Path Dependence in European Development: Medieval Politics, Conflict and State Building*

Avidit Acharya† Alexander Lee‡

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Abstract

During the Middle Ages, most European polities operated under a norm that gave only the close male relatives of a monarch a clear place in the order of succession. When no such heirs were available, succession disputes could take place, with more distant relatives and female(-line) heirs laying competing claims to the throne. These disputes often produced violent conflicts that destroyed existing institutions and harmed subsequent economic development. A shortage of male heirs to a European monarchy in the Middle Ages could thus have deleterious effects on the development trajectories of regions ruled by that monarchy. We provide evidence for this by showing that regions that were more likely to have a shortage of male heirs are today poorer than other regions. Our finding highlights the importance of the medieval period in European development, and shows how small shocks, represented by accidents of royal births, can work in combination with both institutions and norms in shaping long-run development paths.

JEL Classification Codes: O10, N13

Key words: political instability, conflict, state-building, economic development, gender bias, political norms and institutions, European history

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†Assistant Professor of Political Science, Stanford University, Encina Hall West, Stanford, CA 94305. Email: avidit@stanford.edu.

‡Assistant Professor of Political Science, University of Rochester, Harkness Hall, Rochester, NY 14627. Email: alexander.mark.lee@rochester.edu.

1 Introduction

A large body of scholarship argues that the process of political and economic development is highly path dependent.[1] Most works in this "historical institutionalism" literature focus on studying the consequences of large, and often deliberately initiated, macro-historical events—or what the literature calls "critical junctures"[2]—in shaping long run development trajectories. Some of this work, however, also points to the possibility that even small contingent events can produce path dependent outcomes. Paul Pierson, for example, writes that "path dependent arguments based on positive feedback suggest that not only 'big' events have big consequences; little ones that happen at the right time can have major consequences as well" (Pierson, 2000, p. 263). Despite this, empirical studies of the large, long term consequences of such small contingent events have been relatively scarce.[3] This paper contributes one such study.

Our focus in this paper is on the development of state institutions in medieval Europe, and how accidents of royal births—in particular, the availability of male heirs to the monarchs of medieval Europe—contributed to producing a variation in the success or failure of early state-building efforts. The effects of this variation appear to have lasted, and can be seen in contemporary differences in development levels across Europe.

The link between royal births and medieval state development emerges from a simple theory connecting political gender bias and succession norms to political conflict and its consequences for state-building. During the medieval period, most polities operated under a norm that gave the close male relatives of the ruling monarch a relatively clear place in the line of succession, but often did not specify clear succession rules for female (and female-line) heirs. A shortage of male heirs could, therefore, destabilize the polity by creating conflict among the nobility, rival relatives and opportunistic foreigners. In many cases, more distant male relatives would claim the throne over closer female or female-line relatives, leading to a succession dispute. These disputes often turned into violent wars. These wars in turn could have negative effects on a polity's long term

[1] See, e.g., Lipset and Rokkan (1967), North (1990), Skocpol (1979) and Thelen (2004).

[2] The literature on critical junctures includes work on labor incorporation in Latin America by Collier and Collier (2002). In more recent work, the following events have been identified as critical junctures: the Black Death (Voigtländer and Voth, 2012), the end of slavery in the U.S. South (Acharya, Blackwell and Sen, 2014), the defeat of the Germans in the Cameroon front of World War I (Lee and Schultz, 2012), the Glorious Revolution in England (North and Weingast, 1989; Pincus and Robinson, 2011), the French Revolution (Acemoglu et al., 2011), the discovery of the New World (Nunn and Qian, 2011), and the decolonization of Africa (Wantchekon and García-Ponce, 2013).

[3] One recent contribution, however, is that of Dell (2012) who documents the long term economic consequences of a modest drought in early 20th century Mexico.

development, by destroying state institutions and reducing political cohesion. It is also possible that ruling families and local elites in areas ruled by monarchs with relatively few close male relatives anticipated such conflict, and became less willing to invest in building a strong and cohesive state in the first place. Both this underinvestment, and the damage caused by violent conflict had a detrimental effect on contemporaneous and subsequent state development.

