4 Main Empirical Results

In this section we first document a strong association between the capability of European monarchs and the performance of their states. We show that this association is robust to measurement, specification, and that it holds in different samples. We then provide evidence that this relationship is causal, using our identification strategy based on inbreeding.

4.1 Baseline OLS Results

Our baseline regressions are at the state-reign level:

$$y_{r,s} = \beta RulerAbility_{r,s} + \delta_s + \varepsilon_{r,s} \ , \tag{1}$$

where $y_{r,s}$ is one of the three the outcome variables for state s in reign r, as defined in Sections 3.1 and 3.2: *State Performance*$_{r,s}$, $\Delta log(Area)_{r,s}$, or $\Delta log(UrbPop)_{r,s}$. *Ruler Ability*$_{r,s}$ is the assessment of the monarch's ability. For a straightforward interpretation of coefficients, we standardize the assessments of *State Performance* and of *Ruler Ability* so that both variables have mean zero

[34] Van Zanden et al. (2012) collect the information on the relative frequency of meetings of parliaments from a variety of sources. For all states except Turkey, we can link this to our dataset. We link Prussia to the "Brandenburg Diet" and the "Generallandtag" of Austria to the Habsburgs. The data are separately available for Scotland and England for Castile (and Leon) – which we match to Castile, – and for Aragon. All other matches are straightforward.

and standard deviation one.[35] We include state fixed effects δ_s, so that we effectively compare rulers of the same state over time.[36] Throughout, we report standard errors clustered at the state level.

Table 1 shows that *Ruler Ability* is strongly associated with *State Performance*. Column 1 reports the raw correlation. The coefficient of interest, β, is highly significant and sizable: A one standard deviation increase in *Ruler Ability* is associated with a 0.62 standard deviation (std) increase in *State Performance*.[37] Column 2 shows that this association is unchanged when we add state fixed effects, thus comparing only monarchs who ruled the same state. The outcome variable *State Performance* is subject to concerns about biased coding by Woods. We address this by using 'objective' (and also continuous) outcome variables in the next columns. For the reign-specific percentage change in state area, we document a significant and sizable association with ruler ability (column 3). Again, these results are stable when we include state fixed effects (column 4). A one std increase in ruler ability in the same state and century is associated with land area expanding by about 11%.[38] Finally, columns 5 and 6 use the change in urban population during a reign as outcome variable. We document a sizable association: A one std increase in ruler ability in the same state is associated with total urban population in the state expanding by about 11%.

4.2 Robustness of OLS Results

Next, we examine the robustness of our baseline OLS results. Beginning with the baseline sample in column 1, Table 2 successively reduces the sample until column 6. In column 2, we focus on reigns in which the ruler was linked to a dynasty. Thereby, we exclude cases of interregna, regencies in which non-royal individuals exerted power, and instances of non-monarchical governance (as in the Netherlands).[39] The coefficient increases slightly and remains highly significant. Col-

[35]Note that while both are categorical variables, we treat them as continuous variables for ease of estimation throughout the paper. We provide a robustness check using ordered Probit below.

[36]Accounting for time trends is not straightforward in our main regressions because there is no clear-cut time variable: Reigns begin and end at different times in different states, and they also often span across centuries. Below we present a flexible method to filter out time effects: regressions at the ruler pair level, comparing monarchs in different states who ruled contemporaneously.

[37]The regression coefficient using the unstandardized measures is 0.6, implying that moving from an incapable ("-1") to a capable ruler ("1") is associated with a decrease in (unstandardized) state performance by 1.2, which is more than the move from neither good nor bad state performance ("0") to a bad state performance ("-1"). Woods (1913) himself had also manually computed the (not standardized) correlation coefficient of 0.6 in his raw data. He asserted a causal direction from monarch ability to state performance: "Only very rarely has a nation progressed in its political and economic aspects, save under the leadership of a strong sovereign." While Woods was well aware of reverse causality concerns, he provided descriptive evidence in favor of this conclusion. We go beyond Woods' findings by exploring richer specifications and, in particular, by providing an identification strategy.

[38]Note that in our setting, land acquisition is not a zero-sum game. The sample does not include all European states, and the states we cover do not span over the entire European landmass (see Figure A.1). Hence, generally there was territory available for the monarchs in our sample to expand into. The summary statistics in Table A.2 in the appendix shows that in fact the average change in area is positive.

[39]Interregna are periods between the rule of two monarchs when no monarch is present. Regencies are periods of government by others (regents) in lieu of the designated ruler. Usually, these are close relatives such as the mother

umn 3 excludes all regencies, independent of whether the regent was a dynasty member or not. The coefficient again increases slightly. Note that the variation explained (R^2) actually increases in columns 2 and 3, indicating that indeed monarchs hailing from dynasties are crucial to the relationship between ruler ability and state performance. Column 4 excludes the few instances of foreign rule.[40] Column 5 excludes all individuals who appeared as rulers in more than a single reign. These are either monarchs that repeatedly came to power in the same state, or who ruled in more than one state contemporaneously. In both columns 4 and 5, the coefficient remains significant and comparable in size to the baseline. Finally, column 6 applies all restrictions of the preceding columns simultaneously. With only about 75% of the initial sample left, the coefficient remains almost unchanged, and the variation in state performance explained by the regression is actually higher than in the baseline.

Columns 7 and 8 present extensions of our baseline sample. Woods' data stops around 1790, before Napoelon, and he excluded states in Eastern Europe – most prominently, Poland(-Lithuania) and Hungary. In column 7, we extend the coding of states covered by Woods (1913) until World War I based on internet encyclopedias, which in turn draw on historical sources (see Appendix A.4 for detail and Appendix B.4 for additional results). In column 8 we also add data for Poland(-Lithuania) and Hungary from their foundation until 1914. Both extensions yield results that are very similar to those in the baseline sample. In Table A.8 in the Appendix we show that our results also hold when we use only our own coding of state performance and ruler ability for the core sample of Woods.

We document further robustness checks in Appendix B. Table A.9 shows robustness to measurement. We find that our results based on Woods' (1913) original coding are highly robust when we exclude cases that Woods coded with intermediate values for state performance or ruler ability, indicating that he felt a clear judgment was not warranted by the underlying information. In fact, our results are even robust when we recode all those middling values to work *against* a positive association between ruler ability and state performance (Table A.9, col 5). Finally, Table A.10 shows robustness to different specifications, such as using dummies for different values of state and ruler performance, ordered probit, as well as clustering at the state, century, and dynasty levels.

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of an underage monarch, but sometimes these can be officials or members of the elite. In column 2, we exclude all rulers during whose reign regents from outside their dynasty governed. We still include cases of rule by relatives of the designated heir until the heir assumed office. For example, Mariana was regent for Carlos II of Spain until he reached adulthood, and then tried to regain regency by arguing that he was unfit for office. Note that reigns by regents for monarchs are included as separate reigns by Woods. The coding of a monarch's reign begins only when the s/he actually came to power. [++reference to detail on coding (probably best in new appendix section) – SO: addressed in Data Appendix, "Characteristics of Reigns" ++]

[40]Foreign rule refers to instances when monarchs of one state temporarily ruled over another state. For instance, Philipp II of Spain ruled Spain and Portugal from 1580 to 1598, and James VI of Scotland also reigned over England from 1603 to 1625. When excluding episodes of foreign rule, we drop the corresponding observations for Philipp in Portugal, but keep his reign in Spain. When excluding monarchs who governed in more than one state (column 5), we drop both observations, his reign in Spain and that in Portugal.

4.3 Heterogeneity

How does the association between state performance and ruler capability vary across time, space, and personal characteristics of rulers? In Table 3, we include interaction terms between ruler ability and several characteristics. We collect the variables used in this section from encyclopedias and biographies, as explained in detail in Appendix A.1. For column 1, we define a dummy indicating whether a monarch was female, which was the case for 40 of the 338 reigns to which a gender was assignable.[41] The small and statistically insignificant coefficient suggests that there the relationship between ruler ability and state performance did not vary by the ruler's gender. In column 2, we interact *Ruler Ability* with a dummy indicating whether a monarch ascended to the throne before the median age of ascension (28 years). While the interaction term is quantitatively somewhat larger, it remains small compared to the coefficient on *Ruler Ability*, and it is also statistically insignificant. Column 3 uses a dummy indicating whether a ruler was raised as designated heir.[42] The interaction term is positive but minuscule and again statistically insignificant. Column 4 shows that the association between ruler ability and state performance is stronger for those ruler who came to power due to hereditary succession.[43] Finally, in column 5, we interact with a dummy indicating that the prior ruler was executed after trial or murdered (Kokkonen and Sundell, 2014). We find no difference in our baseline association for those reigns. This speaks against the possibility that our result is primarily driven by able monarchs deposing of their (incapable) predecessor, as for instance Catherine the Great, who ascended to power through the murder of her husband. We also note that of the dummies in Table 3 only one is itself statistically significant – in column 1, indicating that female rulers were associated with somewhat lower state performance. One possible explanation is that states led by queens were more frequently involved in warfare (Dube and Harish, 2020). In contrast, age at ascension, being raised as a designated hair, or regicide of the previous ruler are by themselves not associated with state performance.

Did the relationship between monarchs' ability and state performance change over time? The left panel in Figure 4 depicts the coefficient on *Ruler Ability* for different time periods, showing a statistically highly significant correlation throughout.[44] After 1600, the coefficient size decreases. This period also coincides with the rise of parliaments in Western Europe (Van Zanden et al., 2012). Below, we examine whether this trend may have affected the role of ruler ability in their states'

[41]For 28 reigns we cannot assign a gender. As explained in Appendix A.1, these other instances are interregna or reigns by councils.

[42]Note that we were only able to assess whether monarchs were raised for particular roles for 155 observations, of which 121 where raised as monarchs. Another prominent "track" was being raised for a clerical position in the church. Ramiro II of Aragon, for instance, was an abbot before the unexpected death of his childless brother rendered him a candidate for the throne.

[43]Of the 290 reigns in which a single individual was in power, 222 (76%) are cases where the rule was the offspring of the prior ruler.

[44]As before, reigns are allocated to time periods according to the start year of each reign. Table A.13 in the Appendix provides point estimates for these broad periods and also, in a more disaggregate fashion, by century.

performance. The right panel of Figure 4 shows the correlation between ruler ability and state performance for all states in our sample.[45] The coefficients are relatively similar across states, and they are statistically highly significant for all states except Denmark.[46] The coefficient is strongest for Prussia, implying that this state fared particularly well under good rulers and/or suffered particularly strongly under bad ones. Prussia's institutional setting featured few if any constraints on the monarchs' executive power. The other extreme is England, where the association between ruler ability and state performance is less pronounced. This is particularly true after 1600, when the English Parliament gained power vis-à-vis the Crown. For this period, we no longer observe a relationship between ruler ability and the state's performance.[47]

4.4 IV Results

In what follows we provide evidence for a causal relationship between ruler ability and state performance. We first discuss our identification strategy based on hereditary succession and inbreeding. Then we introduce our instrument – the coefficient of inbreeding – and document that it is a strong predictor of ruler ability. The corresponding IV results reveal a positive causal effect of ruler ability on state performance in the second stage.

Identification

An causal interpretation of our OLS estimates is subject to numerous concerns. Omitted variables could influence both the performance of a state and the ability of the ruler in power, and reverse causality is also a possibility – for example, better state performance driving the selection of more capable rulers. In addition, historians may have assessed rulers of better-performing states more favorably (or vice-versa).

Our identification strategy (in combination with our 'objective' outcome variables) enables us to address these concerns. We rely on the combination of two features. First, hereditary succession resulted in pre-determined ruler succession, independent of ability. Second, we leverage the variation in ruler capability due to the wide-spread inbreeding within and between European dynasties. Centuries of intermarriage resulted in a sizable degree of genetic closeness between the potential marriage partners of Europe's monarchs. The exclusion restriction is that inbreeding was not related to state-level outcomes via channels other than ruler ability. There are two potential paths for violating this condition: First, potential historical factors that linked inbreeding to state

[45] Table A.12 provides the corresponding regression estimates.

[46] A possible explanation is that Danish crown had not fully transitioned to a hereditary monarchy. Danish kings were de jure elected by the nobility. However, de facto the oldest son of a ruler was usually elected as his successor (Bartlett, 2020, p. 398). Therefore, Danish monarchs may have been impeded by relatively strong constraints on their executive power.

[47] Woods (1913, p. 245) also noted that the positive association between state performance and ruler ability disappeared for England after 1600. In Section 5 we provide systematic evidence that this is linked to the English monarchs becoming constrained by ever stronger parliaments.

performance. This is unlikely – at least in terms of concerns about inbreeding being related to state outcomes. As we discussed above, the negative effects of inbreeding were unknown to the royal families. If anything, they believed that marrying within dynasties strengthened their noble traits, which would tend to work against our results. However, inbreeding may have been the result of strategic marriage for other reasons. To address this concern, we show that our results also hold when we focus only on the 'hidden' degree of inbreeding – the dimension beyond the parents' relatedness that was embedded in the intertwined family trees of previous generations and thus not observable (and impossible to compute prior to the 1920s).

Second, the exclusion restriction may be violated because of a bias in the coding of historical data. Again, this is unlikely because of Woods' (1906; 1913) hypothesis that intermarriage among what he considered the superior stock of royal families led to *more capable* rulers.[48] Further, the correct measurement of inbreeding was unknown when Woods was writing in 1913, and the fact that inbreeding has negative consequences in humans was only accepted in academic circles decades later.[49] Therefore, the timing of scientific progress on inbreeding renders a violation of the exclusion restriction in Woods' (or other underlying historians') assessment of monarchs unlikely.

First Stage

Our first stage shows that monarchs with a higher coefficient of inbreeding are significantly less capable rulers. This is in line with the fact that genetic closeness between partners carries an increased risk of genetic disorders for their offspring. These disorders, in turn, increased the probability that rulers were incapable and could not effectively fulfill the duties of their offices. Formally, our first stage is:

$$RulerAbility_{r,s} = \gamma F_{r,s} + \delta_s + \varepsilon_{r,s} \ , \tag{2}$$

where $F_{r,s}$ is the coefficient of inbreeding of the ruler of state s in reign r (as described in Section 3.3), *Ruler Ability*$_{r,s}$ is the capability of said ruler, and δ_s are state fixed effects. Again, we cluster standard errors at the state level.

Column 1 in Table 4 documents a negative and statistically highly significant raw relationship between a ruler's coefficient of inbreeding and her or his capability. We obtain a similar result in column 2, where we add state fixed effects (our preferred specification). The effect is sizable:

[48] "The very formation of royal families was thus a question of selection of the most of able in government and war. From their intermarriage with their own kind, in connection with the force of heredity, we find an explanation in their relative superiority" (Woods, 1906, p. 302). See Section 3.1 for further detail.

[49] Darwin was the first to show experimentally that inbreeding depression exists in plants, and then worried that his own offspring might be affected (his wife was his first cousin, cf. Berra, Alvarez, and Ceballos, 2010). It took decades for researchers to become convinced that humans are similarly negatively affected by inbreeding. In 1927, Bronislaw Malinowski, one of the "founding father[s] of social anthropology" (Young, 2004), stated that "biologists are in agreement that there is no detrimental effect produced upon the species by incestuous unions" (Malinowski, 1927). See also Wolf (2005).

Increasing the coefficient of inbreeding by one standard deviation decreases ruler ability by 0.3 standard deviations (standardized beta, unreported). Figure 6 shows a binned scatter plot of the variation underlying column 2, illustrating that the first-stage relationship is not driven by outliers. The next two columns in Table 4 exclude individuals with high coefficients of inbreeding. If anything, the first-stage coefficient increases when we exclude Carlos II, whose parents were as related as siblings (column 3), or when excluding all individuals whose parents were at least as related as uncle-niece pairs, corresponding to $F \geq 12.5$ (column 4). In column 5, we focus on cases of hereditary succession, i.e., those cases in which the ruler who ascended to power was the offspring of the prior ruler. The coefficient remains similar in terms of both magnitude and statistical significance. ++SO: The following is problematic now, because the full sample includes cases where the ruler did not come to power due to hereditary succession: ++This is reassuring for our use of the IV strategy in the full sample, which includes cases where hereditary succession is not historically documented (although it was the norm), or cases of heirless rulers where other close relatives were appointed as the next king or queen (see footnote **??** for detail).

Finally, note that the monotonicity assumption required for IV is likely fulfilled. In our setting, this assumption requires that the instrument does not trigger "defiers," i.e., that inbreeding does not (by accident) lead to ingenious leaders. The literature in genetics documents that "inbreeding depression" only has negative effects on fitness (c.f. Robert et al., 2009; Ceballos and Álvarez, 2013), and therefore in all likelihood on leader ability. It is also not the case that inbreeding increases variance in ability; that is, it is essentially impossible that inbreeding leads to "genius" by accident.

Second Stage Results

Table 5 presents our second stage results in Panel A. In column 1 we use Woods' assessed state performance as the outcome. Note that the instrument is strongly relevant (effective F-statistic of 42).[50] The IV coefficient is positive and strongly significant, suggesting that the ability of monarchs had a positive causal effect on the performance of the states they reigned. In column 2 we exclude monarchs who were at least as inbred as the offspring of uncles and nieces. We obtain a very similar 2SLS coefficient on ruler ability.

Our IV strategy addresses reverse causality and some, but not all, omitted variable biases. For example, our IV would not address the possible issue that Woods' (1906) initial assessment of ruler ability may have influenced his subsequent coding of state performance in Woods (1913). To speak to this concern, columns 3 to 6 in Table 5 turn to our second and third outcome variables – the changes in land area and in urban population during the tenure of each monarch. Again, both

[50]We follow the recommendation by Andrews, Stock, and Sun (2019) and report the effective F-statistic by Montiel Olea and Pflueger (2013), which can be compared to the Stock and Yogo (2005) critical values in our case with one endogenous regressor and one instrumental variable (Andrews et al., 2019). The corresponding critical value for max. 10% relative bias is approximately 16.4 for all three 2SLS specifications.

OLS and IV coefficients point to a positive, large, and significant effect of ruler ability, and the results are robust to excluding rulers with relatively high coefficients of inbreeding above 12.5.

The IV estimates tend to be somewhat larger than the corresponding OLS coefficients. For instance, the OLS estimate corresponding to Table 5 column 1 is 0.618 (Table 1 column 2). Thus, the IV coefficients of 0.794 is 28% larger. A plausible explanation is that – as discussed above – Woods had a bias in favor of rulers hailing from old dynasties, which may have led him to assign better grades to inbred rulers, and correspondingly, worse grades to less inbred rulers. Our IV strategy corrects for this biased assessment of ruler ability and uncovers larger effects. [51]

Panel B shows the corresponding reduced-form relationships between each monarch's coefficient of inbreeding and the three state-level outcomes during the reign. We find sizeable and statistically highly significant coefficients. A one-std increase in inbreeding leads to an approx. 5% decrease in land area and in urban population, according to the estimates in columns 3 and 5, respectively; an alternative interpretation of the magnitudes is that on average, monarchs with $F < 6.25$ (less inbred than the offspring of first cousins) saw a 12% larger increase in their territory than more inbred monarchs with $F \geq 6.25$.[52]

'Hidden' Inbreeding

In what follows, we present IV results for the 'hidden' degree of inbreeding. These specifications can address endogeneity concerns that link inbreeding to state performance – either via strategic royal marriage decisions (e.g., to expand the territory) or via preferences for or against marrying within dynasties that are in turn related to state performance. We first identify the degree of inbreeding that resulted directly from each ruler's parents' family ties (e.g., parents being first cousins or uncle and niece). Then, we deduct this 'naive' degree of inbreeding from the 'full' coefficient of inbreeding. The resulting 'hidden' degree of inbreeding reflects the more remote layers of the pedigree, beyond the parent generation (see Appendix A.6 for further detail on the calculation). Table 6 replicates our previous IV and reduced-form results, using only the 'hidden' component of the coefficient of inbreeding as an instrument for ruler ability. Throughout, we obtain very similar results, both in terms of magnitude and statistical significance. Importantly, the first stage also remains strong, with the effective F-statistic either exceeding or being close to the critical value for max. 10% IV bias.

Other Potential Threats to Identification

In Appendix C we present results that can address further potential threats to our identification strategy. Here, we provide a brief overview. First, the exclusion restriction would be violated

[51] Table A.16 in the Appendix shows the result for the sample of ruler who came to power due to hereditary ascension.

[52] The std of inbreeding is 4, hence -0.013·4=-0.052. The average inbreeding of those with $F < 6.25$ is 1.88, and of those with $F \geq 6.25$, 11.55. Hence (11.55-1.88)·0.013=0.12.

if royals married kin when state performance was low, *and* past bad state performance lowered state-level outcomes during the reign of their offspring. Our results on 'hidden inbreeding' can already alleviate this concern – by effectively excluding marriage decisions at the generation of rulers' parents. Nevertheless, we also account for this possibility more directly in Appendix C.1. We show that controlling for state performance over the previous reign does not affect our 2SLS results (Panel A of Table A.18). In addition, lagged state performance does not predict current state performance or current ruler ability (Panel B of Table A.18 and Table A.17). Second, we show that our results are similarly not driven by strategic marriages *outside* of the kin network. Marriage between completely unrelated parents would imply rulers with zero inbreeding ($F = 0$). These are excluded in our baseline dataset (see footnote 32). Table A.19 in Appendix C.2 shows that our IV results are almost identical when we include the 43 rulers with $F = 0$. Third, in Appendix C.3 we account for a possible confounding role of conflict, which may have been related to dynastic networks (Benzell and Cooke, 2018). We show that our results are robust to controlling for conflict during reigns (Table A.20), and to residualizing our *State Performance* measure with respect to territorial changes (Table A.21). Fourth, in Appendix C.4 we account for a possible role of founders vs. descendants in dynasties (George and Ponattu, 2018), whereby founders of dynasties may be at the same time more capable and less inbred than later descendants. Table A.22 documents that our IV results hold when we include fixed effects for rulers' order within dynasties. Fifth, a related concern is that monarchs may have selected the most able leaders among their offspring as successor (even to the point of 'ridding themselves' of incapable offspring that came earlier in the birth order), or that offspring who were more affected by their parents' consanguineous relationships died in young age, leaving more capable surviving successors. However, both these mechanisms would work against our first stage: Siblings share the same coefficient of inbreeding, and 'eliminating' the least capable ones would reduce the variation in ruler ability that is due to inbreeding. In Table A.23 we show that our results are strong when we reduce the sample to those monarchs who were the first-born sons, as well as for those reigns for which no competing claims from other marriages of the prior monarch were possible.