In areas with one or more potential male heirs, on the other hand, the high level of political stability afforded by a series of unambiguous and uncontested successions enabled certain polities to establish strong and lasting state institutions, making them more resistant to internal conflict and foreign influence, and even enabling them to conquer and exploit other less politically stable areas. Paris is one of Europe's most prosperous metropolises today in part because it enjoyed the uninterrupted reign of a single dynasty in the medieval period for more than three centuries from 987-1316AD (Lewis, 1981). It was in this period that Capetian monarchs laid the foundations of the modern French state with their city as its capital. Naples, by contrast, was a more prosperous city than Paris in the early Middle Ages, but lost ground due to a series of destructive civil wars brought on by succession-related conflicts (Jones, 2000). Our theory provides a new explanation for this reversal.

Our main empirical finding demonstrates the path dependent effects of the uneven nature of state development in medieval Europe arising from the (un)availability of male heirs. We find that regions of Europe that were ruled by medieval monarchs who had an abundance of male heirs are today richer than other regions. We also trace our effects over time by showing that urban density in each century between 1300 and 1800 was higher in regions that had an abundance of male heirs. In addition, we show that an abundance of male heirs decreased the frequency of internal wars and coups, and we find that contemporary economic development is negatively correlated with the frequency of these medieval wars and coups.

Authors such as Strayer (1970) and Tilly (1992) have argued that European polities began to develop state institutions in the period between 1000 and 1500, but that some polities built stronger and more durable states than others. Tilly (1992) in particular highlights the destructive impact of internal wars and political instability on medieval state-building in Europe. In addition, Migdal (1988), Herbst (2000) and Besley and Persson (2011) have argued that strong state institutions, at both the local and central level, are essential for economic development. Our paper provides evidence for these claims by identifying a measurable source of variation in medieval state-building efforts, and documenting its lasting effects on contemporary development.

2 Theoretical Background

We connect contemporary development to the availability of male heirs to medieval European monarchs via conflict, political instability and state-building. The theory is schematically summarized as follows:

$$\begin{array}{c}\text{shortage of}\\ \text{male heirs}\end{array} \Rightarrow \begin{array}{c}\text{conflict and}\\ \text{instability}\end{array} \Rightarrow \begin{array}{c}\text{persistently weaker}\\ \text{state institutions}\end{array} \Rightarrow \begin{array}{c}\text{persistently weaker}\\ \text{development outcomes}\end{array}$$

As we document below, a rich literature provides support for the second and third links above: that political instability and conflict are harmful for the development of state institutions, and strong states are important for economic development. We briefly review this literature. We then provide theoretical background to the first link in the chain above, between male heirs and conflict.

2.1 Conflict, State Building and Development

Tilly (1992) and Strayer (1970) emphasized the importance of the medieval period for the development of durable state institutions in Europe. In turn, Migdal (1988), Evans (1995) and Herbst (2000) argued the importance of state building for economic development. According to this literature, developing state institutions that are capable of providing market supporting public services, law enforcement, and protection of private property rights, is essential for laying the foundations to economic prosperity.[4]

The Middle Ages are a period where the link between state building and long run economic development is likely to have been especially strong, since it was during this period that many of the basic conditions for modern states were being created, or failing to be created. Examples of the achievements of successful medieval states include the reduction of the ability of petty lords to levy arbitrary taxes and customs duties (North, 1973), the reduction in violence, especially the so called "private wars" within the borders of the state (Tilly, 1992), and the development of institutionalized court systems that improved legal institutions (Harding, 2002). These developments made investments