4.5 Ruler-Pair Regressions

So far, our regressions have compared rulers from the same state over time. As we noted in footnote 36, accounting for variation over time is not straightforward because reigns begin and end at different points in different states. Yet, rulers and their states' performance might be affected by continent-wide shocks, such as the Black Death, the Reformation, or long-lasting wars.

In order to account for potential confounding factors over time, we introduce a flexible approach that compares leaders in different states who ruled contemporaneously. For instance, while Carlos III of Spain (assessed as a capable ruler by Woods (1913)) oversaw the "continued improvement" of many aspects of the performance of Spain from 1759 to 1788, Louis XV ruled over

France from 1731 to 1774. Described by Woods (1913, p.317) as "weak, indolent" and of "inferior capacity," Louis XV oversaw the (for France) "disastrous Seven Years War" and domestically a "decline in commerce" where "[u]nder excessive taxes, the peasantry were reduced to extreme misery."

We identify – for each ruler i – all those rulers j who overlapped in their reign in different states for at least one year. Then, we calculate pairwise differences in their ability, in the performance of their states, and in their coefficients of inbreeding. Based on these variables, we estimate regressions at the ruler pair-level:

$$\Delta_{ij}\text{State Performance} = \beta\Delta_{ij}\text{ Ruler Ability} + \mu_{c(i)} + \mu_{c(j)} + \gamma X + \varepsilon_{ij} \quad , \tag{3}$$

where Δ_{ij} indicates the difference in a variable between ruler i and j. For ease of interpretation of coefficients we again standardize the differences in the assessments of *State Performance* and of *Ruler Ability* so that both variables (in differences) have mean zero and standard deviation one. We further estimate IV regressions in this setting using the difference in the coefficient of inbreeding. For the above example of Carlos III and Louis XV, this difference is negative (-5.65) from the perspective of Carlos III, as he had a lower coefficient of inbreeding (3.9) compared to Louis (9.55). In all regressions we further include state fixed effects for both rulers ($\mu_{c(i)}, \mu_{c(j)}$), and we introduce the following additional fixed effects successively: state-pair fixed effects, ruler fixed effects (of ruler i), and state-pair $\times$ century fixed effects. Throughout for the ruler-pair regressions, standard errors are clustered at the state-pair level. In total there are 5,510 pairs of overlapping rulers in our sample with data on ability and state performance for both rulers. For 2,926 of these we also know the coefficient of inbreeding for both rulers.

We present the results for our main outcome variable (*State Performance*) in Table 7; the corresponding regressions for territorial changes and urban population are shown in Appendix Table A.15. Panel A presents the OLS results. Differences in the ability of contemporaneous rulers are strongly positively associated with differences in *State Performance* (column 1). The coefficient is similar to our result in levels (see Table 1). While this is unsurprising, given that we standardized both the differences and the levels in ruler ability and *State Performance*, the almost identical coefficient also implies that our results are not driven by time trends. Next, in column 2 we introduce state-pair fixed effects, absorbing features that are specific to state pairs (such as the frequent wars between England and France). In column 3, we further use ruler fixed effects, which prevents that our results may be dominated by individual rulers. Column 4 uses state-pair $times$ century fixed effects, thus absorbing for example differences between England and France that were specific to the 17th century. In all three increasingly restrictive specifications we obtain very similar results. Finally, our results also holds when we compare each ruler only with the *one* ruler with whom (s)he shared the largest overlap in reign (column 5).

Next, we turn to our IV results in the ruler-pair regressions. Panel B in Table 7 presents the first stage, showing strong negative and highly significant coefficients for all specifications. Comparing contemporaneous rulers, those who were more inbred had lower ability. Building on this strong first stage, Panel C shows our IV results at the ruler-pair level. We document sizable effects of pairwise differences in ruler ability on differences in *State Performance*. The coefficients are similar to our baseline IV specification in Table 5 (column 1), suggesting that aggregate time trends do not confound our identification and causal estimates. Finally, Panel D presents reduced-form results, documenting highly significant and negative relationship between differences in inbreeding across contemporaneous rulers and differences in the corresponding *State Performance*. Appendix Table A.15 shows that the findings for ruler-pair regressions also extend to our other measures of state performance, namely the change in territory and in total urban population during each reign.

4.6 Mechanisms

Why did capable monarchs boost their states' performance? In Appendix D we provide several pieces of suggestive evidence that we summarize here. First, we examine whether physical (as opposed to intellectual) ability could explain our findings, as both are affected by inbreeding. For example, inbred rulers may have had a short life span, ruled for shorter periods, lacked reproductive success (which might have fueled succession crises), or be of smaller or less imposing physical appearance. Appendix D.1.2 (Table A.25) shows that our IV results are unchanged when we control for the age at death, length of reign, the number of offspring, a dummy for whether the rulers were tall or had an imposing physical appearance.[53] Second, we inquire whether our results are driven by cognitive ability (as assessed by Woods) or non-cognitive intellectual ability. In Appendix D.1.3, we use our own assessment of monarchs' non-cognitive ability and show a sizable second stage regression with this measure. This suggests that both cognitive and non-cognitive abilities were crucial for less inbred monarchs to increase state performance.[54] Third, we examine which aspects of Woods' (1913) broad *State Performance* measure drive our results. To this end, we code detailed outcome variables for various economic and political aspects of each reign based on both Woods' text and information from encyclopedias (see Appendix D.2.1 for detail). We find that ruler ability had particularly strong effects on law and order, administrative efficiency, and

[53] In this context, we note that a rich literature connects birth order to individual and social capabilities, typically finding favorable effects for first-born children (c.f. Rohrer, Egloff, and Schmukle, 2015). Motivated by these differences, Oskarsson et al. (2021) show that firstborn sons are more likely to become politicians today. This could potentially also be a mechanism behind our results: if firstborn children were more capable, and if inbreeding led to more infant death, then the next-in-line successors of inbred royal parents may have been less capable because of a birth-order effect (instead of – or in addition to – a direct effect of inbreeding on intellectual capability). However, this is not the case. In unreported results (available upon request), we show that birth-order fixed effects do not affect our IV estimates.

[54] However, the first stage for cognitive ability is stronger by an order of magnitude, and supported by rich evidence in biology linking cognitive ability to inbreeding. This is the reason why we focus on cognitive ability throughout the paper.

diplomatic prestige of a state. Capable rulers also fostered economic performance (both agriculture and commerce) as well as the living conditions of their populace.

Fourth, in Appendix D.2.2 we examine how ruler ability affected war and conflict. We find that overall, states with capable rulers were significantly less likely to experience conflict. Distinguishing between domestic and international conflicts as outcome variables, we then show that this finding is entirely driven by the latter: Capable rulers were much less likely to engage in international conflicts (Table A.29). This suggests an interesting mechanism, given that capable rulers also expanded their states' territory and urban population (see Table 5): Capable rulers avoided conflicts overall, but especially so when these were risky, with potential territorial losses. Lastly, we decompose the change in urban population into an intensive component (growth or decline of urban population within a state's existing borders) and an extensive component (changes in urban population due to territorial gains or losses). We find that able rulers mostly expanded the (taxable) urban population via the extensive margin (Appendix D.2.3). In contrast, on average, capable rulers did not cause faster urban growth *within* their states' boundaries. This is compatible with historical facts across early modern Europe, where strong, capable rulers had an ambiguous effect on domestic city growth because they fostered economic prosperity on the one hand, but they also kept cities' ambitions to become independent in check, thereby curbing their potential to grow further (c.f. Angelucci, Meraglia, and Voigtländer, 2020). In sum, the evidence suggests that capable rulers fostered administrative efficiency, the rule of law, and economic prosperity within their realms, while choosing wisely which external conflicts to engage in – with the result that they managed to expand their territories into valuable, urbanized areas.

5 Constraints on Ruler Power

Were European states inevitably at the mercy of incapable, inbred rulers? The modern literature in political economy and management suggests that leaders matter particularly strongly when they act in institutionally unconstrained environments. Examining CEOs, Clark et al. (2014) show that "leaders matter most when ownership and governance structures correspond with a weak or ambiguous institutional logic." Similarly, at the national level in modern data, Jones and Olken (2005) find particularly strong changes in growth when autocratic leaders die, while Besley and Reynal-Querol (2017) document higher economic growth under hereditary leaders when constraints on them were weak. In our setting, all leaders were hereditary, but there were also important differences in the extent to which their actions were legally and de-facto constrained. In addition, in contrast to previous work, we observe ruler ability. We can thus examine whether institutional constraints mitigated the effects of ruler ability on state performance. We first describe a motivating example – monarchs in England only mattered before a strong parliament emerged – and then present our results.

5.1 Example: Constraints on England's Monarchs in the 17th Century

Consider the cross-state variation of our baseline OLS association documented in Figure 4. The coefficient for England was rather small, especially when compared to other Western European monarchies, such as France and Spain. In Figure A.5 in the appendix, we split England into two separate observations, one containing the reigns before the turbulent seventeenth century and one after 1600. In the seventeenth century, the Civil War and the Glorious Revolution led to increased constraints on the monarch in power (see Figure 5 and the discussion in Section 3.4). This change is also reflected in the relationship between ruler ability and state performance: We document a strong coefficient for England before 1600, which is very similar to other Western European states. After 1600, in contrast, the coefficient is negative and statistically indistinguishable from zero.

5.2 Results: Constrained Monarchs Matter Less

To assess whether the ability of constrained European monarchs mattered less we estimate the following specification with interactions:

$$y_{r,s} = \beta_1 RulerAbility_{r,s} + \beta_2 Constrained_{r,s} + \beta_1 RulerAbility_{r,s} \times Constr_{r,s} + \delta_s + \varepsilon_{r,s} \quad (4)$$

where *Ruler Ability*$_{r,s}$ is the assessed capability of monarch of state s in reign r and *Constrained*$_{r,s}$ is a dummy variable indicating whether the ruler faced institutional constraints, based on the two variables described in Section 3.4 that indicate whether (prior to the start of a reign) constraints on the executive were substantial: the Polity-IV-based constraints on the executive and parliamentary activity. Regarding the outcome variables $y_{r,s}$, a valid concern is that Woods' (1906; 1913) assessment of ruler capability may have been affected by the extent to which their power was constrained. For this reason, we only use our two 'objective' measures of state performance as outcome variables, namely the change in territory and in urban population during each reign. Finally, δ_s denotes state fixed effects. In our IV results, we instrument for *Ruler Ability* with the coefficient of inbreeding $F_{r,s}$, and for the interaction term with *Constrained*$_{r,s} \times F_{r,s}$.[55]

Table 8 presents our results, beginning with our own reign-specific coding of constraints on rulers in columns 1-4. While we draw our conclusions from the IV results, we also report the OLS coefficient for both outcome variables, because these results i) provide a consistency check and b) draw on a larger sample of rulers, since our instrument – the coefficient of inbreeding – is not observed for all rulers. We find a sizable *negative* interaction term that is statistically significant in both IV specifications, and of very similar magnitude as the (positive) coefficient on *Ruler Ability*. In words, these results imply that the ability of rulers did not matter when they faced

[55] The exclusion restriction is that the interaction term *Constrained*$_{r,s} \times F_{r,s}$ affected changes in territory and urbanization only via the ruler ability – constraints channel. While it is possible to imagine violations of this condition, two features can help to address these: The variable *Constrained* in levels is included in both the first and second stage regressions, and the constraints on rulers are measured *before* the respective ruler came to power.

"substantial limitations on executive authority." The indicator for constrained rulers itself also has a statistically significant effect on territorial change and on urban growth. That is, constraints on executive power boost performance of the state also directly. If we were to take the estimated coefficients at face value, a one-std increase (about 1) in the ability of an *unconstrained* ruler would have a similar effect as introducing substantial institutional constraints on an average ruler (with *Ruler Ability*=0).[56]

Columns 5-8 repeat the analysis, using the activity of parliaments from Van Zanden et al. (2012) to construct the dummy variable that indicates constrained rulers. While this indicator is much more coarse, it broadly confirms the results from the earlier columns: Throughout, capable rulers have positive effects (and incapable rulers, negative effects), and this finding is significantly weakened for rulers constrained by more active parliaments.

In sum, our results suggest that the capability of monarchs mattered less when and where their actions were constrained by institutions. In our setting, parliaments – and therefore the constraints on monarchs – became gradually stronger in North-Western Europe after the 16th century (Van Zanden et al., 2012). At the same time, the dynasties ruling Europe increasingly drew on an ever smaller pool of potentially suitable royal marriage partners. In turn, this increased the coefficient of inbreeding throughout, and particularly so in Northern Europe. One fascinating implication of our results is thus that the emergence of strong parliaments in North-Western Europe may have shielded these states from the negative effects of ever more inbred royal elites.[57]

6 Conclusion

The importance of individual leaders for the course of history has been subject to continued debate since the times of Napoleon. The Emperor of the French also illustrates a central identification problem: rather than 'great men' shaping history, historical circumstances may give rise to 'great men,' who find their way into office even when born to a modest family on a far-off Mediterranean island. In other words, it is hard to disentangle a causal effect of leaders on their state's performance from unobserved factors or even reverse causality. We explored the period that has been most prominently debated in this context: Europe between the 10th and 18th century.

This paper is the first to provide systematic causal evidence that more capable European rulers boosted outcomes for the states they governed. To identify these effects, we exploited the fact

[56] Recall that we standardize *Ruler Ability* so it has mean zero and standard deviation 1.

[57] One may wonder whether this result could also be driven by inbreeding depression being "purged" over time (Ceballos and Álvarez, 2013). This is unlikely. We exploit differential changes in constraints on executives across states, while the elimination of deleterious alleles via purging would have been common a trend across Europe (if it was quantitatively important at all). In addition, this channel would be captured by two other robustness checks that we present: i) ruler-pair regressions (which implicitly absorb time trends, in section 4.5) and ii) our regressions that include dummies for each ruler's order in the dynasty (in Appendix C.4). Neither of these checks diminishes our main coefficient of interest.

that European monarchs ascended to power by hereditary succession, independent of their ability. In addition, ruler ability varied because of century-long inbreeding within dynasties. The detrimental effects of inbreeding were unknown until the 20th century; in fact, a popular belief among European dynasties was that kin marriage helped to preserve royal virtues. In addition, a significant part of consanguinity (the degree of genetic similarity) was 'hidden' in the history of kin marriage during previous generations. In combination, these features yield quasi-random variation in ruler ability, allowing us to identify its causal effect on state performance. We find sizeable coefficients, with capable leaders boosting their states' performance along multiple dimensions, including economic outcomes, administrative efficiency, urban growth, and territorial gains. The latter is particularly striking, given that capable rulers were less likely to engage in conflicts. In combination, these two observations suggest that able rulers chose wisely which conflicts to engage in, favoring those that promised territorial gains. Overall, our results imply that European rulers did 'make history,' with their actions shaping the European map during the period that laid the foundation for modern nation states.

We also showed that the effect of ruler ability on state performance was muted in states with strong institutional constraints on their monarchs. The most important institution exerting such constraints were parliaments, and these, in turn, were most active in North-Western Europe. At the same time, inbreeding of dynasties surged in North-Western Europe between the 15th and 18th century. Our results suggest that parliaments shielded Northern Europe's states from the adverse effects of inbreeding within their ruling dynasties.

Our findings complement earlier causal analyses of national leaders today, as this literature similarly finds more substantial effects for more autocratic and less constrained leaders. We extend these conceptually as we open the black box of national leader effects by emphasizing the importance of particular individual traits in shaping state performance. We hope that future work on modern national leaders similarly moves from the identification of leader effects to causal analysis of *why* national leaders matter.

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FIGURES

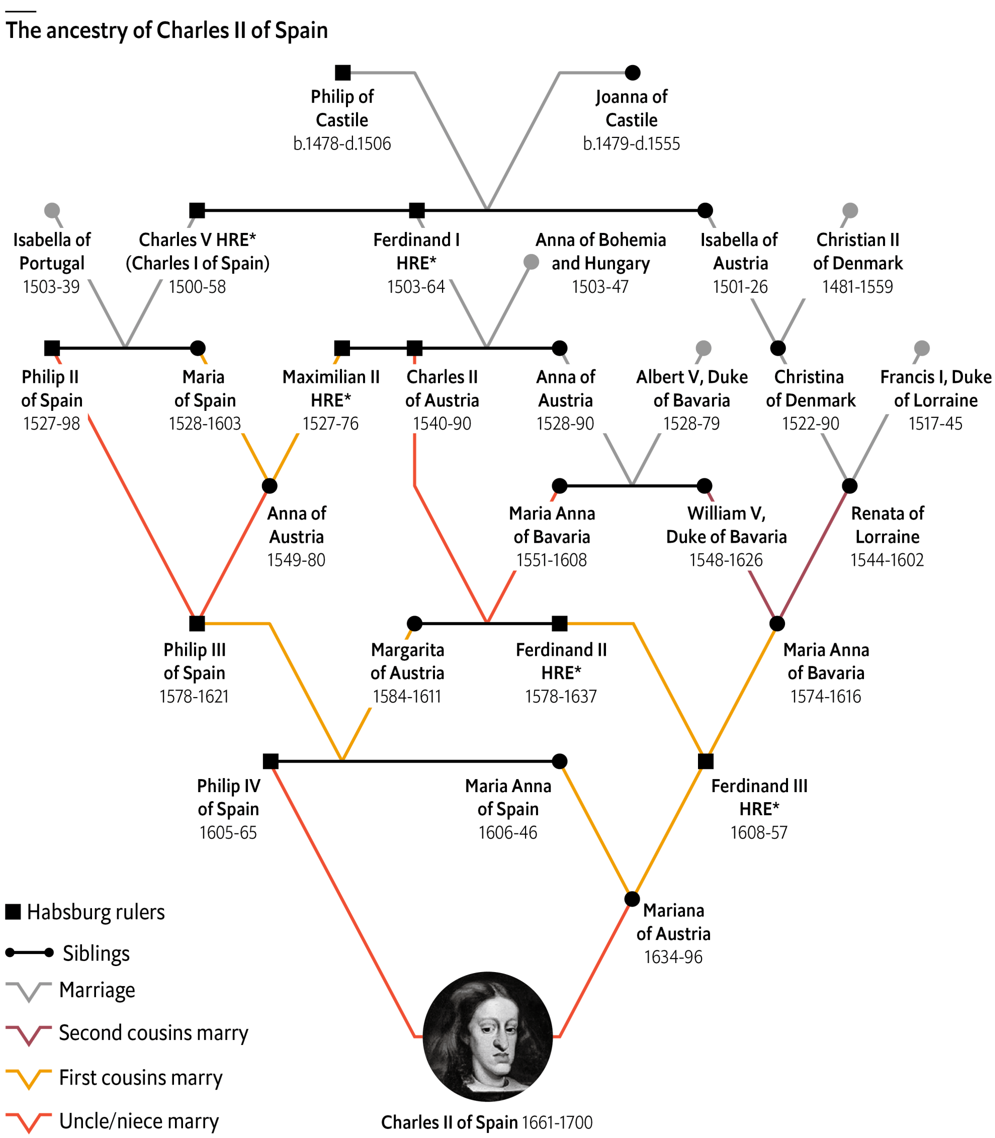

Figure 1: Pedigree of Carlos II. of Spain

Note: The figure shows the pedigree of Carlos II., King of Spain from 1665 to 1700. Note the intricate links to common ancestors of both his parents, stretching back over multiple generations. From The Economist's coverage of this paper on February 20th, 2021 © The Economist Newspaper Limited, London. All rights reserved.

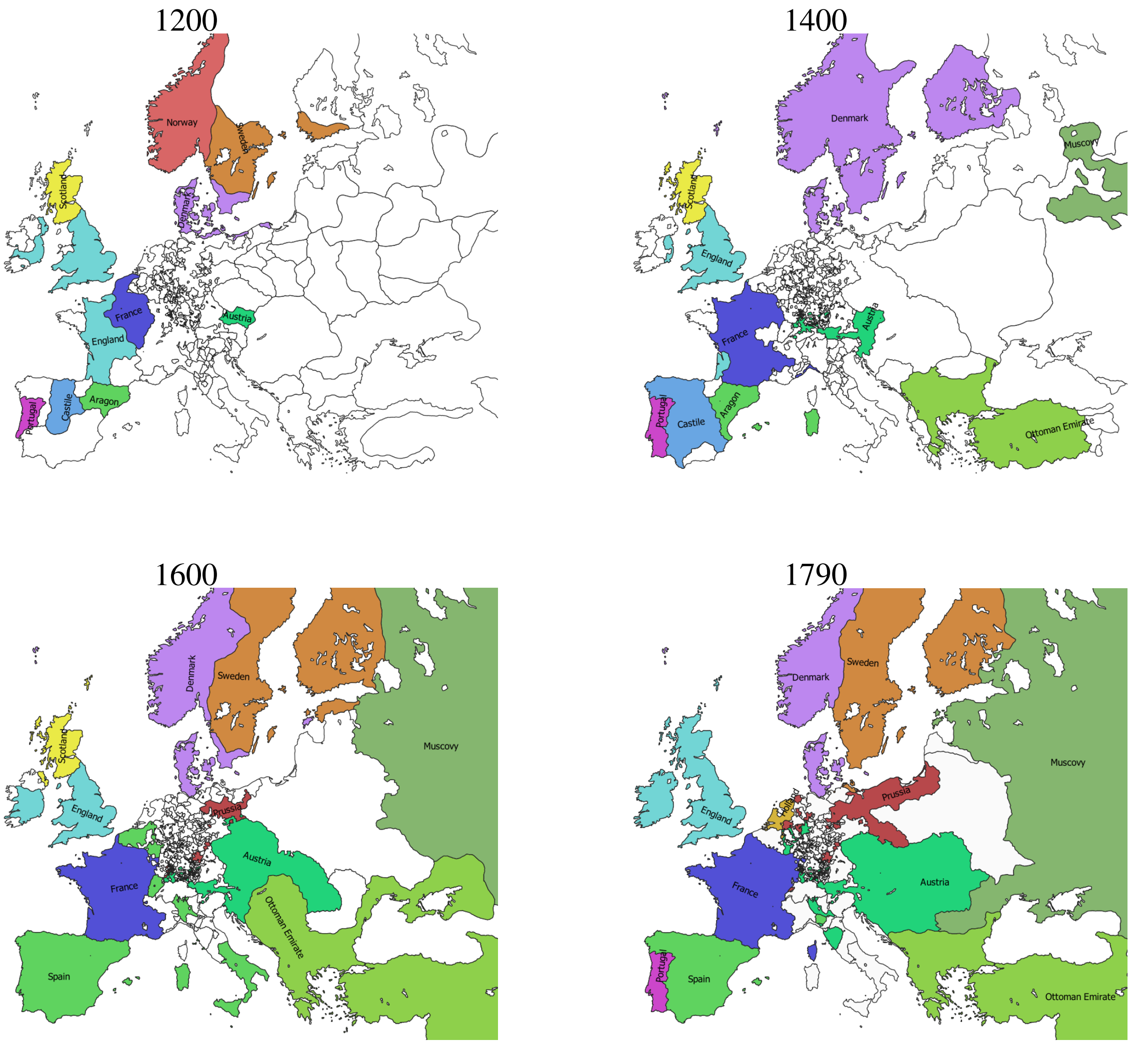

Figure 2: States in Sample

Note: The figure shows the boundaries of the states in our baseline sample at four points in time: 1200, 1400, 1600, and 1790. Data on state boundaries are from Abramson (2017). See Appendix A.1 for detail

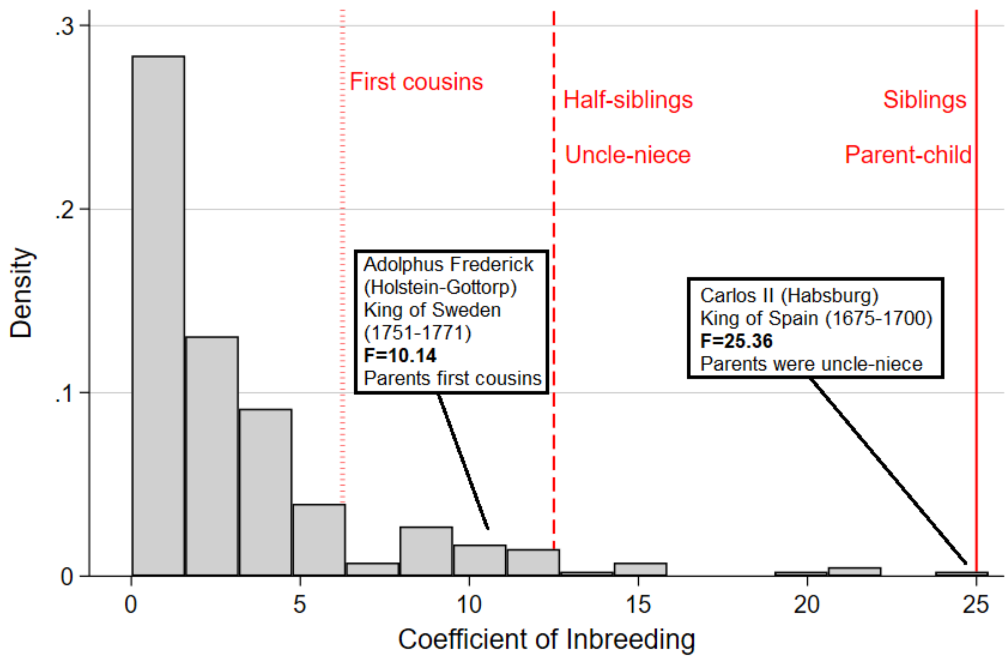

Figure 3: Histogram: Coefficient of inbreeding of Monarchs

Note: The figure shows the distribution of the coefficient of inbreeding (F) – the instrument for ruler ability in our analysis – for the 278 European Monarchs with available genealogical information in our baseline dataset. $F = 0$ indicates no relation among the parents of a monarch, $F = 50$ would theoretically result from self-fertilization.

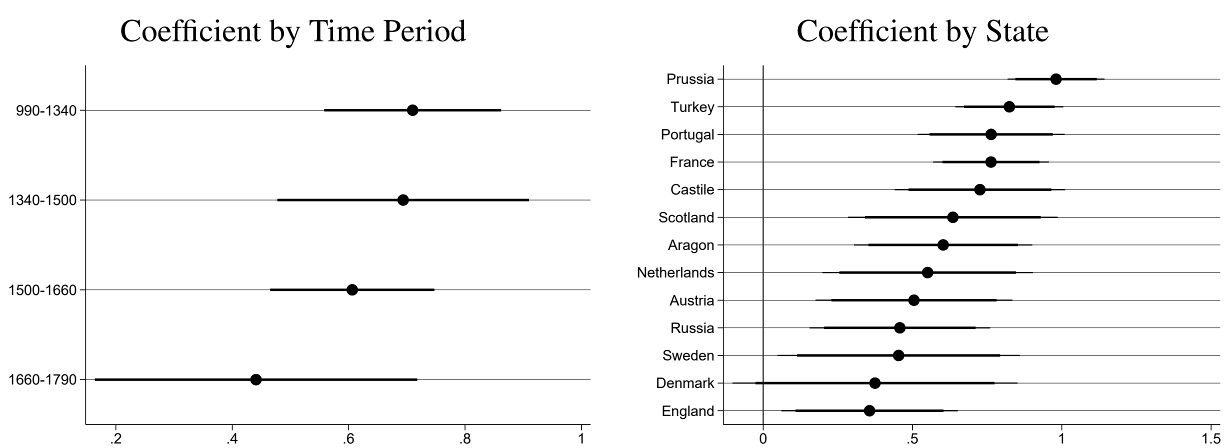

Figure 4: Association between Monarch Ability and State Performance by Period and State

Note: The figure shows coefficients of regressing ruler ability on state performance by time period (left panel) and by states in our baseline sample (right panel). Underlying each panel, we run a joint OLS estimation that includes state fixed effects. The corresponding regressions are reported in Appendix B.3. The figure also shows 90% confidence intervals (based on robust standard errors).

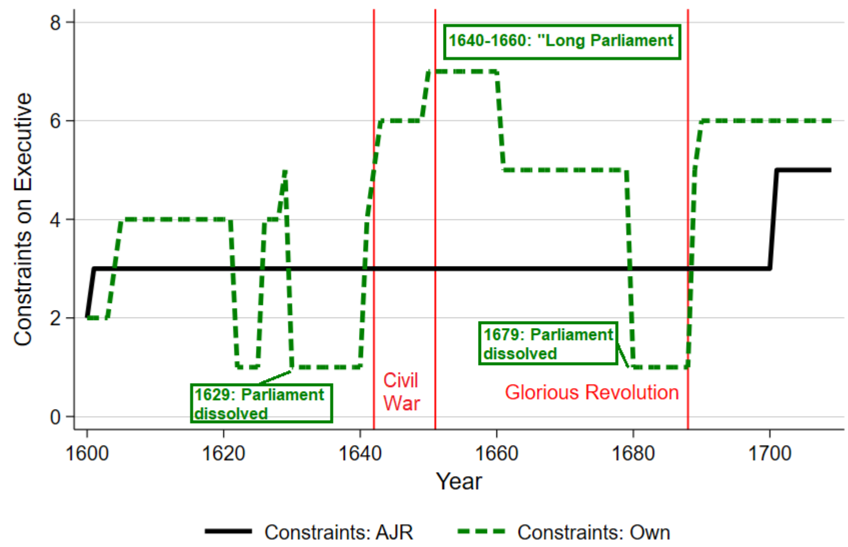

Figure 5: Constraints on Executive: Year-by-year, 17th Century England

Note: The figure shows changes in constraints on the executive for England in the 17th century, using the Polity IV score that ranges from 1-7. The black solid line depicts the century-level coding by Acemoglu et al. (2005), while the green dashed line shows our annual variable, which can then be mapped to individual reigns.

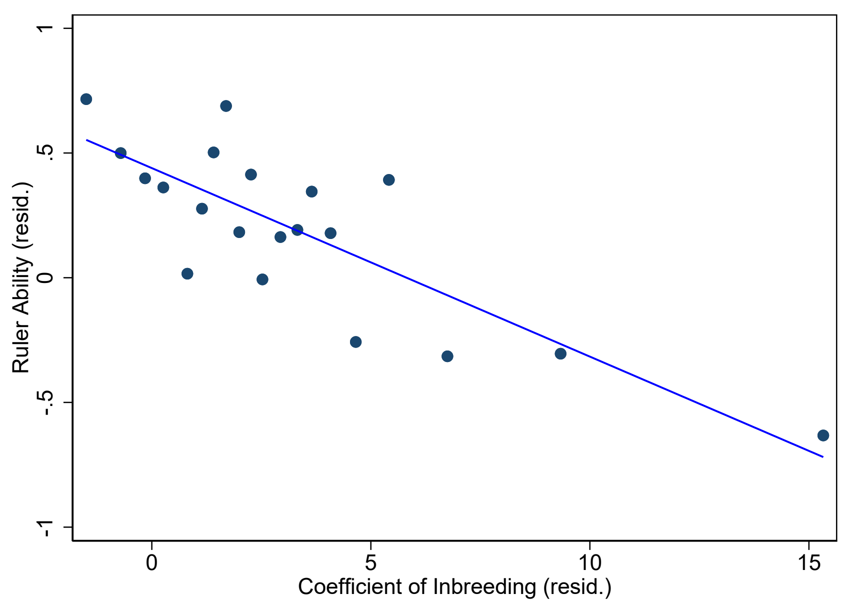

Figure 6: First Stage: Binscatter with state Fixed Effects

Note: The figure shows a binned scatter plot for our first-stage regression of a ruler ability on the coefficient of inbreeding, controlling for state fixed effects. Each of the 20 bins in the graph corresponds to more than 10 individual rulers.

TABLES

Table 1: Monarchs and Performance of State – OLS Results

Dependent variable as indicated in table header

Dep. Var.	*State Performance*		$\Delta log(Area)$		$\Delta log(UrbPop)$	
	(1)	(2)	(3)	(4)	(5)	(6)
Ruler Ability	0.616***	0.618***	0.117***	0.113***	0.110***	0.098***
	(0.052)	(0.050)	(0.032)	(0.035)	(0.028)	(0.027)
State FE		✓		✓		✓
R^2	0.38	0.41	0.07	0.11	0.05	0.10
Observations	336	336	298	298	289	289

Note: The table documents a strong relationship between ruler ability and our three measures of performance of the state at the reign level. *State Performance* in columns 1-2 is a comprehensive measure based on the coding by Woods (1913). The dependent variable in columns 3-4 is the change in a state's land area during a monarch's reign, and in columns 5-6, it is the change in total urban population. All regressions are run at the reign level. Standard errors clustered at the state level in parentheses. * p<0.1, ** p<0.05, *** p<0.01.

Table 2: Robustness of OLS Results: Different Samples

Dep. Var.: *State Performance*

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Notes:	Baseline	Only Dynasty Members	Exclude Regencies	Exclude Foreign Rule	Exclude Multi-Reign Rulers	All Restrictions	Extended Sample until 1914	Extended Sample incl. PL & HU
Ruler Ability	0.618***	0.653***	0.687***	0.626***	0.616***	0.670***	0.532***	0.554***
	(0.050)	(0.058)	(0.070)	(0.052)	(0.053)	(0.071)	(0.044)	(0.042)
State FE	✓	✓	✓	✓	✓	✓	✓	✓
R^2	0.41	0.45	0.50	0.42	0.41	0.50	0.34	0.34
Observations	336	290	262	325	317	235	374	437

Note: The table documents the robustness of our baseline regression (col 2 in Table 1) to using different samples. *State Performance* is a comprehensive measure based on the coding by Woods (1913). See Section 4.2 for a detailed description of the sample restrictions for cols 2-6. In col 7 we extend the sample (based on our own coding) for all states included in Woods until 1914. In col 8 we extend the sample to further include Poland and Hungary, again until 1914 (see Appendix A.4 for detail). All regressions are run at the reign level. Standard errors clustered at the state level in parentheses. * p<0.1, ** p<0.05, *** p<0.01.

Table 3: OLS Results – Heterogeneity by Ruler Characteristics

Dep. Var.: *State Performance*

	(1)	(2)	(3)	(4)	(4)
Dummy for:	Female	Young Ascension	Raised as Heir	Hereditary Succession	Regicide (lagged)
Ruler Ability	0.607***	0.552***	0.578***	0.411***	0.612***
	(0.062)	(0.092)	(0.186)	(0.099)	(0.063)
Dummy × Ruler Ability	0.027	0.122	0.015	0.238**	-0.003
	(0.124)	(0.099)	(0.193)	(0.108)	(0.199)
Dummy	-0.207*	0.009	-0.233	0.105	0.007
	(0.107)	(0.069)	(0.154)	(0.121)	(0.192)
State FE	✓	✓	✓	✓	✓
R^2	0.40	0.40	0.45	0.39	0.40
Observations	312	305	141	290	191

Note: The table shows results of interacting the baseline regression with dummy variables. In column 1, this indicator is one if the ruler was a woman. In column 2, the interaction variable is a dummy for rulers ascending to the throne below the median age of 28 years. In column 3, it indicates rulers who were raised as designated heir, while in column 4 it indicates rulers who raise to power due to hereditary succession. In Column 5 the dummy indicates whether the prior ruler was murdered or executed after trial. The dependent variable, *State Performance*, is a comprehensive measure based on the coding by Woods (1913). All regressions are run at the reign level. Standard errors clustered at the state level in parentheses. * p<0.1, ** p<0.05, *** p<0.01.

Table 4: Inbreeding and Monarch Ability – First-Stage Results

Dependent Variable: Ruler Ability

	(1)	(2)	(3)	(4)	(5)
Note:			F < 25	F < 12.5	Hereditary Succession †
Coefficient of Inbreeding	-0.068***	-0.076***	-0.077***	-0.084***	-0.066***
	(0.012)	(0.012)	(0.014)	(0.017)	(0.013)
State FE		✓	✓	✓	✓
R^2	0.09	0.15	0.15	0.12	0.16
Observations	235	235	234	227	191

Note: The table shows results of our first-stage regressions of ruler ability on monarchs' coefficient of inbreeding. The coefficient of inbreeding measures the degree of similarity in the genes of offspring due to common ancestors, and thus the increased risk of genetic disorders resulting from the consanguinity of the monarch's parents. Column 3 excludes Carlos II of Spain, whose parents shared as many genes as offspring of siblings. Column 4 excludes all monarchs whose parents shared at least as many genes as offspring of half-siblings. All regressions are run at the reign level. Standard errors clustered at the state level in parentheses. * p<0.1, ** p<0.05, *** p<0.01.

† Subsample includes only documented cases where rulers ascended to power due to hereditary succession.

Table 5: Monarchs and State Performance – IV and Reduced-Form Results

Dependent variable as indicated in table header

	(1)	(2)	(3)	(4)	(5)	(6)
Dep. Var.	*State Performance*		$\Delta log(Area)$		$\Delta log(Urban Pop.)$	
Note:		F < 12.5		F < 12.5		F < 12.5
A. Second Stage Regressions						
Ruler Ability	0.794***	0.645***	0.176***	0.311**	0.194***	0.304**
	(0.100)	(0.185)	(0.051)	(0.123)	(0.051)	(0.123)
State FE	✓	✓	✓	✓	✓	✓
First Stage Effect. F-Stat	42.2	24.6	39.1	21.1	34.8	21.3
Observations	235	227	203	196	198	191
B. Reduced-Form Regressions						
Coefficient of Inbreeding	-0.061***	-0.054***	-0.013***	-0.025**	-0.013***	-0.024**
	(0.011)	(0.013)	(0.004)	(0.010)	(0.003)	(0.010)
State FE	✓	✓	✓	✓	✓	✓
R^2	0.11	0.08	0.10	0.11	0.07	0.08
Observations	235	227	203	196	198	191

Note: The table shows the results of second-stage and reduced-form regressions for our three outcome variables. The instrument, the coefficient of inbreeding, measures the increased risk of genetic disorders resulting from the consanguinity of the monarch's parents. Columns 1-2 use the assessment of political and economic conditions during each monarch's reign from Woods (1913) as measure of state performance, column 3-4 use the change in land area during each monarch's reign, calculated from Abramson (2017), and column 5-6 use the change in the urban population of the state during each monarchs reign. Column 2, 4, and 6 exclude all monarchs whose parents share as many genes as offspring of half-siblings. The table reports the first-stage effective F-statistic from the Montiel Olea and Pflueger (2013) robust weak instrument test; the corresponding critical value for max. 10% relative bias is 16.4. All regressions are run at the reign level and include state fixed effects. Standard errors clustered at the state level in parentheses. * p<0.1, ** p<0.05, *** p<0.01.

Table 6: Monarchs and State Performance – ‘Hidden’ Inbreeding

Dependent variable as indicated in table header

	(1)	(2)	(3)	(4)	(5)	(6)
Dep. Var.	*State Performance*		$\Delta log(Area)$		$\Delta log(UrbanPop.)$	
Note:		F < 12.5		F < 12.5		F < 12.5
			A. Second Stage Regressions			
Ruler Ability	0.757***	0.710***	0.161**	0.234**	0.199***	0.270***
	(0.132)	(0.201)	(0.064)	(0.105)	(0.057)	(0.098)
State FE	✓	✓	✓	✓	✓	✓
First Stage Effect. F-Stat	17.2	14.0	19.8	16.3	19.5	16.3
Observations	235	227	203	196	198	191
			B. Reduced-Form Regressions			
Hidden Coefficient of Inbreeding	-0.091***	-0.080**	-0.018**	-0.026*	-0.023**	-0.030**
	(0.025)	(0.028)	(0.008)	(0.012)	(0.009)	(0.013)
State FE	✓	✓	✓	✓	✓	✓
R^2	0.11	0.09	0.10	0.10	0.07	0.08
Observations	235	227	203	196	198	191

Note: The table repeats all specifications from Table 5, but using only the ‘hidden’ component of inbreeding as an instrumental variable for ruler ability. The ‘hidden’ part of the overall coefficient of inbreeding was due to complex intermarriage patterns in the generations prior to a ruler’s parents. It could not be computed before the 20th century. See Appendix A.6 for details on the calculation of the ‘hidden’ measure of inbreeding. The table reports the first-stage effective F-statistic from the Montiel Olea and Pflueger (2013) robust weak instrument test; the corresponding critical value for max. 10% relative bias is approximately 16.4. All regressions are run at the reign level and include state fixed effects. Standard errors clustered at the state level in parentheses. * p<0.1, ** p<0.05, *** p<0.01.

Table 7: Ruler-Pair Regressions

Dep. Var.: Δ_{ij} *State Performance*

	(1)	(2)	(3)	(4)	(5)
Note:					One-ruler match
			A. OLS		
Δ_{ij} Ruler Ability	0.632***	0.633***	0.614***	0.594***	0.577***
	(0.012)	(0.013)	(0.015)	(0.017)	(0.032)
R^2	0.45	0.46	0.75	0.81	0.89
Observations	5,510	5,510	5,510	5,495	1,678
			B. First Stage Regressions		
Δ_{ij} Coefficient of Inbreeding	-0.042***	-0.043***	-0.043***	-0.038***	-0.044***
	(0.004)	(0.005)	(0.004)	(0.005)	(0.008)
R^2	0.15	0.17	0.62	0.70	0.77
Observations	2,926	2,926	2,925	2,888	1,678
			B. Second Stage Regressions		
Δ_{ij} Ruler Ability	0.857***	0.840***	0.803***	0.664***	0.639***
	(0.094)	(0.094)	(0.069)	(0.084)	(0.124)
First Stage Effect. F-Stat	90.48	87.30	123.15	53.55	23.10
Observations	2,926	2,926	2,926	2,926	1,743
			B. Reduced-Form Regressions		
Δ_{ij} Coefficient of Inbreeding	-0.036***	-0.036***	-0.035***	-0.025***	-0.024***
	(0.005)	(0.005)	(0.004)	(0.003)	(0.005)
R^2	0.13	0.15	0.62	0.72	0.81
Observations	2,926	2,926	2,925	2,888	1,678
Fixed Effects					
State	✓	✓	✓	✓	✓
State-pair		✓	✓	✓	✓
Ruler			✓	✓	✓
state-pair × Century				✓	✓

Note: The table shows results from ruler-pair regressions. For each ruler, we compute the pair-wise difference in their ability, their coefficient of inbreeding, and the performance of their state relative to all concurrently ruling monarchs. Columns 1-4 include, for each ruler, all rulers of other states that overlapped for at least one year in their reign. Column 5 keeps for each ruler only the one ruler from all other states that he or she shared the largest temporal overlap in their reigns with. Section 4.5 provides further detail. The table reports the first-stage effective F-statistic from the Montiel Olea and Pflueger (2013) robust weak instrument test; the corresponding critical value for max. 10% relative bias is 16.4. All regressions are run at the reign-pair level. Standard errors, clustered at the state-pair level, in parentheses. * p<0.1, ** p<0.05, *** p<0.01.