[4]North and Weingast (1989) and North (1981) provide a counterpoint to these claims. They caution that if the state is too strong, its rulers may transgress by expropriating too much from productive subjects, thereby reducing investments and economic growth. In contrast, recent work by Stasavage (2012) shows that in many instances strong rulers were able to restrain guilds from creation barriers to entry, which would have otherwise stifled competition and hurt development. Although no consensus exists on how strong a state must be for it to become harmful for development, we take the view that state building in medieval Europe was particularly good for long term development because it laid the foundations for the most fundamental institutions that support market activity—institutions that Migdal (1988) and Herbst (2000) have argued are lacking in much of contemporary Africa.

in economic activity more attractive by reducing the possibility of expropriation by greedy locals, bandits, and corrupt royal officials. Protection from a large coercive monopolist with long term interests made obsolete many of the ad hoc techniques that medieval traders had developed to protect against these types of expropriation (Greif, 1993; Milgrom, North and Weingast, 1990).[5]

Complementary to the literature on state development, Bates (2001) argues that while having a strong states is important for development, building state institutions in the presence of political instability and conflict can be challenging.[6] In the face of high instability, rulers know that they could be ousted at any time, and have little incentive to invest in state-building. And, in the presence of frequent conflict, their incremental investments would be periodically destroyed anyway.[7] These arguments give us a basic relationship between state capacity and development that has been summarized and extended formally by Besley and Persson (2010). We rely on their work as well as the previous literature to justify the second and third links of the theory represented by schematic diagram above, with two important additions.

First, previous work has focused on the argument that internal conflict and political instability reduce investments in state capacity, in turn reducing economic investments and hurting development. In many models of conflict and state capacity, such as that of Besley and Persson (2010), violent internal conflict does not have any direct destructive impact on state institutions or development outcomes; it simply diverts resources away from productive activities. In addition to this, we suggest the possibility that such conflict damages existing state institutions as well, and therefore hurts development via this second, more direct, channel.[8]

[5]Many of the achievements of medieval states in the Early Modern period involved the removal of competitors to state authority rather than the creation of large bureaucracies, modern armies or changes in state capacity, but which were central to the later development of modern state institutions (Brewer, 1990; Downing, 1993)

[6]See Alesina and Perotti (1996) and Barro (1996) for evidence that political instability is harmful for development.

[7]This gives rise to the following development "trap:" although strong states are often required to limit conflict, conflict itself inhibits the development of strong states. See Cox, North and Weingast (2013) for a closely related argument.

[8]Besley and Persson (2010) make the distinction between internal conflicts (civil wars) and external conflicts (interstate wars), and argue that internal conflicts hurt state building while external conflicts promote state building. The importance of this distinction was first suggested by Tilly (1992). In other recent work Dincecco and Onorato (2013) and Voigtländer and Voth (2013) find a positive relationship between external war and urbanization in the early modern period. For our purposes, the relevant wars are internal wars, because conflicts emerging from succession disputes are more likely to be internal (though some important wars emerging from succession disputes, such as the Hundred Years War, count as both internal and external).

Second, most previous work on state capacity and development provides only a proximate theory of the impact of state capacity on development. Nevertheless, differences in state development that arose in the distant past are likely to have persisted, making it possible in our context that European polities in which conflict destroyed or stunted the development of the state in the medieval period have persistently lagged behind those in which such conflict did not destroy state institutions as severely. This view is consistent with an influential literature that argues that historical institutions are generally very persistent, and their development over time tends to be incremental (North, 1990; Acemoglu, Johnson and Robinson, 2005).

2.2 Male Heirs, Conflict and Political Instability

Our theory is that the availability of male heirs affected the likelihood of conflict, and subsequently development, in the (i) *cultural* context of political gender bias, and the (ii) *institutional* context of weakly specified succession rules. That is, if we view the availability of male heirs as being largely contingent (i.e., reflecting *luck*) then the the main theoretical contribution of our work is that *luck works in combination with both culture and institutions in shaping development paths.*