Table 8: The Role of Institutional Constraints on Ruler Power

Dependent variable as indicated in table header

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Constraints coding:	—- Authors' Annual Polity IV Coding —-				– Century-Level Parliamentary Activity –			
Dep. Var.	$\Delta log(Area)$		$\Delta log(UrbanPop.)$		$\Delta log(Area)$		$\Delta log(UrbanPop.)$	
Estimation:	OLS	IV	OLS	IV	OLS	IV	OLS	IV
Ruler Ability	0.104***	0.155***	0.095***	0.192***	0.095***	0.182***	0.098***	0.210***
	(0.034)	(0.042)	(0.026)	(0.053)	(0.030)	(0.056)	(0.030)	(0.056)
Constrained Ruler	0.108***	0.054*	0.300***	0.220***	-0.045	-0.113	-0.131***	-0.155
	(0.010)	(0.032)	(0.037)	(0.025)	(0.043)	(0.074)	(0.038)	(0.115)
Constrained Ruler × Ruler Ability	-0.109**	-0.106***	-0.040	-0.139**	-0.076	-0.184*	-0.107**	-0.404***
	(0.038)	(0.035)	(0.031)	(0.059)	(0.042)	(0.094)	(0.036)	(0.156)
State FE	✓	✓	✓	✓	✓	✓	✓	✓
First Stage F-Stat		15.4		13.4		15.4		13.6
R^2	0.10		0.10		0.09		0.09	
Observations	295	200	286	195	269	202	263	197

Note: The table shows that the effect of ruler ability on the performance of their states was muted when their executive power was constrained. In columns 1-4, the dummy *Constrained Ruler* indicates "substantial limitations" on ruler power, as by our own reign-level coding based on the Polity IV scale (see Section 5 and Appendix E for detail). In columns 5-8 we define a monarch to be constrained if the state was above the 90th percentile of the (century-level) measure of parliamentary activity from Van Zanden et al. (2012). All regressions are run at the reign level. Standard errors clustered at the state level in parentheses. * p<0.1, ** p<0.05, *** p<0.01.

Online Appendix

History's Masters
The Effect of European Monarchs on State Performance

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A Data: Coverage, Validation, and Detail

This appendix provides background on the coverage of our dataset, the coding of variables, and summary statistics.

A.1 Detail: Dataset and Variables

Dataset

Our main dataset is based on a list of reigns for 13 states.[1] Woods (1913) provides tables on pages 305-403, listing – for each reign – the time period, the name of the ruler (or a description of the status when no monarch reigned, such as for interregna, regencies, or Republican government, e.g. in the Netherlands), an assessment of the rulers' ability, as well as the performance of the state during this reign. Ruler ability and state performance are coded categorically ranging from "-" to "+." For the few cases where more than one ruler appears, we focus on the ruler whose coding works against our baseline results.[2]

Sample Coverage

Table A.1 provides detail on the sample size. In total, 366 reigns are recorded by Woods (1913). For 353 of these, Woods was able to assess state performance. The others are either very short reigns or Woods was not able to make a definitive assessment based on scarce sources. Figure A.1 provides a timeline for all states in our main sample. The earliest state to enter our sample is France (in 990, when Hugh Capet founded the Capetian dynasty), and the last state to enter is Sweden, after it split from Denmark in 1623 under Gustavus Vasa to become a separate political entity.

[1] States enter the dataset when the ruler first mentioned by Woods appears. States can consist of former states listed, as is the case with Sweden, which emerges as a separate state once it split from Denmark. Likewise, states can exit our dataset when they are taken over by other states. In our dataset, Castile becomes part of Aragon (referred to as "Spain" in Woods (1913)), and Scotland becomes part of England. [++fix parentheses – not sure what you want here++ SO: done]

[2] For instance, for Ferdinand and Isabella, who jointly and successfully (as assessed by Woods) ruled over the Habsburg Empire from 1479 to 1504, we focus on Isabella, who had a higher coefficient of inbreeding than her husband.

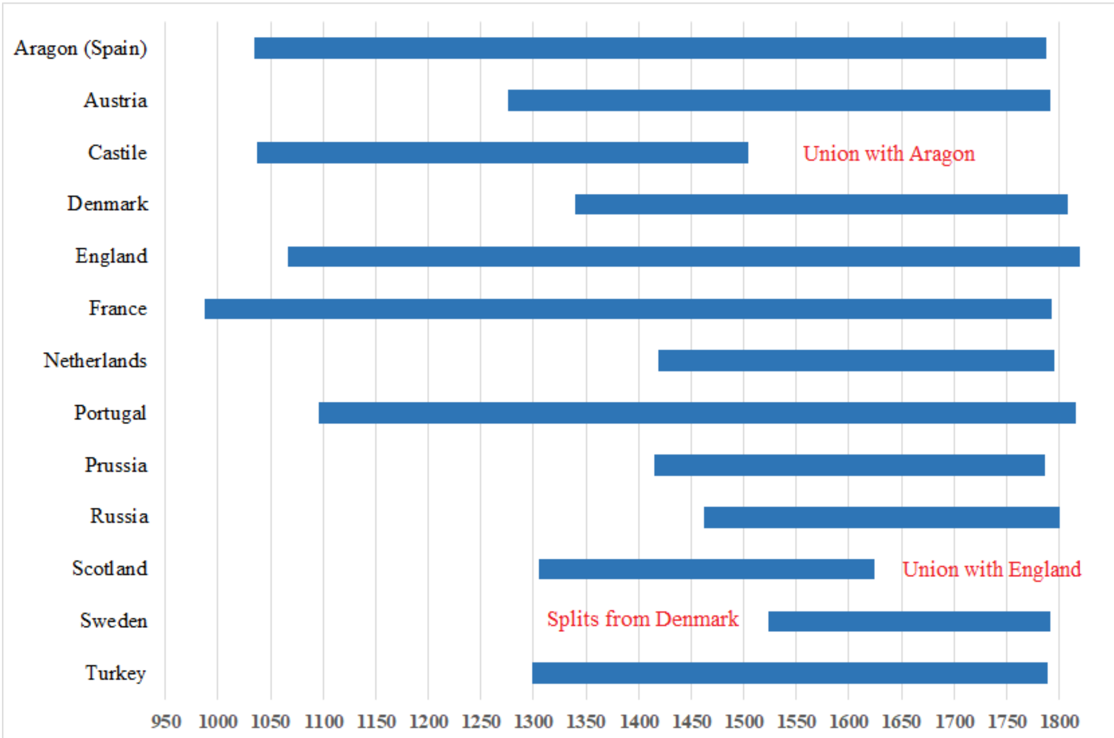

Figure A.1: Timeline of Sample Coverage: States in Sample

Note: The figure shows the states in our sample together with the time period over which they are covered.

For 341 reigns, Woods assessed the ability of the ruler. He was unable to do so for instances where rule was short or for episodes of Republican government in the Netherlands. Our alternative measures of state performance based on territorial changes and the change in urban population within the state are available for 317 and 307 reigns, respectively.[3] In total, both our main explanatory and outcome variable – *Ruler Ability* and *State Performance* assessed by Woods – are available for 336 reigns. Only 235 of these were reigns with an individual in power who is also listed in our genealogical data source, so that we have information on the coefficient of inbreeding.

Additional Variables

In addition to the variables described in Section 3 of the paper, we code other characteristics of rulers and reigns whenever this information is available. We collect this information from the English-language Wikipedia, but amend it whenever required by information from the corresponding national language Wikipedia.

[3]Most of the reduction in sample size is explained by the fact that the data in Abramson (2017) only ranges from 1100 to 1790, so that we do not have areas at the beginning or the end of some reigns, or both. In a few other cases, Woods' list starts while the political entity is not yet de facto politically independent and therefore not covered by Abramson (2017), as for instance for the early years of the Netherlands.

Table A.1: Sample

Sample	Obs.
All reigns	366
Reigns with assessed *State Performance*	353
Reigns with assessed *Ruler Ability*	341
Reigns with information on border changes	317
Reigns with information on urban population	307
Both: *Ruler Ability* & *State Performance*	336
Both + individuals (gender assigned)	312
Both + coefficient of inbreeding (F)	235
Both: *Ruler Ability* & border changes	298
Both + coefficient of inbreeding (F)	203
Both: *Ruler Ability* & urban population	289
Both + coefficient of inbreeding (F)	198

Note: This table provides details on our baseline sample size for the three outcome variables (*State Performance*, territorial changes, and change in urban population during reigns) as well as the main explanatory variable *Ruler Ability* and our instrument – the coefficient of inbreeding of rulers.

Characteristics of Reigns

Dummy: Reign by Regents. For every reign, we identify whether the monarch in power was a regent. To this end, we code a dummy indicating whether the title of the reign/name of the ruler contains the string "minority", "regency", or "regent", and manually verify this. ++ About a fifth of our sample are reigns by regents (cf. Table A.2), which are assessed systematically worse by Woods (cf. Table A.24).++ For instance, while Alfonso V of Portugal (born in 1432) ruled de jure from 1438 to 1481, starting at the age of six, Woods (1913) splits this reign into three, one from 1438 to 1439 where both his mother, Leonor, and his uncle, Peter, ruled. After this failed regency "divided" between both, Peter became the sole regent of Alfonso V's "minority" (second reign in Woods), until the latter became of age in 1449, when his actual reign started (third reign in Woods).

Length of Reign. We calculate the length of each reign by subtracting each reign's start year from the end year. Both are listed in Woods and validated by us. We opt for Woods choice whenever unclear, to ensure that his assessments concern the similar period.

Dummy: Regicide. For every reign in which an identifiable person is in power, we code a variable indicating regicide. This variable indicates whether the person died by execution after a trial or was murdered, and is zero if the person exited office through natural death, an accident, or death in battle. Note that individuals executed or murdered *after* their reign ended are not coded as a regicide.

Personal Characteristics of Rulers

Dummy: Female. We manually assess the gender of the person in power if an identifiable person is in power and define this variable indicating female persons. For all other instances, this indicator is set to missing.

Dummy: Educated as Heir. We assess from biographical accounts for every reign if the person was intended to or educated to be the future heir or ruler. For instance, Albert II (who co-ruled Austria from 1330-1359) initially prepared for an ecclesiastical career and became a bishop early on.[4] Only when his elder brother, Frederick, died did he become (together with his surviving brother) ruler of the Habsburg lands. On the other hand, Albert's son, Rudolph (IV), was – as the oldest son – predetermined to become heir and likely educated as such. We presume that he was considered and brought up as heir in the direct absence of any other indication.

Dummy: Hereditary Succession. For every reign, we construct a variable indicating whether the person became the ruler due to hereditary succession. We code a dummy variable equal to one whenever a monarch is an offspring of the prior monarch in the state considered. We code cases when one sibling succeeds another one similarly as cases of hereditary succession, as was the case of Henry I of England, who came to power after his brother, William II, died.

Age at Ascension. We calculate this variable by subtracting the year of birth (collected from internet encyclopedias by us) from the first year of this persons' reign (as recorded by Woods). We also code a dummy indicating whether a person ascended to power relatively young before the median age of 28 years.

Age at Death. We calculate this variable by subtracting the year of birth from the year of death (both collected from internet encyclopedias by us).

Number of Children. We code this variable by combing the number of all (legitimate and illegitimate) children mentioned on online encyclopedias and surviving beyond five. For instance,

[4] Albert co-ruled with his brother, the "obscure" Otto, which is why we focus on Albert instead when gathering additional variables for this reign.

Charles VII of France (1422 - 1461) had 14 legitimate children, of which nine survived beyond the age of five. Louis (XI), his first-born, became the next King of France, ruling 1461 - 1483. Charles further had three (known) legitimate daughters, with one of his mistresses.

Dummy: Tall. We identify individuals described as “tall” or “very tall” or taller than 1.79 meters (5.87 feet) as tall. The information comes from online encyclopedias. Our choice of cutoff is arbitrary, but inspired by Koepke and Baten (2005), who – estimating the height of Europe for our sample period, – state that ”89.3% of the male observations fall into the range 164-178.9 cm”. We assume a value of zero for all other individuals for which no such descriptions are available. We further standardize this variable.

Physical Appearance. We code physical appearance based on information available in online encyclopedias, and takes the values “-1” for those described as “weak” or in similar terms or “1”, for those described as strong or imposing or along similar lines. We assume a value of zero for all other individuals for which no such descriptions are available. We further standardize this variable.

Summary Statistics

Table A.2 provides summary statistics for the main variable in our analysis and core sample, and Table A.3 does so for other variables used in the analysis describing characteristics of reigns and rulers.

Table A.2: Summary Statistics – Main Outcome and Explanatory Variables

A. Main Outcome Variables

	Mean	SD	Min	Max	N
State Performance	0.03	1.00	-1.30	1.04	336
Δ Log(Area)	0.08	0.43	-1.11	3.48	294
Δ Log(Urb. Pop.)	0.16	0.47	-1.09	3.00	285

B. Main Explanatory Variables

	Mean	SD	Min	Max	N
Ruler Ability	0.00	1.00	-1.14	1.14	336
Coefficient of Inbreeding	3.29	4.10	0.01	25.36	235
Hidden Coefficient of Inbreeding	2.67	2.76	0.01	14.00	235

Note: The table provides summary statistics for the main outcome and explanatory variables. These are for our core sample covered by Woods (1913). Ruler Ability and *State Performance* are standardized.

Table A.3: Summary Statistics – Other Variables

A. Ruler Characteristics						
	Mean	SD	Min	Max	N	Sources & Detail
Dummy: Female	0.12	0.33	0.00	1.00	311	App. A.1
Dummy: Educated as Heir	0.78	0.42	0.00	1.00	141	App. A.1
Dummy: Primogeniture	0.57	0.50	0.00	1.00	274	App. A.1
Age at Ascension	30.33	12.34	0.00	80.00	305	App. A.1
Age at Death	52.35	13.68	16.00	82.00	305	App. A.1
Number of children	5.27	4.19	0.00	21.00	289	App. A.1
Dummy: Tall	0.10	0.30	0.00	1.00	311	App. D.1.2
Physical Appearance	0.03	0.45	-1.00	1.00	311	App. D.1.2
Noncognitive Ability	-0.18	0.87	-1.00	1.00	311	App. D.1.3

B. Reign Characteristics						
	Mean	SD	Min	Max	N	Sources & Detail
Constrained Ruler	0.05	0.23	0.00	1.00	329	Section. 3.4
Length of reign (in years)	18.59	13.63	0.00	60.00	336	App. A.1
Regency	0.22	0.42	0.00	1.00	336	App. A.1
Dummy: Regicide	0.14	0.34	0.00	1.00	200	App. A.1
Conflict: Dummy	0.88	0.33	0.00	1.00	336	App. C.3
Conflict: Share Years at War	0.57	0.36	0.00	1.00	336	App. C.3

Note: The table provides summary statistics for variables of characteristics of rulers and reigns. These are for our core sample covered by Woods (1913). Physical Appearance and Non-cognitive Ability are standardized.

A.2 Validation of Woods' State Performance and Ruler Ability Coding

To check Woods' (1906; 1913) coding of state performance and ruler ability, we asked a research assistant to review the evidence in various encyclopedias and devise own assessments of ruler capability and state performance, using Woods' three-tier scale. Whenever in the text we mention our own assessment, we refer to his. To validate this research assistants' assessments (on which we entirely rely for our analysis for Poland, Hungary, and all reigns after 1800), we asked two other research assistants to assess a randomly selected subset of reigns. In the following we show that the assessments across our research assistants and Woods are highly comparable.

A.2.1 Validation of Woods by Main Research Assistant

The left panel of Figure A.2 provides a binned scatter plot of our main research assistants' assessment of monarch ability with that of Woods (1913). A clear assessment was possible based on online encyclopedias only for 170 rulers. In 97 out of 169 assessed cases, our research assistant reached the same assessment as Woods did, while in 20 they reached the opposite assessment. Those examples for instance include Peter III of Russia. He ruled for less than a year in 1762, and Woods characterized him as "[w]eak, dissolute, violent." However, this characterization has been reversed by historians since the time of Woods (c.f. Palmer, 2005), and is reflected in the assessment of our research assistant. For 53 cases, in 16 cases Woods assigned a grade between -1,0, or 1. Our research assistant was not given this option and hence there cannot be exact agreement for those. Of the remaining 37 cases, 19 are instances where our research assistant assigned the monarch's ability a value 1, while Woods assigned 0. These cases include James IV of England and Leopold I of Hapsburg. Overall, the correlation between our own and Woods' coding is $\rho = 0.52$.

The right panel of Figure A.2 provides a binned scatter plot of our research assistants' assessment of state performance with that of Woods (1913) ($\rho = 0.49$). Of the 234 reigns for which our research assistant was confident in making an assessment, in 124 they completely agreed with Woods' assessment. In 27 instances, they reached the opposite assessment than Woods did; in 18 cases Woods assigned a state performance between the values of 0, 1, and -1. The remaining 83 instances are cases where our research assistant and Woods disagree in their assessment of state performance by a value of one, but not diametrically so.

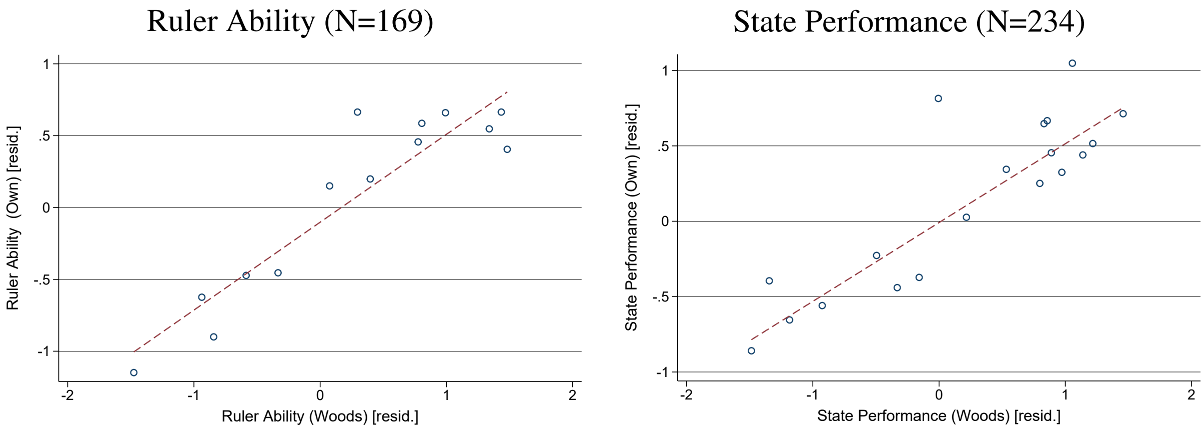

Figure A.2: Validation: Binscatters with state FE

Note: The figure shows our validation of the coding of ruler ability and state performance by Woods (1913). We code these variables during each reign possible from online encyclopedias and assess the association of our assessment with that of Woods. The left binned scatter shows residuals of state fixed effects of this association for ruler ability. The right binned scatter show this association for state performance.

A.2.2 Validation by all three Research Assistants

We asked two additional research assistants to assess state performance and ruler ability for randomly selected subsets of reigns. One of them was asked to review 343 reigns of the extended sample, while a second one reviewed 48 reigns of the core sample. As the tables A.4 and A.5 below provide evidence for, there is a high agreement on the assessment both between our research assistants, as well as between each of them and Woods.

Table A.4: Correlations of Ruler Ability Assessments

Variables	Woods	Own (Main)	Own (RA 1)	Own (RA 2)
Woods	1.00			
Nb. Obs.				
Own (Main)	0.53	1.00		
Nb. Obs.	170			
Own (RA 1)	0.50	0.53	1.00	
Nb. Obs.	228	195		
Own (RA 2)	0.44	0.69	0.63	1.00
Nb. Obs.	48	30	32	

Table A.5: Correlations of State Performance Assessments

Variables	Woods	Own (Main)	Own (RA 1)	Own (RA 2)
Woods	1.00			
Nb. Obs.				
Own (Main)	0.50	1.00		
Nb. Obs.	234			
Own (RA 1)	0.52	0.56	1.00	
Nb. Obs.	237	253		
Own (RA 2)	0.60	0.63	0.72	1.00
Nb. Obs.	48	41	32	

A.3 Territorial Changes: Details and Example

++Here we briefly discuss how we link state borders data to reigns and provide an example of an area change during a reign.

The state borders provided by Abramson (2017) are available at five year intervals only, while reigns in Woods (1913) start and end at any year. We link the end year of each reign to the subsequent five-year observation, and start dates to the preceding five-year observation. For reigns shorter than five years, we check historical sources to confirm that the implied territorial changes indeed occurred during the respective reigns. For the 19 reigns lasting shorter than two years, we find 3 instances in which our approach leads to erroneous percentage changes in area, and for the 41 reigns lasting between three and five years, we find eight such instances. Excluding these or assigning the approximated percentage changes assessed by us leaves our results unaffected.++

Figure A.3 provides an example for territorial change. It shows the change in land area of Habsburg Austria under Queen Maria Theresa (1740-1780). Austria lost territories (depicted in red) in Silesia to Prussia, but it gained areas from Poland (in green). Overall, Austria increased its area by 7%.

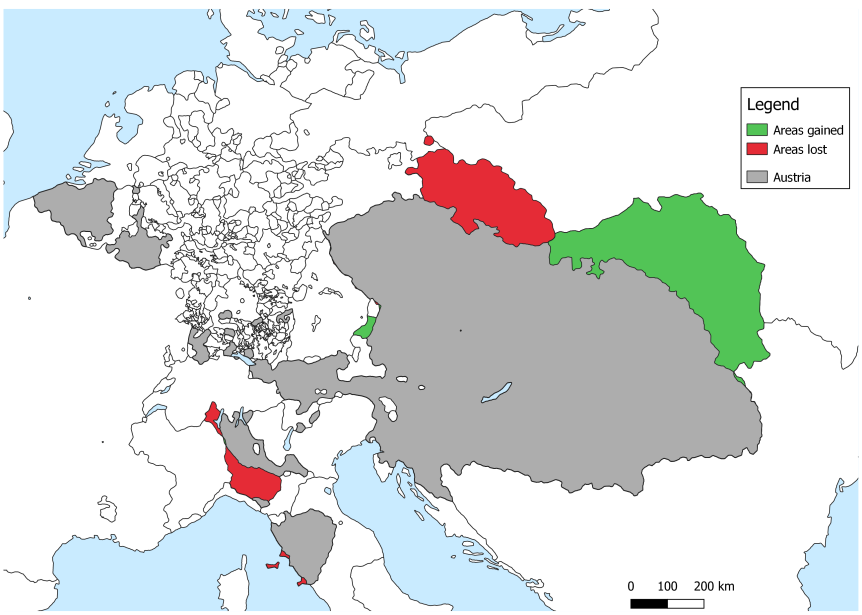

Figure A.3: Austria's Territorial Changes During the Reign of Maria Theresa

Note: The figure shows the change in land area under the control of the Austrian Habsburg from the beginning to the end of Queen Maria Theresa's reign from 1740 to 1780. The data on state borders is from Abramson (2017), and we calculate net gains of 7% during the reign of Maria Theresa.

A.4 Extended Sample: Coding

In this Appendix, we extend Woods's original sample temporally until WWI and spatially to include Poland and Hungary. To do so – similar as in our validation in Appendix section A.2 – we asked a research assistant to assess the capability of rulers from all of the states covered by Woods reigning after Napoleon until World War I (or until the last monarch available or ruling until the start of World War I – for instance, the list of monarchs of France ends with Napoleon III, who ruled from 1852 to 1870).[5] In extending the time periods of the states coded by Woods, we assess ruler ability and state performance for 38 additional reigns, for 29 of which we are able to also obtain coefficients of inbreeding from http://roglo.eu/. In addition, we add Poland and Hungary to the dataset. Both reigns were not coded by Woods, but sufficient historical information is available for comprehensive coding. Adding Poland and Hungary (until World War I) adds 63 additional reigns, with 40 also having information on the coefficient of inbreeding.

A.5 Data and Background on Coefficient of Inbreeding

The coefficient of inbreeding measures the degree of similarity in the genes of offspring due to common ancestors, and was developed by Wright (1921). It is the probability that both gene copies at any locus in an individual are identical by descent, i.e. from a common ancestor (Rédei, 2008), and is defined as follows:

$$F = \sum_{paths} (0.5)^n (1 + FA)$$

where F is the coefficient of inbreeding, $paths$ is each path through which an individual can derive identical alleles from a common ancestors of both parents, n is the number of individuals in the paths (excluding the individual itself), and $1 + FA$ is a correction factor for the inbreeding coefficient of the common ancestor in the path. The 0.5 component comes from the fact that each individual has 0.5 chance to pass on a particular allele to offspring.

Figure A.4 provides an illustrative example of the calculation of the inbreeding coefficient. A is the offspring of B and another individual. Let us assume that the parents of individual A are unrelated, so that we do not have to apply a correction factor for the common ancestor B. Lines signify blood relationship. If A were to mate with B, the offspring I would be inbred. To calculate the coefficient of inbreeding, we first note that only one common ancestor exists, B, and only one path. In this path, there are two individuals which are not I, A and B. Hence $F(I) = 0.5^2 = 0.25$. Were B inbred as well, we would have to adjust for that "ancestral" degree of inbreeding (FA)of B.

Rulers with Particularly High Coefficient of Inbreeding

Table A.6 shows the reigns with the highest coefficient of inbreeding in our sample.

[5] In terms of procedure, we compiled a list of monarchs and asked research assistants to assess the capability of rulers and the performance of their states on the same three-point scale as Woods (1913), using Woods' original sources as well as modern encyclopedias.

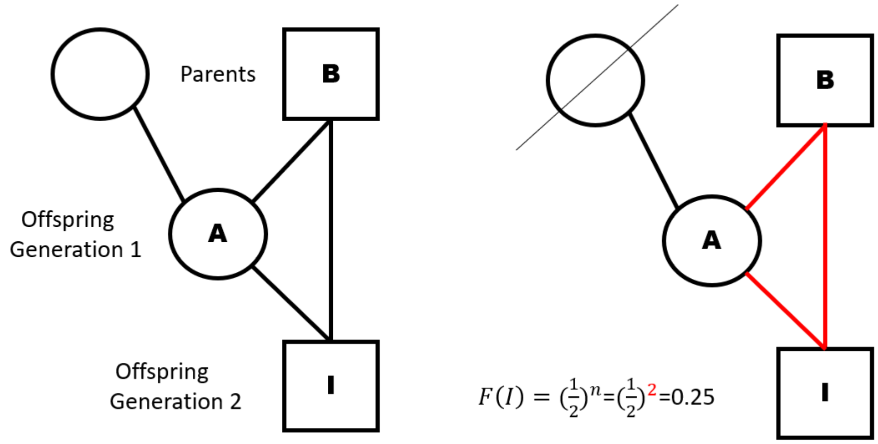

Figure A.4: Example Calculation of Inbreeding Coefficient

Note: The figures show the calculation of the coefficient of inbreeding for an parent-child offspring. Exactly one path through a common ancestor (B) of length $n = 2$ exists.

Table A.6: Rulers with the Highest Coefficient of Inbreeding

State	Ruler	Reign span	*Ruler Ability*	*State Performance*	Coefficient of inbreeding
Aragon	Charles ll	1679 - 1700	-1	-1	25.36
Aragon	Philip lll	1598 - 1621	-1	-1	21.26
Portugal	Philip lll of Spain	1598 - 1621	-1	-1	21.26
Portugal	Sebastian	1568 - 1578	-1	-1	20.25
Castile	Peter the Cruel	1350 - 1369	0	0	15.78
Aragon	Mary Anne (Regent for Charles II)	1665 - 1679	-1	-1	15.65
Austria	Leopold l	1657 - 1705	0	1	15.65
Austria	Ferdinand ll	1619 - 1637	0	-0.5	14.05
Austria	Ferdinand lll	1637 - 1657	0	0	12.07
Portugal	Philip ll of Spain	1580 - 1598	0.5	-1	11.45
Aragon	Philip ll	1556 - 1598	0.5	0.5	11.45
Aragon	Philip IV	1621 - 1665	-0.5	-1	11.32
France	Anne of Austria (Regent for Louis XIV)	1643 - 1661	0	0	11.32
Portugal	Philip IV of Spain	1621 - 1640	-1	-1	11.32
Sweden	Adolphus Frederick	1751 - 1771	-0.5	-1	10.4

Note: This table shows the 15 reigns in which the ruler had the highest coefficient of inbreeding (F) in our dataset. Assessments of *State Performance* and *Ruler Ability* come from Woods (1913). The coefficient of inbreeding is calculated using http://roglo.eu/.

Correlates of Inbreeding

Table A.7 shows the results of OLS regressions of the coefficient of inbreeding on various characteristics of reigns. Column 1 shows our first stage result: More inbred rulers are assessed as less cognitive capable rulers by Woods (1913). Column 2 shows that more inbred rulers are also assessed worse by us in terms of their non-cognitive ability. The following two columns document that this is not driven by inbred rulers having shorter tenures or ascending to the throne at younger ages. Inbred rulers are less likely to serve as regents for other rulers. They are no more likely to die while in office, die younger in general, or have less offspring. Similarly, we find no evidence that inbred rulers were more likely to be tall or to have a strong physical appearance. However, if the prior ruler was killed while in office, the next ruler tends to have a significantly lower level of inbreeding, in line with the idea of new dynasties coming to power.

Table A.7: Results: Correlates of Inbreeding

Dependent variable as indicated in table header

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Dep. var.:	(Cognitive) Ruler Ability	Non-cognitive Ability	Length of Reign	Age at Ascension	Regency	Regicide†	Age at Death	Number of Children	Tall‡	Physical Appearance§
Coefficient of Inbreeding	-0.076***	-0.066***	0.253	-0.122	-0.005	-0.007**	0.088	-0.097	0.002	-0.008
	(0.012)	(0.018)	(0.184)	(0.128)	(0.004)	(0.003)	(0.263)	(0.060)	(0.005)	(0.033)
State FE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
R^2	0.15	0.12	0.06	0.04	0.08	0.06	0.08	0.04	0.13	0.05
Observations	240	256	256	256	256	149	256	243	256	256

Note: All regressions are run at the reign level. Table shows results from regressions of reign or ruler characteristics on the ruler's coefficient of inbreeding, and include state fixed effects. Standard errors clustered at the state level. * p<0.1, ** p<0.05, *** p<0.01.

† Dummy indicating whether the *prior* ruler was executed after a trial of murdered.

‡ "Tall" is dummy indicating that ruler was described as "tall," "very tall," or had a recorded height of over 179 cm. Missing values are recorded as zeros.

§ "Physical Appearance" is a dummy indicating whether monarch was described as physically "weak" (-1) or "strong" (1). Missing values are recorded as zeros.

A.6 Details on Calculation of Hidden Component of Inbreeding

In our main analysis, the instrument is the coefficient of inbreeding, F. As is evident from the discussion in A.5 and the pedigree of Carlos II (Figure 1), high values of F need not necessarily imply very closely related parents. Instead, relationship links in temporal distance from the parents of an individual can build up over time, and account for a sizable share of the observed coefficient of inbreeding. Consider Carlos II again. With $F = 25.36$, he is the monarch with the highest coefficient of inbreeding in our dataset. Yet, his parents were 'merely' uncle and niece, with most of the similarity in genes actually coming from a multitude of pathways through many distant common ancestor. The 'naive' coefficient of inbreeding of Carlos, based on his parents being uncle-niece, would be $F = 12.5$, implying that more than half of the observed F of Carlos would require knowledge of relationship links beyond that of his grandparents. We calculate a hidden component of the coefficient of inbreeding by subtracting the coefficient of inbreeding implied by the closest relationship link between a rulers' parents indicated on *roglo.com*:

$$F(hidden) = F - F(naive)$$

where $F(naive)$ is 12.5 for monarchs whose parents were uncle and nieces (4 monarchs in total), and 6.25 for the (17) monarchs whose parents were (first) cousins. In the remainder we only use the hidden component as instrument for ruler ability. For Carlos, this would amount to $F(hidden) = 12.86$. Thereby, we isolate the component of the inbreeding coefficient that could be anticipated even without the advanced knowledge of calculating inbreeding coefficients and the intricate details of pedigrees.

B Additional Empirical Results

This appendix provides additional empirical results and robustness checks.

B.1 Baseline Results Using Author's Coding for Woods' Reigns

In Table A.8 we compare our baseline regressions using Woods' (1913) assessment and our own coding (as described in Appendix A.2). Column 1 repeats the baseline OLS regression (corresponding to Table 1, col 2 in the paper). Columns 2 uses our own coding of *State Performance*, combined with Woods' coding of ruler ability. Column 3 flips this specification, using Woods' coding of *State Performance* and our own coding of ruler ability. Finally, in column 4 we use our own assessments of both *State Performance* and ruler ability. For all checks in columns 2-4 we document a smaller but still sizable and highly significant association.

Table A.8: OLS Results Based on Woods' and Authors' Coding

Dep. Var.: *State Performance*

	(1)	(2)	(3)	(4)
Coding of *State Performance*:	Woods	Own	Woods	Own
Coding of *Ruler Ability*:	Woods		Own	
Ruler Ability	0.618***	0.422***	0.395***	0.461***
	(0.050)	(0.068)	(0.064)	(0.076)
State FE	✓	✓	✓	✓
R^2	0.41	0.22	0.24	0.25
Observations	336	224	176	159

Note: *State Performance* is a comprehensive measure that was originally coded by Woods (1913). Columns 2 and 4 use the authors' own coding of state performance on the same scale. Similarly, the coding of ruler ability is based on Woods (1913) in cols 1 and 2, and based on the authors' assessment in cols 3 and 4. See Appendix A.2 for detail on the coding. All regressions are run at the reign level. Robust standard errors in parentheses. * p<0.1, ** p<0.05, *** p<0.01.

B.2 Alternative Specifications, Conservative Coding, and Clustering

In this Appendix section, we presents various robustness checks for different specification, for a conservative coding of ruler ability and state performance, and for different levels of clustering standard errors.

In Table A.9 we restrict attention to selected variable values as coded by Woods (1913). Specifically, in column 1 we exclude all reigns that do not indicate a clearly good or bad state performance. Excluding intermediate cases, the point estimate increases considerably. Column 2 focuses only on reigns of clearly capable or incapable rulers (i.e., a 1 or -1 coding), resulting in a point estimate that is very similar to the full sample. Column 3 restricts attention to cases where both ruler ability and state performance are required to be clearly good or clearly bad. In column 4, we exclude any reign where either variable takes the middling values of 0.5 or -0.5, and again find a very similar coefficient. For column 5, we recode all those middling values to work *against* a positive association between ruler ability and state performance.[6] Still, the coefficient remains sizable and significant.

Table A.9: Robustness: Different modifications of Woods' Coding

Dep. Var.: *State Performance*

	(1)	(2)	(3)	(4)	(5)
Note:	"+" or "-" State	"+" or "-" Ruler	"+" or "-" Both	"+", "0", or "-" Both	Recoded Conservatively §
Ruler Ability	0.768***	0.631***	0.770***	0.659***	0.498***
	(0.047)	(0.051)	(0.050)	(0.047)	(0.057)
State FE	✓	✓	✓	✓	✓
R^2	0.51	0.49	0.59	0.47	0.30
Observations	245	249	204	282	336

Note: This table documents robustness of our baseline regression to the measurement of ruler ability and state performance. *State Performance* is a comprehensive measure based on the coding by Woods (1913). Column 1-3 use Woods' coding and exclude all reigns that are not rated as either clearly bad (-1) or clearly good (1). Column 4 excludes all reigns that are not rated as either clearly bad (-1), clearly good (1) or mediocre (0). All regressions are run at the reign level. Standard errors clustered at the state level. * p<0.1, ** p<0.05, *** p<0.01.
§ Recode all variables that are not either clearly bad (-1), clearly good (1) or mediocre (0), such that they work against the positive association of state performance and ruler ability. We recode 36 ruler abilities and 24 state performances.

Table A.10 presents further robustness checks with a focus on alternative specifications. Column 1 uses as outcome variable a dummy indicating that state performance was good, instead of using a continuous variable ranging from bad ("-1") to good ("1"). Column 2 retains this dummy outcome variable and furthermore uses dummies for each possible value of the independent variable, ruler ability, instead of a continuous version thereof. The coefficients are as one would expect. Incapable rulers are negatively associated with good state performance, while capable rulers show a positive coefficient. The middling values of ruler ability are imprecisely estimated, while the rulers that were not clearly good or bad ("0") are the omitted base level. Column 3 does justice to the categorical nature of the *Ruler Ability* variable, by estimating an ordered probit regression. As in column 2, the individual coefficients are sensible and statistically highly significant for the 'good' and 'bad' ruler categories (still using neutral ruler ability ("0") as excluded category).

[6]To do so, we reassign all the middling values of 0.5 or -0.5, where Woods was unsure to either of the closest value of 0,1, or -1. For this we consider the other variable and recode the variable to work against a positive association between both. For instance, if the ruler was coded as having low ability (-1), and the performance of the state as middling between 0 and 1, we recode state performance in this case to 1.

Table A.10: Robustness: Specification

Dependent variable as indicated in table header

Dep. Var.:	Dummy Performance‡		*State Performance*
	(1)	(2)	(3)
Estimation:	OLS	OLS	Ordered Probit
Ruler Ability	0.520***		
	(0.067)		
Ruler Quality = -1		-0.147**	-0.945***
		(0.063)	(0.159)
Ruler Quality = -0.5		-0.010	-0.535*
		(0.154)	(0.276)
Ruler Quality = 0.5		0.101	0.011
		(0.150)	(0.285)
Ruler Quality = 1		0.488***	1.111***
		(0.082)	(0.182)
State FE	✓	✓	✓
R^2	0.29	0.33	
Observations	336	336	336

Note: This table documents robustness of our baseline regression to using dummy variables and probit estimation. *State Performance* is a comprehensive measure based on the coding by Woods (1913). All regressions are run at the reign level. Clustered standard errors (state) in parentheses. * p<0.1, ** p<0.05, *** p<0.01. ‡ Dummy variables that takes on value 1 if Woods coded performance of state as "good," and that takes on value zero otherwise.

Table A.11 includes further fixed effects to our estimation and provides robustness to clustering standard errors at alternative levels. In column 1 we cluster standard errors at the state level as in our baseline specification. Given the small number of clusters, we also employ the small-cluster bootstrapping technique by Roodman, Nielsen, MacKinnon, and Webb (2019). This goes back to Cameron, Gelbach, and Miller (2008), who recommend to use cluster bootstrap-based procedures to provide asymptotic refinement to the standard test of significance (which is based on an asymptotic approximation). We report the wild bootstrap p-values in brackets below the standard errors, confirming the high level of statistical significance. In column 2, we cluster at the state, dynasty, and century level, effectively reducing variation to monarchs hailing from a dynasty. Again, size and significance of the main coefficient of interest is barely affected. Lastly, in column 3 we include fixed effects at all these levels, which further increases the size of the main coefficient.

Table A.11: Robustness: Clustering and FE

Dep. Var.: *State Performance*

	(1)	(2)	(3)
Cluster Level	State	State, Dynasty, Century	State, Dynasty, Century
Ruler Ability	0.618***	0.653***	0.684***
	(0.050)	(0.050)	(0.073)
	[0.0000]	[0.0015]	[0.0021]
State FE	✓	✓	✓
Century FE			✓
Dynasty FE			✓
R^2	0.41	0.45	0.60
Observations	336	290	290

Note: *State Performance* is a comprehensive measure based on the coding by Woods (1913). All regressions are run at the reign level. Wild bootstrapped p-value in brackets, following Roodman et al. (2019) to account for the relatively small number of clusters. * p<0.1, ** p<0.05, *** p<0.01.

B.3 Baseline Results by State and Time Period

Table A.12 shows how our baseline results varies by state. We interact state fixed effects with ruler ability and show these coefficients in Column 1. Column 2 further splits England into two separate entities, one before 1600 and one after 1600, and depicts coefficients for both. Only for England before 1600 do we find a sizable and significant association between ruler ability and state performance. This is visualized in Figure A.5. Columns 3 and 4 in Table A.12 probe the robustness of these coefficients by including century and dynasty fixed effects. Their inclusion renders the coefficients of Russia and Denmark smaller, and those of England and Sweden larger, but overall, our results are robust.

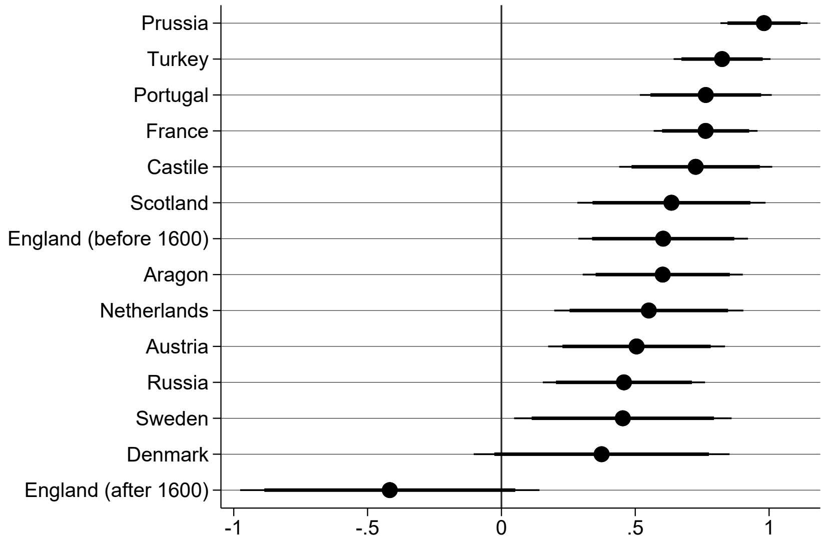

Figure A.5: Baseline OLS Results by State - England Before and After 1600

Note: The figure visualizes the estimation from column 2 in Table A.12, showing coefficients of each state and 90% confidence intervals. England is split into two separate observations, one including all reigns before 1600, and a second one including all those after 1600.

Table A.13 shows how our baseline result varies over time. Column 1 shows the coefficients of interactions of ruler ability and a dummy indicating whether the majority of a reign was before 1500, and one indicating that the majority of the reign lay in the years after 1500. Column 2 instead shows coefficients of interactions of ruler ability with a dummy indicating that the reign started in a specific time period. Lastly, column 3 shows the coefficients of interactions of ruler ability with an indicator for each century. This indicator take on value 1 whenever the majority of a reign lay in a specific century. Throughout, we document slightly smaller associations between ruler ability and state performance in later years.

B.4 OLS and IV Results in the Extended Sample

Table A.14 presents our OLS and IV results for the extended sample for our main outcome variable *State Performance*. The corresponding coding is described in Appendix A.4. Columns 1-3 show OLS estimates, columns 4 to 6 first-stage estimates, and columns 7-9 second-stage results. For comparison, columns 1, 4, and 7 repeat our results from the baseline sample. Columns 2, 5, and 8 use the sample of all states coded by Woods (1913), extended by our coding until the last monarch available or ruling until the start of World War I in 1914. The correlation between ruler ability and state performance is slightly smaller in this extended sample, as is evident from column 2. In light of our results in Section 5 in the paper, this decrease in coefficient size might reflect the increase

Table A.12: Baseline By State

Dep. Var.: *State Performance*	(1)	(2)	(3)	(4)
Aragon	0.603***	0.603***	0.456***	0.442***
	(0.000)	(0.000)	(0.048)	(0.054)
Austria	0.505***	0.505***	0.511***	0.525***
	(0.000)	(0.000)	(0.000)	(0.040)
Castile	0.726***	0.726***	0.789***	0.765***
	(0.000)	(0.000)	(0.027)	(0.041)
Denmark	0.374***	0.374***	0.242***	0.247***
	(0.000)	(0.000)	(0.000)	(0.049)
England	0.356***		0.559***	0.564***
	(0.000)		(0.043)	(0.060)
England (before 1600)		0.604***		
		(0.000)		
England (after 1600)		-0.417***		
		(0.000)		
France	0.763***	0.763***	0.765***	0.772***
	(0.000)	(0.000)	(0.003)	(0.051)
Netherlands	0.551***	0.551***	0.548***	0.570***
	(0.000)	(0.000)	(0.081)	(0.127)
Portugal	0.763***	0.763***	0.698***	0.713***
	(0.000)	(0.000)	(0.014)	(0.014)
Prussia	0.981***	0.981***	0.981***	1.001***
	(0.000)	(0.000)	(0.000)	(0.029)
Russia	0.458***	0.458***	0.202***	0.199***
	(0.000)	(0.000)	(0.000)	(0.014)
Scotland	0.635***	0.635***	0.638***	0.627***
	(0.000)	(0.000)	(0.032)	(0.054)
Sweden	0.454***	0.454***	0.964***	0.934***
	(0.000)	(0.000)	(0.000)	(0.058)
Turkey	0.824***	0.824***	0.864***	0.920***
	(0.000)	(0.000)	(0.000)	(0.050)
State FE	✓	✓	✓	✓
Century FE				✓
Dynasty FE			✓	✓
R^2	0.43	0.45	0.57	0.58
Observations	336	336	336	336

Note: This table documents the relationship between ruler ability and state performance by state. *State Performance* is a comprehensive measure based on the coding by Woods (1913). In column 1 we interact the baseline regression with a dummy for each state in the sample. Column 2 splits England into two observations, one for all reigns before 1600 and one for all those after 1600. All regressions are run at the reign level. Standard errors are robust. * p<0.1, ** p<0.05, *** p<0.01.

Table A.13: Baseline By Time Period

Dep. Var.: *State Performance*

	(1)	(2)	(3)
pre1500			
post1500			
990-1340		0.710***	
		(0.071)	
1340-1500		0.694***	
		(0.101)	
1500-1660		0.606***	
		(0.066)	
1660-1790		0.441***	
		(0.130)	
10th century			0.939***
			(0.135)
11th century			0.702***
			(0.152)
12th century			0.493*
			(0.265)
13th century			0.873***
			(0.072)
14th century			0.634***
			(0.134)
15th century			0.576***
			(0.091)
16th century			0.519***
			(0.133)
17th century			0.507***
			(0.135)
State FE	✓	✓	✓
R^2	0.41	0.42	0.42
Observations	336	336	336

Note: This tables documents the relationship between ruler ability and state performance by broad time period. *State Performance* is a comprehensive measure based on the coding by Woods (1913). In column 1 we interact the baseline regression with a dummies indicating whether the reign began before or ater 1500. Column 2 shows coefficients of interactions with broader time periods, and column three shows the coefficient by century. All regressions are run at the reign level. Standard errors clustered at the state level. * p<0.1, ** p<0.05, *** p<0.01.

of executive constraints during this later time period. The first stage (col 5) is marginally weaker, while the second stage is actually somewhat stronger (col 8). A very similar picture emerges when we also add Poland(-Lithuania) and Hungary in columns 3, 6, and 9, respectively.

Table A.14: OLS and IV Results in the Extended Sample

Dep. Var.: *State Performance*

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Specification:	OLS			First Stage			Second Stage		
Sample:	Woods	+ until WWI	+ PL, HU	Woods	+ until WWI	+ PL, HU	Woods	+ until WWI	+ PL, HU
Ruler Ability	0.618***	0.532***	0.554***				0.794***	0.903***	0.933***
	(0.050)	(0.044)	(0.042)				(0.148)	(0.098)	(0.096)
Coefficient of Inbreeding				-0.076***	-0.053***	-0.056***			
				(0.011)	(0.010)	(0.010)			
R^2	0.41	0.34	0.34	0.15	0.11	0.12	0.39	0.23	0.23
Observations	336	374	437	240	271	317	235	264	304

Note: This table shows OLS, first-stage and second-stage results for our baseline sample based on the coding by Woods (1913) in columns 1, 4, and 7, and when extending this sample until World War I (columns 2, 5, and 8), as well further including Poland and Hungary (columns 4, 6, and 9). *State Performance* is a comprehensive measure based on the coding by Woods (1913). All regressions are run at the reign level. Standard errors clustered at the state level. * p<0.1, ** p<0.05, *** p<0.01.

B.5 Ruler-Pair Regressions for Territorial Changes and Urban Population

Table A.15 presents the ruler-pair regressions explained in Section 4.5 in the paper, using the change in territory (cols 1 and 2) and in urban population (cols 3 and 4) as outcome variables. The table shows OLS results in Panel A, followed by First Stage regressions, IV results, and the reduced form in Panels B-D.

Table A.15: Ruler-Pair Regressions: Territory and Urbanization

Dependent variable as indicated in table header

	(1)	(2)	(3)	(4)
Dep. Var. :	Δ_{ij} Change in Area		Δ_{ij} Change in Urban Pop.	
		A. OLS		
Δ_{ij} Ruler Ability	0.231***	0.177***	0.205***	0.159***
	(0.020)	(0.022)	(0.018)	(0.022)
R^2	0.14	0.72	0.11	0.67
Observations	4,668	4,651	4,296	4,263
		B. First Stage Regressions		
Δ_{ij} Coefficient of Inbreeding	-0.040***	-0.025***	-0.040***	-0.025***
	(0.005)	(0.005)	(0.005)	(0.005)
R^2	0.15	0.71	0.15	0.71
Observations	2,364	2,329	2,364	2,329
		C. Second Stage Regressions		
Δ_{ij} Ruler Ability	0.214**	0.468***	0.264***	0.310*
	(0.101)	(0.175)	(0.096)	(0.186)
First Stage Effect. F-Stat	73.29	25.45	65.53	21.76
Observations	2,364	2,364	2,200	2,200
		D. Reduced-Form Regressions		
Δ_{ij} Coefficient of Inbreeding	-0.009**	-0.012***	-0.010***	-0.008*
	(0.004)	(0.003)	(0.004)	(0.004)
R^2	0.14	0.68	0.10	0.69
Observations	2,364	2,329	2,200	2,156
Fixed Effects				
State FEs	✓	✓	✓	✓
Additional FE‡		✓		✓

Note: This table shows results from ruler-pair regressions for the outcome variables territorial change and change in urban population. For each ruler, we compute the pair-wise difference in their ability, their coefficient of inbreeding, and the respective outcome variables, to all concurrently ruling monarchs. We compare each ruler to all rulers of other states that overlapped for at least a year in their reign. All regressions are run at the reign-pair level. The table reports the first-stage effective F-statistic from the Montiel Olea and Pflueger (2013) robust weak instrument test; the corresponding critical value for max. 10% relative bias is 16.4. Standard errors, clustered at the state-pair level, in parentheses. * p<0.1, ** p<0.05, *** p<0.01.

‡ Additional fixed effects include state-pair FE, ruler FE, and state-pair × century FE.

B.6 IV Results for Hereditary Succession Sample

Table A.16 presents Second Stage results for the sample of ruler that come power due to hereditary succession.

Table A.16: IV Results – Hereditary Succession Sample

Dependent variable as indicated in table header

	(1)	(2)	(3)
Dep. Var. :	*State Performance*	$\Delta log(Area)$	$\Delta log(UrbPop)$
Ruler Ability	0.848***	0.155***	0.148**
	(0.139)	(0.053)	(0.073)
State FE	✓	✓	✓
First Stage Effect. F-Stat	26.4	16.6	15.7
Observations	191	164	162

Note: This table shows the results of second-stage regressions for our three outcome variables for the sample of reigns where the monarch ascended to the throne by hereditary succession. The instrument, the coefficient of inbreeding, measures the increased risk of genetic disorders resulting from the consanguinity of the monarch's parents. Column 1 uses the assessment of political and economic conditions during each monarch's reign from Woods (1913) as measure of state performance, column 2 uses the change in land area during each monarch's reign, calculated from Abramson (2017), and column 3 uses the change in the urban population of the state during each monarchs reign. The table reports the first-stage effective F-statistic from the Montiel Olea and Pflueger (2013) robust weak instrument test; the corresponding critical value for max. 10% relative bias is 16.4. All regressions are run at the reign level and include state fixed effects. Standard errors clustered at the state level in parentheses. * p<0.1, ** p<0.05, *** p<0.01.

C Potential Threats to the Exclusion Restriction: Additional Results

In this appendix, we provide additional results that complement our discussion of potential concerns with our identification strategy. We address a variety of possible alternative mechanisms related to path dependence in state performance, strategic marriage (inside or outside of the kin network), or conflict.

C.1 Past State Performance and (Strategic) Kin Marriage

It would constitute a threat to our exclusion restriction if royals married kin when state performance was low, leading to a higher coefficient of inbreeding in the following generation, *and* if past low state performance reduced performance during the reign of their offspring.

As we document in Panel B of Table A.18, past state performance does not predict current state performance in our reduced-form regression. Even more, we can account for dynamics of state performance in our analysis leaving our main results unaffected. Column 1 repeats our baseline reduced form.[7] Lags of state performance do not affect current state performance, as is evident from column 2.[8] Column 2 also shows that the inclusion of such lags does not affect the coefficient on the current ruler's coefficient of inbreeding. The remaining columns show this for our 'objective' measures of state performance.

Table A.17, organized in a comparable manner, documents that past state performance further does not predict ruler ability in our first stage. Past bad state performance does not lead to significantly worse rulers. Hence, neither of the conditions required for strategic kin marriage to affect our exclusion restriction appear to be fulfilled. Therefore, including lags of state performance and lags of the coefficient of inbreeding, does also not affect our IV estimates, evident from panel A of Table A.18.[9]

Table A.17: Past State Performance as Confounder: First Stage

Dep. Var.: Ruler Ability

	(1)	(2)	(3)	(4)
Coefficient of Inbreeding	-0.076***	-0.078***	-0.068***	-0.068***
	(0.012)	(0.012)	(0.011)	(0.012)
L.State Performance		-0.065		
		(0.101)		
L.Δ Log(Area)			-0.061	
			(0.153)	
L.Δ Log(Urb. Pop.)				-0.095
				(0.157)
State FE	✓	✓	✓	✓
R^2	0.15	0.15	0.12	0.11
Observations	240	222	201	196

Note: All regressions are run at the reign level. Lag varies in length depending on ruler lifetime. Standard errors clustered at the state level. * p<0.1, ** p<0.05, *** p<0.01.

[7] Each regression uses the largest available sample for estimation.

[8] Note that "time periods" in this setting refer to reigns, which naturally vary in length.

[9] ++Note that the IV coefficient in column 6 is no longer significant at common levels. In (unreported) regression in which we include the 43 monarchs whose parents share no *known* relationship with each other, the p-value is 0.048 instead.++

Table A.18: Past State Performance as a Confounder: IV and RF Results

Dependent variable as indicated in table header

Dep. Var.	*State Performance*		$\Delta log(Area)$		$\Delta log(UrbPop)$	
	(1)	(2)	(3)	(4)	(5)	(5)
A. Second Stage Regressions						
Ruler Ability	0.794***	0.806***	0.176***	0.115***	0.194***	0.105
	(0.100)	(0.147)	(0.051)	(0.035)	(0.051)	(0.068)
L.State Performance		0.034				
		(0.068)				
L.Δ Log(Area)				0.054		
				(0.045)		
L.Δ Log(Urb. Pop.)						-0.053
						(0.040)
State FE	✓	✓	✓	✓	✓	✓
First Stage Effect. F-Stat	42.2	32.9	39.1	42.2	34.8	32.7
Observations	235	200	203	190	198	184
B. Reduced-Form Regressions						
Coefficient of Inbreeding	-0.061***	-0.062***	-0.013***	-0.008***	-0.013***	-0.008
	(0.011)	(0.010)	(0.004)	(0.002)	(0.003)	(0.005)
L.State Performance		-0.029				
		(0.070)				
L.Δ Log(Area)				0.049		
				(0.057)		
L.Δ Log(Urb. Pop.)						-0.067*
						(0.035)
State FE	✓	✓	✓	✓	✓	✓
R^2	0.11	0.11	0.10	0.04	0.07	0.05
Observations	235	218	203	190	198	184

Note: The table shows the results of second-stage and reduced-form regressions controlling for lags of the outcome variable. The instrument, the coefficient of inbreeding, measures the increased risk of genetic disorders resulting from the consanguinity of the monarch's parents. The table reports the first-stage effective F-statistic from the Montiel Olea and Pflueger (2013) robust weak instrument test; the corresponding critical value for max. 10% relative bias is 16.4. Lag varies in length depending on length of the reign. All regressions are run at the reign level and include state fixed effects. Standard errors clustered at the state level in parentheses. * p<0.1, ** p<0.05, *** p<0.01.

C.2 Strategic Marriage Outside of Kin Network

Alternatively, rulers might strategically marry *outside* of their dynasty network when they anticipate future territorial expansion. Marrying outside a dynasty network also potentially mechanically increases state performance in the following period by enlarging territory due to the strategic marriage. Such a mechanism could result in a link between inbreeding and state performance, as a marriage between completely unrelated individuals would result in a coefficient of inbreeding of $F = 0$ in the next generation.

Note that we actually exclude monarchs with (likely) completely unrelated parents from our baseline IV analysis. For rulers without (known) family relations, our source *roglo.com* does not provide F. Yet, this does not imply that those are necessarily zero. In Column 2 of Table A.19 below, we include the 43 rulers whose parents (likely) had no relationship: our results are stronger compared to the baseline results excluding these 43 rulers, presented in Column 1, but not solely driven by these.

Table A.19: Strategic marriage outside of kin network: IV results

Dependent Variable: *State Performance*

	(1)	(2)
Sample	Baseline	Exclude $F = 0$
Ruler Ability	0.794***	0.814***
	(0.100)	(0.099)
State FE	✓	✓
First Stage Effect. F-Stat	42.18	38.35
Observations	235	278

Note: *State Performance* is a comprehensive measure based on the coding by Woods (1913). The table reports the first-stage effective F-statistic from the Montiel Olea and Pflueger (2013) robust weak instrument test; the corresponding critical value for max. 10% relative bias is approximately 16.4. All regressions are run at the reign level. Standard errors clustered at the state level. * p<0.1, ** p<0.05, *** p<0.01.

C.3 Wars and Conflict Among Dynasties

Conflicts could pose a threat to our exclusion restriction if they were systematically associated with both inbreeding and state performance. Overall, there is mixed evidence on the relationship between relatedness and conflict: Spolaore and Wacziarg (2016) find evidence of a positive link between relatedness and the probability of conflict at the level of *societies*. Benzell and Cooke (2018) explore the relationship between family networks of *alive* ruler pairs and conflict between their states. Their core results use random deaths in kinship networks to instrument for ties between monarchs, documenting that stronger alive kinship ties *reduce* conflict between states (and vice-versa, random deaths of connecting network members raise the probability of interstate conflict). However, these kinship linkages at the ruler-*pair* level do not necessarily translate into higher levels of inbreeding of the individual rulers.[10] In fact, when using relationship by blood between pairs of rulers rather than shared (alive) kinship ties, Benzell and Cooke (2018, Appendix D.1) find a *positive* (albeit insignificant) association with conflict. Similarly, in our core sample, states under more inbred rulers had a higher probability of conflict and a higher share of years under conflict (unreported). Correspondingly, we document in Table A.29 that higher ruler ability (due to lower inbreeding) reduced conflict. Here, we explore the extent to which conflict may confound our main results on state performance and territorial changes. Before presenting the empirical results we note that the most likely implication of inbreeding being positively associated with conflict is that inbreeding adds more variability in state performance and territorial changes due to more frequent wars. That is, incapable (inbred) rulers would fight more often – and our results suggest that they would lose more often. While this would add identifying variation in our data, it would not necessarily confound our results.

Nevertheless, we also empirically address the concern that conflict may affect our results. To do so, we code a dummy for whether a ruler was involved in a conflict during his or her tenure, and include this in both stages of our IV regressions. In addition to the dummy for any conflict during a reign, we also compute the share of conflict years during each reign.[11] We perform this analysis in Table A.20. Column 1 presents our baseline results; column 2 shows that the IV coefficient barely changes when we control for conflict. This is also the case when we control for the share of years during each monarch's reign in which the state was involved in a conflict or war (column 3). In addition, the two conflict variables are themselves quantitatively small and statistically insignificant.

We can also address a possible role of conflicts directly in our measurement of state perfor-

[10] For instance, consider two brothers – offspring of genetically unrelated parents – who rule two different states. They would have strong blood (and kinship) ties, while both having an inbreeding coefficient of zero. One example close to this hypothetical case is Henry III, who ruled Castile from 1400 to 1406, and his brother Ferdinand I of Portugal (reign 1412-1416). Both have an inbreeding coefficient of 1.30 (less than half that of second cousins), while their kinship ties were extremely close. Furthermore, cousins (also with relatively close kinship ties) can have different inbreeding coefficients. Consider the case of Philipp II, ruling Spain from 1556 to 1598, and his cousin Maximilian II, concurrently ruling Austria (1564-1576). The latter had a comparatively low coefficient of inbreeding (1.38), while the former was almost as inbred as offspring of first cousins with a coefficient of inbreeding of 11.45.

[11] The data comes from David Brecke's Conflict Catalogue (available from https://brecke.inta.gatech.edu/research/conflict/) and starts in 900 AD. We first identify whether a state participated in any conflict (in Europe) within a given year. Then, we calculate the share of years of each reign in which a state participated in a conflict.

Table A.20: IV Results Controlling for Conflict

Dep. Var.: *State Performance*

	(1)	(2)	(3)
Ruler Ability	0.794***	0.769***	0.731***
	(0.100)	(0.093)	(0.101)
Conflict: Dummy		-0.156	
		(0.192)	
Conflict: Share Years at War			-0.201
			(0.173)
State FE	✓	✓	✓
First Stage Effect. F-Stat	42.18	35.53	25.18
Observations	235	235	235

Note: *State Performance* is a comprehensive measure based on the coding by Woods (1913). All regressions are run at the reign level. Table shows results from instrumental variable regressions, in which ruler ability is instrumented with the coefficient of inbreeding. The table reports the first-stage effective F-statistic from the Montiel Olea and Pflueger (2013) robust weak instrument test; the corresponding critical value for max. 10% relative bias is approximately 16.4. Standard errors clustered at the state level. * p<0.1, ** p<0.05, *** p<0.01.

mance. Our main measure of state performance is a composite measure, including territorial changes as one of many assessed features (others being administrative reform, economic performance, etc). This directly sidesteps the potential confounding effects of warfare. In column 1 of Table A.21 we show our baseline second stage results. In column 2 we use as outcome the residuals of a regression of the percentage change in territory under the control of a monarch during their reign from (Abramson, 2017) on our composite measure of state performance. Column 3 instead uses our measure of state performance residualized with a categorical variable of territorial expansion ("1") or decline ("-1") assessed by our research assistant.[12] ++In column 2 and 3 the coefficient size is (marginally) reduced; the effect of ruler ability retains statistical significance and remains sizable. This underlines the importance of territorial changes in state performance, but also that of other aspects of state performance, beyond territorial changes. ++

[12]See Appendix D.2.1 for detail.

Table A.21: IV Results using State Performance Excluding Territorial Gains

Dep. Var.: *State Performance*

	(1)	(2)	(3)
Note on Dep. Var.:	Baseline	Resid. wrt % territorial changes †	Res. wrt territorial changes ‡
Ruler Ability	0.794***	0.734***	0.430**
	(0.100)	(0.109)	(0.203)
State FE	✓	✓	✓
First Stage Effect. F-Stat	42.18	44.51	25.07
Observations	235	199	117

Note: *State Performance* is a comprehensive measure based on the coding by Woods (1913). All regressions are run at the reign level. The table shows results from IV regressions in which ruler ability is instrumented with the coefficient of inbreeding. The table reports the first-stage effective F-statistic from the Montiel Olea and Pflueger (2013) robust weak instrument test; the corresponding critical value for max. 10% relative bias is 16.4. Clustered standard errors (at the state level) in parentheses. * p<0.1, ** p<0.05, *** p<0.01.

† Column 2 residualizes the dependent variable by the percentage change in area during a monarch's reign based on the borders from Abramson (2017).

‡ Column 3 residualizes the dependent variable by our own indicator of territorial change during each reign, where 1 (0,-1) indicate territorial growth (stagnation, decline).

C.4 Order within Dynasties: Founder and Descendant Effects

George and Ponattu (2018) show that dynastic politics generates a "reversal of fortune" development pattern, where places develop faster in the short run (due to "founder effects" where bequest motives increase the relevant time horizon), but are poorer in the long run, as descendant effects outweigh founder effects (i.e., intergenerationally transmitted political capital renders descendants less politically accountable). One could presume that incest was worst at the end of dynasties – at the same time when the "reversal" effect would also be strongest.

To address this concern, we code a categorical variable for the order of rulers within dynasties. For example, Carlos III is the 3rd of the Spanish Bourbons. Yet, he also hails from the Bourbon dynasty ruling France. He is the 8th of all Bourbons, ordered by the year in which his reign began. We account flexibly for the potential importance of dynasty and founder effects by including fixed effects for the order of monarchs within their dynasties. Column 1 of Table A.22 repeats our baseline IV result. Column 2 restricts attention to rulers with information on their dynasty. Column 3 includes fixed effects for all rulers of the same order within their dynasty, treating rulers hailing from the same dynasty across states as part of different dynasties. Column 4 instead includes fixed effects that treat such rulers as hailing from the same international dynasty. In both cases, our estimates are sizable and significant. While "reversal of fortunes" development patterns resulting from founder and descendant effects are potentially capturing some the effect of ruler ability on state performance running through inbreeding, the latter is operating distinctively from these.

Table A.22: IV Regressions Accounting for Monarch's Order in Dynasty

Dep. Var.: *State Performance*

	(1)	(2)	(3)	(4)
Sample	Baseline	—— Known Order in Dynasty ——		
Ruler Ability	0.794***	0.845***	0.893***	0.616**
	(0.100)	(0.116)	(0.121)	(0.257)
State FE	✓	✓	✓	✓
Order in Dynasty FE			✓	
Order in International Dynasty FE				✓
First Stage Effect. F-Stat	42.2	40.6	47.1	8.8
Observations	235	231	231	231

Note: *State Performance* is a comprehensive measure based on the coding by Woods (1913). All regressions are run at the reign level. "Order in Dynasty" is the order of a monarch in their dynasty in the same state, and "Order in International Dynasty" is the order of a monarch in their dynasty, considering that certain dynasties ruled in more than one states. For example, Carlos III is the 3rd of the Spanish Bourbons. Yet, he also hails from the Bourbon dynasty ruling France. He is the 8th of all Bourbons, ordered by the year in which his reign began. The table reports the first-stage effective F-statistic from the Montiel Olea and Pflueger (2013) robust weak instrument test; the corresponding critical value for max. 10% relative bias is 16.4. Standard errors clustered at the state level. * $p<0.1$, ** $p<0.05$, *** $p<0.01$.

Figure A.6, depicting the association of monarchs' coefficient of inbreeding and their order within their (domestic) dynasty, provides clues as to why the development dynamics found in George and Ponattu (2018) cannot account for our main result. The graph shows boxplots of the coefficient of inbreeding for each quintile of a rulers order within the domestic dynasty. While indeed monarchs of higher order within their dynasties tend to have higher coefficients of inbreeding, there are also plenty of monarchs with comparably high coefficients of inbreeding among those of lower orders.

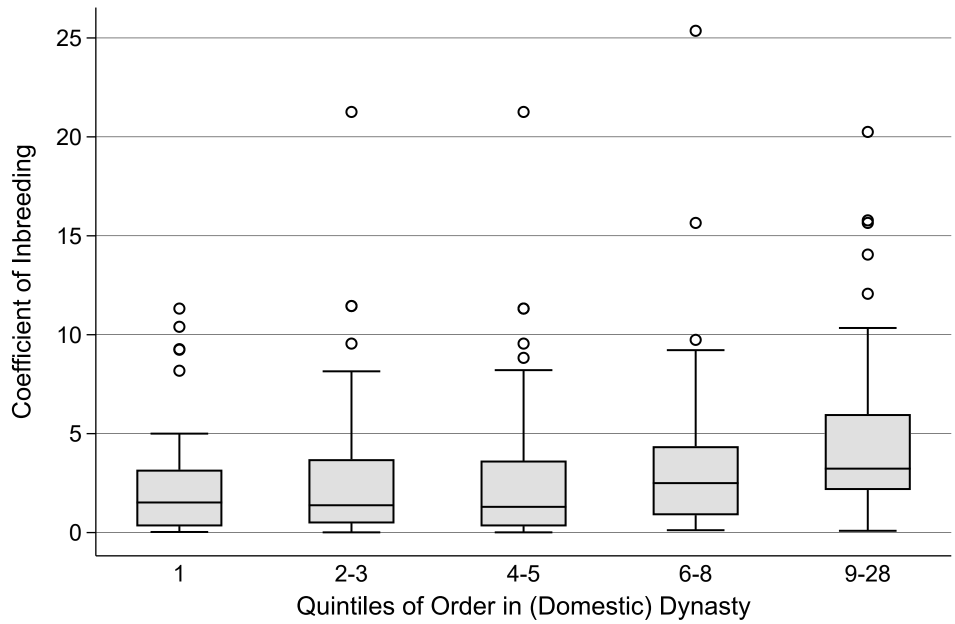

Figure A.6: Inbreeding Coefficient and by Quintiles of Order in (Domestic) Dynasty

Note: The figure shows boxplots of the coefficient of inbreeding for quintiles of rulers' order within (domestic) dynasties. The labels correspond to the dynastic order of monarchs within each quintile. E.g., the highest quintile contains monarchs that are at least the 14th representative of their (domestic) dynasty.

C.5 Selection among Offspring

One concern with our identification strategy revolves around the selection of less inbred and more capable individuals among the prior rulers' offspring. Fathers could 'rid themselves' of incapable offspring, or offspring who were more affected by their parents' consanguineous relationships might have died in young age, thus leaving more capable surviving successors. Note that both these mechanisms would work against our first stage for the case when rulers only can draw successors from offspring of one marriage: Siblings share the same coefficient of inbreeding, and 'eliminating' the least capable ones would reduce the variation in ruler ability that is due to inbreeding. In column 2 of Table A.23 we show that our results are very similar to the baseline IV result (reprinted for convenience in Column 1) when reducing the sample to those monarchs who likely were the first-born sons and thus the most commonly legally mandated heirs to the throne. That is, we focus on monarchs of whom we know that either they were the first-born offspring (irrespective of gender), or, if the first-born's gender was female, were the second-born offspring. While this reduction in sample size by about 50% leads to a weaker first stage, the second stage coefficient is remarkably stable and highly significant.

It would be more of a concern if monarchs remarried and selected an heir among the offspring from the less consanguineous marriage. In Column 3 were therefore reduce the sample to those monarchs whose parents either had only one marriage or, if they had more than one marriage, had no offspring from any other marriage. Again, the strength of the second stage supports the idea that selection among offspring from the same or any other marriage is not a concern for the validity of our IV results.

Table A.23: IV Result: Selection Among Offspring

Dep. Var.: *State Performance*

	(1)	(2)	(3)
Sample:	All	Firstborn Sons	No Competing Claims
Ruler Ability	0.794***	0.738***	0.642***
	(0.100)	(0.270)	(0.183)
State FE	✓	✓	✓
First Stage Effect. F-Stat	42.18	19.28	12.77
Observations	235	120	145

Note: *State Performance* is a comprehensive measure based on the coding by Woods (1913). All regressions are run at the reign level. Table shows results from instrumental variable regressions, in which ruler ability is instrumented with the coefficient of inbreeding. The first column repeats our baseline IV results, column 2 restricts attention to first born sons, and column 3 to those monarchs whose parents had only one marriage or no offspring from any other marriage. The table reports the first-stage effective F-statistic from the Montiel Olea and Pflueger (2013) robust weak instrument test; the corresponding critical value for max. 10% relative bias is approximately 16.4. Standard errors clustered at the state level. * p<0.1, ** p<0.05, *** p<0.01.

D Details on Potential Mechanisms

In this Appendix we provide additional analyses of the potential mechanisms underlying our main finding that ruler ability had a causal effect on the performance of states. We first focus on ruler characteristics, asking which ruler characteristics where affected by inbreeding and in turn determined state performance. We show that the effect likely stems from the intellectual (as opposed to physical) abilities of monarchs – in particular both cognitive and non-cognitive abilities. Second, we focus on which dimensions of state-level outcomes were affected by inbred rulers. There we show that ruler ability affected both political and economic components of state performance. Capable rulers were less likely to participate in conflicts, but that they nevertheless tended to increase the urban population of their territory by successful conquest. This suggests that capable rulers engaged in conflicts when these benefited their state, but avoided them otherwise.

D.1 Ruler Characteristics

D.1.1 Characteristics of Able Rulers

We start by documenting correlates of ruler ability per se. Table A.24 shows that ruler who had more children, ruled for longer, came to power after the prior ruler was killed, were described as tall, and assessed (by us) as having higher non-cognitive ability, were characterized as more able by Woods. Except for the "tall" and "regicide" dummies, these correlations are strongly significant. They are sizable throughout. Recall that *State Performance* is standardized to mean zero and standard deviation one. Hence, increasing the number of monarchs offspring by ten is associated with an increase in Woods assessment of this monarch's ability by half a standard deviation. Similarly, going from a monarch with negative non-cognitive ability ("-1") to one with positive non-cognitive ability ("1") is associated with an increase in assessed ruler ability of more than 0.8 of a standard deviation.

D.1.2 Did the Physical or Intellectual Ability of Rulers Matter?

Inbreeding has negative consequence for both intellectual and physical abilities. Theoretically, our results could therefore be driven by i) the (potentially anticipated) early deaths of monarchs and their lack of reproductive success due to inbreeding, by ii) other physical features caused by inbreeding that render leaders effective or reported as such, or by iii) their lack of intellectual capabilities that rendered them ineffective leaders (Alvarez, Ceballos, and Quinteiro, 2009; Álvarez, Vilas, Ceballos, Carvalhal, and Peters, 2019). In the preceding section, we already documented that physical characteristics of ruler tend to not be decisive in determining Woods (1913)'s assessment of ruler ability. To further distinguish between these possibilities, we control for proxies of the physical consequences of inbreeding in our IV regression. Column 1 of Table A.25 shows our baseline IV regression comparison. In column 2, we control for the length of a monarchs reign.

Table A.24: OLS: Correlates of Ruler Ability

	Dep. Var.: Ruler Ability								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Length of reign (in years)	0.020***								
	(0.004)								
Age at Ascension		-0.004							
		(0.005)							
Regency			-0.402*						
			(0.193)						
L.Regicide †				0.052					
				(0.240)					
Age at Death					0.012*				
					(0.006)				
Number of children						0.050**			
						(0.017)			
Tall ‡							0.219		
							(0.187)		
Physical Appearance §								0.129***	
								(0.020)	
Noncognitive Ability									0.311***
									(0.056)
State FE	✓	✓	✓	✓	✓	✓	✓	✓	✓
R^2	0.13	0.07	0.08	0.07	0.09	0.09	0.07	0.09	0.20
Observations	341	310	341	194	310	292	317	317	317

Note: All regressions are run at the reign level. Table shows results from Ordinary Least Squares Regressions. Standard errors clustered at the state level. * p<0.1, ** p<0.05, *** p<0.01.
† Dummy indicating whether the *prior* ruler was executed after a trial of murdered.
‡ "Tall" is dummy indicating that ruler was described as "tall," "very tall," or had a recorded height of over 179 cm. Missing values are recorded as zeros.
§ "Physical Appearance" is a dummy indicating whether monarch was described as physically "weak" (-1) or "strong" (1). Missing values are recorded as zeros.

Less inbred monarchs might have lived longer and thus had more opportunities to become successful leaders. In column 3 we directly control for the age at death of the monarchs. Our main coefficient of interest, that of ruler ability, is unaffected by the inclusion of these controls. This renders it unlikely that physical features caused by inbreeding and leading to a shorter life span or reign span drive our results. Another concern might be reproductive success. Inbred monarchs might have less surviving children, which could have threatened their position in guaranteeing the survival of the dynasty. In Column 4, we thus directly control for the number of each monarchs' children, and again find little effect of this inclusion for our main coefficient of interest.[13] Alternatively, inbreeding could have affected the height or appearance of monarchs. Such features

[13]Data on the number of children comes from online encyclopedias and includes legitimate and illegitimate offspring.

– rather than cognitive ability – might then have made less inbred rulers better rulers, or at least have lead contemporary witnesses and historians to assess those as better rulers.[14] From online encyclopedias, we code up any information on the height of the monarch and create dummy indicating tall monarchs. The result in Column 5 shows that the inclusion of this dummy leaves our main coefficient of interest barely affected. In Column 6, we include an indicator of physical strength and appearance. Again, our main coefficient of interest is barely changed in size or significance. This suggests that it is the intellectual abilities of monarchs rather than their physical abilities which were affected by inbreeding and rendered them successful or unsuccessful rulers.[15] Inbred monarchs were incapable leaders because of the consequences of inbreeding for their *intellectual* abilities to effectively reign their states, and not because of inbreeding's consequences for the physical abilities to achieve longevity, produce heirs, reach a certain height or physical strength.

D.1.3 Did Cognitive or Non-cognitive Intellectual Abilities Matter?

What kind of intellectual abilities mattered for European monarchs? Recent work emphasizes the importance of both cognitive and non-cognitive intellectual abilities (Lindqvist and Vestman, 2011; Heckman, Stixrud, and Urzua, 2006). The "Ruler Ability" measure from Woods (1913) explicitly aimed at capturing cognitive abilities.[16] We draw on the adjectives provided by Woods (1913) to describe monarchs and code up a similar measure aimed at capturing non-cognitive abilities of monarchs. We assign values of "1" to individuals described as outgoing or emotionally stable and along similar lines, and value of "-1" for those with negative non-cognitive abilities such as neurotic or phlegmatic individuals. We standardize the measure to ensure comparability.

Column 1 of Table A.26 repeats or baseline IV specification, while Column 2 uses our measure of non-cognitive ability. While the size of the latter coefficient is larger, the First Stage effective F-statistic is markedly lower.

D.2 Dimensions of State Performance

D.2.1 Which Aspects of State Performance Mattered?

Our main outcome variable, *State Performance* as assessed by Woods (1913), is a composite measure. In particular, Woods covered various economic and political aspects of reigns: "finances, army, navy, commerce, agriculture, manufacture, public building, territorial changes, condition of

[14] For instance, based on a representative sample of Swedish conscripts, Lindqvist (2012) documents that taller men are significantly more likely to become managers.

[15] ++ A caveat regarding measurement applies. While we measure inbreeding well (to the extent that the genealogies were recorded accurately), our assessments of other personal characteristics such as height and physical appearance are less granular and likely have higher measurement error.++

[16] Woods (1913, p.5) focused on what he called "mental"(i.e., cognitive) ability as opposed to "morals " (closely related to non-cognitive ability). In his earlier work, he already described that the two are strongly correlated based on a (larger) sample of European nobility (Woods, 1906).

Table A.25: IV Results Controlling for Physical Features of Monarchs

Dep. Var.: *State Performance*

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Ruler Ability	0.794***	0.820***	0.805***	0.824***	0.572***	0.794***	0.711***	0.793***	0.798***
	(0.100)	(0.088)	(0.104)	(0.106)	(0.138)	(0.098)	(0.103)	(0.099)	(0.097)
Length of reign (in years)		0.011***							
		(0.003)							
Age at Ascension			-0.006						
			(0.006)						
Regency				-0.389***					
				(0.134)					
L.Regicide †					-0.144				
					(0.220)				
Age at Death						0.002			
						(0.008)			
Number of children							0.020		
							(0.023)		
Tall ‡								-0.061	
								(0.157)	
Physical Appearance §									-0.028
									(0.040)
State FE	✓	✓	✓	✓	✓	✓	✓	✓	✓
First Stage Effect. F-Stat	42.18	44.93	42.50	42.62	37.58	46.14	44.53	40.89	44.66
Observations	235	235	235	235	136	235	225	235	235

Note: *State Performance* is a comprehensive measure based on the coding by Woods (1913). All regressions are run at the reign level. Table shows results from instrumental variable regressions, in which ruler ability is instrumented with the coefficient of inbreeding. The table reports the first-stage effective F-statistic from the Montiel Olea and Pflueger (2013) robust weak instrument test; the corresponding critical value for max. 10% relative bias is approximately 16.4. Standard errors clustered at the state level. * p<0.1, ** p<0.05, *** p<0.01.
† Dummy indicating whether the *prior* ruler was executed after a trial of murdered.
‡ "Tall" is dummy indicating that ruler was described as "tall," "very tall," or had a recorded height of over 179 cm. Missing values are recorded as zeros.
§ "Physical Appearance" is a dummy indicating whether monarch was described as physically "weak" (-1) or "strong" (1). Missing values are recorded as zeros.

law and order, general condition of the people as a whole, growth and decline of political liberty, and the diplomatic position of the nation, or its prestige when viewed internationally," (Woods, 1913, p. 10). While our main interest focuses on the composite assessment of state performance, we further assess the various components in order to examine which specific aspects drive our result. We asked a research assistant to read through the full text of Woods (1913), assessing each of the components. Then, we validated and extended this coding using information available in online encyclopedias. In total, we assess 14 components, which we roughly group into political aspects and economic aspects of reigns. Here we provide a brief list of each of these, and some questions that display what aspects are covered by these measures.

- Political aspects of state performance

Table A.26: IV Results: Cognitive or Non-cognitive Intellectual Abilities?

Dep. Var.: *State Performance*

	(1)	(2)
(Cognitive) Ruler Ability	0.794***	
	(0.100)	
Ruler Non-cognitive Ability		0.926**
		(0.363)
State FE	✓	✓
First Stage Effect. F-Stat	42.18	13.64
Observations	235	247

Note: *State Performance* is a comprehensive measure based on the coding by Woods (1913). All regressions are run at the reign level. Table shows results from instrumental variable regressions, in which ruler ability (cognitive ability in Column 1, and non-cognitive ability in Column 2) is instrumented with the coefficient of inbreeding. The table reports the first-stage effective F-statistic from the Montiel Olea and Pflueger (2013) robust weak instrument test; the corresponding critical value for max. 10% relative bias is approximately 16.4. Standard errors clustered at the state level. * p<0.1, ** p<0.05, *** p<0.01.

  - Territorial changes: Did the territory of the state expand or shrink?
  - Law and order: Did the executive maintain and promote law and order in the state?
  - Public liberty: Was there persecution of minorities? Was there serfdom?
  - Finances: What was the state of treasury, royal finances, and public debt?
  - Army: How well-equipped, large, and successful was the army?
  - Navy: Did a navy exist? How well was the naval force equipped?
  - Administration: Was the public administration effective, was it corrupt?
  - Diplomacy and prestige: Was the diplomacy of the state effectively implemented, was its diplomatic strategy successful? How was the state rated among other powers in Europe?

- Economic aspects of state performance
  - Living conditions of inhabitants: Did the welfare of the general populace change during a reign?
  - Infrastructure: Were roads, bridges, ports built or destroyed, or did they decay?
  - Commerce: Was there more commercial activity, trade, and growing prosperity? Or were restrictions on commerce and trade implemented?
  - Agriculture: Were there droughts, loss of farm land, or emigration of farmers?
  - Manufacture: Did the state produce and export more or less manufactures during the reign?

For all these aspects, we code negative developments as "-1" and positive ones as "1." Where we have neither information on positive nor negative developments, we presume no change and code zeros. For those reigns for which Woods (1913) did not reach an assessment of *State Performance*, we similarly set our assessments of particular aspects to missing rather than zero.

We discuss results for political and economic aspects separately. Table A.27 shows results of our baseline second stage regressions, where the dependent variables – instead of our composite measure *State Performance* – are our assessments of political aspects during each reign. As with in our baseline analysis, we standardize the dependent and explanatory variables to mean zero and standard deviation one. In column 1 of Table A.27, we again document a sizable effect of ruler ability on territorial change. Note, however, that this is a different measure than the one used in the main body of the paper. This measure is a categorically assessed variable based on historical sources, while the earlier one employed actual data on polity borders from Abramson (2017). We also document sizable effects of ruler ability on law and order in their states, on finances, on the effectiveness of the administration, and the diplomatic prestige of the state. The remaining outcomes are also positively affected by ruler ability, but while the coefficients are sizeable, they are not statistically significant.

Table A.27: IV Results: Political Components of State Performance

Dependent variable as indicated in table header

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dep. var.:	Territorial Change	Law and Order	Public Liberty	Finances	Army	Navy	Adminis-tration	Diplomatic Prestige
Ruler Ability	0.678***	0.498***	0.323*	0.574***	0.320	0.211	0.478**	0.438**
	(0.208)	(0.160)	(0.185)	(0.220)	(0.271)	(0.163)	(0.226)	(0.178)
State FE	✓	✓	✓	✓	✓	✓	✓	✓
First Stage Effect. F-Stat	46.62	46.62	46.62	46.62	46.62	46.62	46.62	46.62
Observations	235	235	235	235	235	235	235	235

Note: All regressions are run at the reign level. Table shows results from instrumental variable regressions, in which ruler ability is instrumented with the coefficient of inbreeding. The first-stage effective F-statistic from the Montiel Olea and Pflueger (2013) robust weak instrument test is 45.9; the corresponding critical value for max. 10% relative bias is approximately 16.4. Standard errors clustered at the state level. * p<0.1, ** p<0.05, *** p<0.01.

Next, we consider economic aspects of state performance and the causal effect of ruler ability on each of these. Table A.28 documents strong effects of ruler ability on the living conditions of a state's populace, on agriculture, and on its commerce. The remaining components also have positive signs, but the corresponding coefficients are small and not statistically significant.

D.2.2 Conflict as Outcome

In this section we show that incapable rulers participated in international conflict more often. The data on conflict are from David Brecke's Conflict Catalogue and start in 900 AD.[17] We identify

[17]The data are available at https://brecke.inta.gatech.edu/research/conflict/. Accessed in May 2021.

Table A.28: IV Results: Economic Components of State Performance

Dependent variable as indicated in table header					
	(1)	(2)	(3)	(4)	(5)
Dep. var.:	Living Conditions	Agri-culture	Commerce	Manu-factures	Infra-structure
Ruler Ability	0.408**	0.583**	0.868***	0.102	0.050
	(0.185)	(0.263)	(0.253)	(0.234)	(0.169)
State FE	✓	✓	✓	✓	✓
First Stage Effect. F-Stat	46.62	46.62	46.62	46.62	46.62
Observations	235	235	235	235	235

Note: All regressions are run at the reign level. Table shows results from instrumental variable regressions, in which ruler ability is instrumented with the coefficient of inbreeding. The table reports the first-stage effective F-statistic from the Montiel Olea and Pflueger (2013) robust weak instrument test; the corresponding critical value for max. 10% relative bias is approximately 16.4. Standard errors clustered at the state level. * p<0.1, ** p<0.05, *** p<0.01.

whether a state participated in any conflict (in Europe) within a given year. Based on this information, we generate two outcome variables: a dummy for at least one conflict during a reign, and the share of years of each reign in which a state participated in a conflict.

Column 1 in Table A.29 shows that capable rulers were less likely to participate in any conflict, and their reigns also saw a smaller share of years of conflict (col 2). Is this because of less domestic unrest under capable monarchs or because capable monarchs were less likely to attack or get attacked by other monarchs (Dube and Harish, 2020)? To answer this question, we classify conflicts as internal if only one state is listed as a participant, and as a external (international) whenever more than one state is listed as participant. In columns 3 and 4 of Table A.29, we use internal conflict as our outcome variable, and in columns 5 and 6, external conflict. The results show that our previous result is driven by external conflicts: More capable leaders tended to participate in fewer conflicts involving other states, while there is no meaningful difference for internal conflicts. This is remarkable, given that more capable rulers also managed to expand their territory and urban population (see Table 5 in the paper). The most likely explanation for these findings is that – on average – capable rulers were better at selecting external wars that promised territorial expansions, while they avoided those that would likely have been costly.

D.2.3 Decomposition of Change in Urban Population

In this Appendix, we decompose the effect of monarchs ability on the change in urban population during their reign into changes stemming from (i) the growth of cities always under control of the monarch during the entire reign, and (ii) the acquisition and loss of territory containing cities during the reign.

We start by imputing the yearly population for each of the cities in Bairoch (assuming a linear

Table A.29: IV Results: Conflict as Outcome

Dependent Variable: Conflict during a reign; detail in table header

	(1)	(2)	(3)	(4)	(5)	(6)
Dep. Var:	All Conflicts		Internal		External	
	Dummy	Share	Dummy	Share	Dummy	Share
Ruler Ability	-0.315***	-0.160**	-0.054	-0.034	-0.323***	-0.136**
	(0.090)	(0.071)	(0.055)	(0.073)	(0.084)	(0.056)
State FE	✓	✓	✓	✓	✓	✓
First Stage Effect. F-Stat	37.65	37.65	37.65	37.65	37.65	37.65
Observations	240	240	240	240	240	240

Note: All regressions are run at the reign level. The table reports the first-stage effective F-statistic from the Montiel Olea and Pflueger (2013) robust weak instrument test; the corresponding critical value for max. 10% relative bias is approximately 16.4. Standard errors clustered at the state level. * p<0.1, ** p<0.05, *** p<0.01.

growth rate), and identify which polities these cities lay in at each 5-year intervals using the borders provided by Abramson (2017). For each reign, we then calculate the total urban population between the beginning and the end of each reign (we use urban population at the 5-year intervals at which the territory data is available). Note that such changes can result from either changes in the population of the cities that remained in the polity throughout the reign ("intensive"), or from changes in the urban population located in areas lost or gained during a reign ("extensive"). We identify the cities and their population that have always remainder under control, and those that were gained, or lost, during the reign of each monarch.

We decompose changes in total urban population into these separate components. Note that the urban population in the area controlled by a monarch at the beginning of his or her reign consists of (i) urban population in areas that will remain under the control of that monarch until the end of the reign, and (ii) the initial urban population in areas are lost during the reign:

$$Pop_t^{Urb} = Pop_t^{Urb,remain} + Pop_t^{Urb,lost}$$

where t indicates the beginning of a reign, and Pop^{Urb} stands for urban population. Similarly, urban population at the end of a reign can be decomposed into a first component which remained under control by the monarch, and a second component, comprising the urban population at the end of a reign in areas that were gained due to territorial expansion during the reign:

$$Pop_T^{Urb} = Pop_T^{Urb,remain} + Pop_T^{Urb,gained}$$

Therefore:

$$\frac{Pop_T^{Urb}}{Pop_t^{Urb}} = \frac{Pop_T^{Urb,remain} + Pop_T^{Urb,gained}}{Pop_t^{Urb,remain} + Pop_t^{Urb,lost}}$$

Let $\gamma_{gained} = \frac{Pop_T^{Urb,gained}}{Pop_T^{Urb,remain}}$ be the urban population in territories gained during the reign relative to the that in territories that remained under control during the entire reign. Similarly, denote by $\gamma_{lost} = \frac{Pop_t^{Urb,lost}}{Pop_t^{Urb,remain}}$ the fraction of urban population in the beginning of the reign in territories lost, relative to the population in areas kept. Then:

$$\frac{Pop_T^{Urb}}{Pop_t^{Urb}} = \frac{Pop_T^{Urb,remain}(1+\gamma_{gained})}{Pop_t^{Urb,remain}(1+\gamma_{lost})} = (1+\gamma_{intensive})\frac{1+\gamma_{gained}}{1+\gamma_{lost}}$$

where $1+\gamma_{intensive} = \frac{Pop_T^{Urb,remain}}{Pop_t^{Urb,remain}}$ and $\gamma_{intensive}$ is the rate of urban population growth in areas that remained under a monarchs control during the reign.

Applying logarithms, this yields a composition of percentage change in urban population into an intensive and extensive margin:

$$log(Pop_T^{Urb}) - log(Pop_t^{Urb}) = \underbrace{log(1+\gamma_{intensive})}_{\text{intensive: city growth in areas remaining under control}} + \underbrace{\underbrace{log(1+\gamma_{gained})}_{\text{acquisition of cities}} - \underbrace{log(1+\gamma_{lost})}_{\text{loss of cities}}}_{\text{extensive margin}}$$

Table A.30 shows the results for log changes in total urban population (cols 1-3) as well as for its intensive (cols 4-6) and extensive (cols 7-9) components. For each outcome, we first report the OLS results in the full sample, followed by OLS results in the "IV sample," (i.e., reigns for which we have information on the coefficient of inbreeding), followed by the IV results. Column 1 shows a sizeable correlation between ruler ability and the overall change in urban population. The result is very similar in the subsample in column 2. The IV result in column 3 shows a large and highly significant coefficient, replicating our baseline result from Table 5 in the paper that a one standard deviation increase in the ability of a monarch raises urban population by almost 20%. Interestingly, this is effect is entirely due to the extensive margin. The IV estimate for the intensive margin is minuscule with a relatively small standard error, indicates a 'reliably estimated zero.'[18] In contrast, the IV coefficient for the extensive margin in column 9 is as large as the total effect in column 3. A plausible explanation for these findings is that strong, capable rulers had an ambiguous effect on domestic city growth (i.e., on the intensive margin) because they fostered economic prosperity on the one hand, but they also kept cities' ambitions to become independent in check (c.f. Angelucci,

[18]The OLS estimate for the intensive margin full sample is statistically significant but so quantitatively small, and it loses its significance in the subsample in column 5). In addition, the OLS coefficients for the extensive margin (cols 7 and 8) are also significantly larger than those for the intensive margin.

Meraglia, and Voigtländer, 2020).

Table A.30: Decomposition of Changes in Urban Population

Dependent Variable: Log change in urban population during reign, detail in table header

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Dep. Var:	Total Change in Urb.			Intensive Change in Urb.			Extensive Change in Urb.		
Specification:	OLS	OLS	IV	OLS	OLS	IV	OLS	OLS	IV
Note:		IV sample			IV sample			IV sample	
Ruler Ability	0.098***	0.105**	0.194***	0.022**	0.019	0.004	0.077**	0.086**	0.190***
	(0.027)	(0.041)	(0.051)	(0.009)	(0.013)	(0.030)	(0.026)	(0.038)	(0.063)
State FE	✓	✓	✓	✓	✓	✓	✓	✓	✓
First Stage Effect. F-Stat			34.8			34.8			34.8
R^2	0.10	0.10	0.07	0.11	0.09	0.08	0.07	0.10	0.04
Observations	289	198	198	289	198	198	289	198	198

Note: All regressions are run at the reign level. The table reports the first-stage effective F-statistic from the Montiel Olea and Pflueger (2013) robust weak instrument test; the corresponding critical value for max. 10% relative bias is approximately 16.4. Standard errors clustered at the state level. * p<0.1, ** p<0.05, *** p<0.01.

E Detail on Coding State-Year Level Constraints on Executive

Constraints on the Executive refer to legal and de-facto constraints limiting the actions of the executive branch of government. In a widely used measure, the Polity IV project provides a categorical variable measuring the relative strength of these constraints across states from 1800 onward (Marshall, Jaggers, and Gurr, 2017). Acemoglu, Johnson, and Robinson (2005) code a similar variable at the 100- and 50-year interval from 1000 CE until 1850. They base the measure on an encyclopedia of world history (Langer, 1972; Stearns and Langer, 2001). We follow their approach, but additionally identify the exact year when constraints on the executive (whereby we focus on the monarchs exclusively) changed. We code this measure for all states in our dataset except Turkey, which is not covered by these sources. After 1800, we use the year-by-year measure of constraints on the executive from Marshall et al. (2017).

Figure 5 provides an example of the gained granularity. While Acemoglu et al. (2005) code England as having "slight to moderate limitation on executive authority" (category 3) throughout the 17th century, our refined measure shows that, instead, English kings over many decades in this century faced "substantial limitations" (category 5). See the discussion in Section 3.4 for examples.[19]

The categories of "constraints on the executive" range from 1 to 7, where 1 indicates unlimited

[19] Note that for the first three reigns in France recorded by Woods, as well as for the first reign in Castile, Portugal, Prussia, Russia, and Scotland, we do not have information on constraints in our sources. Treating these reigns as unconstrained leaves our result unaffected (unreported).

authority of the monarch and 7 indicates "Executive Parity or Subordination" to other branches of government. We define an indicator of a monarch being constrained when constraints on the executive are at least 5 – "Substantial Limitations on Executive Authority."

We list the categories below:

- 1: Unlimited Authority: There are no regular limitations on the executive's actions (as distinct from irregular limitations such as the threat or actuality of coups and assassinations.)
- 2: [Intermediate Category]
- 3: Slight to Moderate Limitation on Executive Authority: There are some real but limited restraints on the executive.
- 4: [Intermediate Category]
- 5: Substantial Limitations on Executive Authority: The executive has more effective authority than any accountability group but is subject to substantial constraints by them.
- 6: [Intermediate Category]
- 7: Executive Parity or Subordination: Accountability groups have effective authority equal to or greater than the executive in most areas of activity

++Table A.31 lists all 19 reigns for which we consider the monarchs to be constrained. ++

Table A.31: "Substantially" Constrained Rulers

State	Ruler	Reign span	*Ruler Ability*	*State Performance*	Constraints on Executive
Denmark	Valdemar IV	1340 - 1375	1	1	5
England	Richard ll	1389 - 1399	0.5	-0.5	5
England	Henry V	1413 - 1422	1	0	5
England	Regency (Humphrey of Gloucester)	1422 - 1440	-1	-1	5
England	Interregnum	1649 - 1659	-1	1	6
England	Charles ll	1660 - 1685	-1	1	7
England	William lll	1689 - 1702	1	1	5
England	Anne	1702 - 1714	-1	0	6
England	George l	1714 - 1727	-1	1	6
England	George ll	1727 - 1760	-1	1	6
England	George lll	1760 - 1820	0	1	6
Netherlands	The States	1650 - 1672	-1	0	5
Netherlands	William lll	1672 - 1702	1		5
Netherlands	The States	1702 - 1747	-1	-1	5
Netherlands	William IV	1747 - 1751	-0.5	-0.5	5
Netherlands	Minority of William V (Anne, daughter of George II of England, Regent)	1751 - 1759	-0.5	-1	5
Netherlands	Republic	1759 - 1766	-1	-1	5
Netherlands	William V	1766 - 1795	-1	-1	5
Sweden	Gustavus lll	1771 - 1792	1	1	5

Note: This table shows the 19 reigns for which the constrains on executive in the year prior to the first year of the reign were at least substantial (≥ 5) in our dataset. Assessments of *State Performance* and *Ruler Ability* come from Woods (1913).

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Quick Guide to Identification, Mechanisms, and Measurement Concerns

Section 4 presents empirical evidence that supports a causal relationship between ruler ability and state performance. The tables below provide a brief guide to identification concerns, to historical and empirical evidence that render these alternative mechanisms unlikely, and to measurement concerns and how we address these.

Table A.32: Summary: Threats to Identification and Ways to Address Them

Identification Concerns

We IV strategy exploits two features: i) Pre-determined hereditary appointment of rulers independent of their ability; ii) the fact that inbreeding led to variation in ruler ability. The exclusion restriction is that inbreeding affected state performance only through its effect on the ability of the hereditary ruler. This table discusses potential concerns about our identification strategy, with reference to sections in the paper and appendix where we address these concerns.

Type of evidence: **H**istorical/**E**mpirical	Description of Concern and Evidence
H: Section 2.3	*Did monarchs anticipate the negative effects of inbreeding and avoid them?* Note that the correct coefficient of inbreeding is difficult to anticipate, as it requires both the correct formula (only devised by Wright in 1921, cf. footnote 5) and detailed pedigrees hailing back generations. While incest avoidance is common in humans, consanguineous relationships (among those related in the wider family) were common before the Catholic church in Europe, and monarchs could (and did) get exemptions from the pope to form these (see also the discussion in section 2.3). In fact, keeping the blood line "pure" through consanguineous marriages was often a declared aim of Europe's ruling dynasties (see footnote **??**). This further addresses a related concern with out measure of "hidden" inbreeding. Considering that monarchs knew their family trees, they would not need to calculate the coefficient of inbreeding perfectly, but merely calculate a measure that is correlated with the true coefficient. Even if monarchs would have implicitly calculated such a measure, they would have done so in a way that works against our results (i.e., looking for more inbreeding).
E: Section C.1 and section 4.4	*Strategic Marriage within kin network?* Did unsuccessful monarchs strategically chose more closely related marriage partners to fend of external threats? (a) Note first that this decision must have been in the prior generation, hence the strategic choice is an inter-generational one. Still, if state performance in the past reign had a direct bearing on the present one; and incapable and unsuccessful monarchs were to strategically marry of their offspring to close kin so that the next rulers coefficient of inbreeding was higher, this could pose an identification problem. Also note that successful monarchs aiming to consolidate or expand their territory by consanguineous marriages works against our reduced form. We directly address this concern in Appendix section C.1, where we show that controlling for lags of state performance leaves our main results unaffected. (b) Other concerns strategic marriage of close kin are addressed by our analysis in section 4.4. There we only use the component of inbreeding "hidden" in the pedigree (that is, the amount of inbreeding not coming from marriages between first cousins and uncle nieces in the past two generations) and show that our results remain unaffected. Hence our results are unaffected by close kin marriage in the past generation.

Identification Concerns (continued)	
Type of evidence: **H**istorical/**E**mpirical	Description of Concern and Evidence
E: Appendix sections C.2 and C.3	*Selective Marriage outside of kin network?* Did able monarchs aim to strategically "marry out" in order to expand their realms reach? (a) In the baseline analysis we exclude all those monarchs for whom no relationship between their parents could be identified in our source. Including those does not affect our results, as Appendix C.2 documents. (b) We further exclude any territorial component from our measure of state performance (by residualizing Woods' comprehensive assessment of state performance with our measure of territorial change) and show that our main results go through in Appendix C.3
H/E: Appendix section C.3	*Conflict among related dynasties as a confounder?* If related dynasties were more likely to fight wars between one another (as Benzell and Cooke (2018) find weak evidence for) and were more inbred, this could pose a threat to our identification. (a) Note first that conflict a priori likely only increases the variance of state performance, and does not systematically lead to territorial acquisitions or losses. (Apart from the effect mediated by ruler ability, which leads us back to our main argument). (b) We can directly address any concern related to our outcome – state performance – resulting from (successful or unsuccessful) conflicts by excluding territorial acquisitions directly from our main outcome (cf. Table A.21) and by controlling for conflict in our main regression (Table A.20). As is evident from the result in the tables and the discussion in section C.3, our main results remain unaffected by this.
H/E: Appendix section C.4	*Founder effects and time trends.* Is the main result driven by regression to the mean from early successful founder to incapable and mechanically more inbred later rulers within dynasties? We address this concern directly by controlling for the order of individual monarchs within their dynasties. We include fixed effects for the first, second, and so forth of every dynasty (all "Habsburg" dynasty members) or of every national dynasty (distinguishing the first of the Spanish Habsburgs from the first of the Austrian Habsburgs then). Our main results are robust to the inclusion of such fixed effects.

Mechanisms in line with Our Argument	
Our argument in section 4 is that inbreeding renders ruler incapable. Here we summarize our evidence that inbred monarchs are bad for state performance because they pursue ineffective policies and/or select ineffective personnel.	
Type of evidence: **H**istorical/**E**mpirical	Description of Mechanism and Evidence
E: Appendices D.2.1,D.2.2, and D.2.3	*Inbred monarchs are bad for state performance because they pursue ineffective strategies.* We find some supportive evidence for this. Inbred monarchs decrease internal stability, administrative capacity and the diplomatic position of a state; they lower the state of commerce and agriculture and living conditions in general (cf. Appendix D.2.1). In D.2.2 and D.2.3 we show that less inbred and thus capable rulers partake in less international conflicts, yet acquire more urbanized territories by successful but less conflicts.
H	*Inbred monarchs are bad for state performance because they select incapable advisers.* This is perfectly in line with our argument. Note that selection of capable advisers is a core task of national leaders, and failure to do so reflects upon their own capability. See also the discussion in footnote **??** for a historical example.
E: Appendix section D.1.3	*Does Cognitive or Non-cognitive Intellectual Ability drive our results*? Woods (1913) specifically aimed at assessing the cognitive ability of monarchs, and research in biology documents a strong negative effect of inbreeding on cognitive abilities. Yet, recent research emphasizes non-cognitive intellectual ability as an important determinant of leadership. In section D.1.3, we document that using our own assessment of non-cognitive abilities yields a large and significant effect in the second stage. While we prefer using the measure of cognitive ability by Woods (1913), for which a well-established first stage relationship is suggested by the literature in biology, our findings are consistent with non-cognitive ability playing a role as well in rendering less inbred monarchs more successful.

Ruling out Alternative Mechanisms *Our argument in section 4 is that inbreeding renders ruler incapable. Our measure of capability is a coding of intellectual capacity. We find suggestive evidence that our finding is not driven by the physical consequences of inbreeding or the selection of heirs among differentially capable sons.*	
Type of evidence: **H**istorical/**E**mpirical	Description of Concern and Evidence
H: Tables A.7 and A.25	*Inbreeding decreased fertility, thus creating a threat to succession.* We find only a weak association between rulers' coefficient of inbreeding and the number of (surviving) children in Table A.7 in our sample, and find that controlling for the number of (surviving) offspring leaves our main results unaffected (see Table A.25).
E: Tables A.7 and A.25	*Inbreeding decreases longevity and thus tenure, leading to a threat to succession, as well as to more chances to prove themselves as able rulers/acquire land.* Table A.7 shows that by no means more inbred rulers had shorter tenures or longevity, and Table A.25 controls for longevity in our main specification, again leaving our results unaffected.
E: Tables A.7 and A.25	*Inbreeding decreases height and lower physical appearance, leading to lower perceived capability driving our results.* Table A.7 documents that inbred rulers were not systematically less likely to be assessed as tall or as having a strong physical appearance. In Table A.25 we also directly control for (assessments of) height and physical appearance, leaving our results unaffected.
H/E:Table A.23	*Do monarchs select more able successors among their many offspring and potential heirs?* For instance, monarchs could systematically depose incapable older sons to clear the way for younger, more capable sons. (a) Note ahead that in general the (modern) literature finds that cognitive capabilities decrease in birth order (Cf.Rohrer, Egloff, and Schmukle (2015)) and that today politicians are more likely to be first-born (Oskarsson, Dawes, Lindgren, and Öhrvall, 2021), making such a selection of later-born offspring rarely a wise choice. (b) If such a selection of more capable offspring were to take place among the offspring from the same marriage, it works against our first stage relationship, as all offspring from the same parents share an identical coefficient of inbreeding, and we would not observe those most affected by inbreeding in our dataset of monarchs. (c) Selection of more capable offspring from different (and potentially less consanguineous) marriages could pose a concern. We address this directly in Table A.23 where we restrict attention to those monarchs who were the first-born offspring of their parents (or the second-born in case the first born was a women) as well as to those monarchs without potential competitors for the throne from other marriages. While our sample size is reduced by this, our main finding remains sizable and significant.

Measurement Concerns *We use three main outcome variables, an assessment of state performance, the percentage change in area ruled during each reign, and the percentage change in the urban population. Here we discuss several concerns regarding measurement of the latter two. Note that our results are robust to entirely excluding territorial changes, and that we address concerns with the measurement of the inbreeding coefficient and ruler capability in the other two tables.*	
Type of evidence: **H**istorical/**E**mpirical	Description of Measurement Concern and Evidence
H/E: Tables A.7 and A.25	*Is land acquisition a zero-sum game?* Note that our sample does not include all European states, and that the states we cover do not span over the entire European landmass (see Figure A.1). Thus, there was always land available for the monarchs in our sample to expand into. Table A.2 shows that the average change in area is positive.
E: Table A.13 and section 4.5 and A.25	*Did it become more difficult to acquire land over time?* We address this concern in two ways: (a) Directly by using the change in urban population as the outcome variable. Note that it is never easy to expand into heavily populated territory. (b) We show robustness to including time fixed effects in Table A.13. Further, in section 4.5 we only compare concurrently ruling monarchs.
E: Tables A.7 and A.25	*Five year intervals in measurement of territorial gains and losses.* We link the end year of each reign to the subsequent five-year observation, and start dates to the preceding five-year observation. This potentially gives rise to errors in measurement. Note first that it is not clear that these errors should not be random but work against our main finding. In fact, such errors are rare even for the shorter reigns, for which this should be more of a concern. See the discussion in Appendix section A.3 .