In nearly all of medieval Europe, inheritance practices contained a strong element of gender bias, preferring male heirs over female heirs, and male lines of descent over female lines.[9] While matrilineal inheritance systems are common in some parts of Africa, Southeast Asia and pre-Columbian America (Hartung, 1985), they were virtually unknown in pre-modern Europe, a continent that is also noted for having had a strong pro-male gender bias relative to other areas of the world (Boserup, 1970; Alesina, Giuliano and Nunn, 2013). European aristocracy felt strongly that women would be incapable of exercising military power, and that a married woman would be heavily influenced, if not controlled, by her husband (McLaughlin, 1990; Jansen, 2002). Moreover, certain polities of the former Carolingian Empire that practiced "Salic law," outright prohibited inheritance through female lines of descent (Herlihy, 1962; Potter, 1937). Under these prejudices, it is not surprising that the availability of male heirs would be important for guaranteeing peaceful and smooth successions.

In addition, and despite such cultural gender bias, political stability in medieval European monarchies was closely tied to the succession procedures of the regime, with clearer succession procedures reducing instability (Herz, 1952). Kokkonen and Sundell

[9]In fact, all European monarchies had some form of male-preferred inheritance up to 1980: no European monarchy practiced absolute (gender-neutral) primogeniture before 1980 (Corcos, 2012).

(2014) have shown, for example, that the transition to primogeniture-base inheritance systems in medieval Europe was associated with increases in leader tenure and overall political stability. They trace Europe's transition from agnatic systems of succession and selection by assemblies to a system of male-preferred primogeniture, which gives priority to the first born son of the monarch, but allows female(-line) heirs to inherit the throne when direct male heirs are not available (Ward, 2014).[10] They document, however, that no matter which system was used, the nobility were rarely perfectly coordinated on the succession order, and the polity would experience a great deal of conflict and instability resulting primarily from competing claims to succession. For example, the throne might be claimed by living daughters and their husbands, or more distant relatives, who would cite various conflicting inheritance rules as justification.[11] The Hundred Years War is perhaps the best-known historical example of a succession related conflict. The central issue of the war was whether the French throne descended by primogeniture to Joan II of Navarre, half-sister of the deceased King John I (the Posthumous), and subsequently to Edward III of England; or whether Salic law prohibited this inheritance through a female-line, making John's uncle, Phillip of Poitiers, the rightful heir (Sumption, 2009).[12] In fact, it is difficult to point to *any* part of the continent where the lack of a close male heir was not associated with a destructive war arising from such competing claims. In Supplemental Appendix A.8 we provide a list of 18 known cases where the death of a king without any male heirs led to a civil war, in which a disputed succession was unequivocally the main issue.

The importance of institutionalized succession rules points to the central place that coordination problems play in political organization: after a ruler dies, the nobles (and other members of the polity, more generally) must find a way to coordinate around a successor if they are to avoid conflicts arising from succession disputes (Kokkonen and Sundell, 2014; Tullock, 1987; Kurrild-Klitgaard, 2000). It also suggests that a shortage of male heirs should affect conflict and instability less—and therefore have a smaller effect

[10]Here, it is worth noting that even in the polities that used elections to select a new monarch, 47% of successors were close male relatives of the deceased monarch, as compared to 60% of successors in areas that practiced agnatic succession or male-preferred primogeniture.

[11]Even where all the competing claimants were female or female- line, the expectation that a queen's husband would exercise substantial power, and the practice of marrying royal daughters into aristocratic and royal families, meant that there were frequently powerful in-laws with much stronger incentives to intervene than they would have had if their were male heirs.

[12]The Hundred Years War thus illustrates how a disputed succession could result in destructive war when inheritance norms are in conflict and it is unclear which norm trumps the other. In addition, because the war involved the kings of England prosecuting their claim to the Kingdom of France, it also demonstrates how the tangled pattern of elite marriages could result in external rulers having plausible claims to the thrones of other monarchies.

on contemporary development—in polities where succession norms are more strongly institutionalized. Where succession rules are well-defined, the ambiguity in succession caused by a lack of males is much easier to resolve. For example, because most regions in our study eventually institutionalized male-preferred primogeniture as their succession norm, the effect of the availability of male heirs should be weaker in polities that were early adopters of this norm. In fact, inheritance norms such as primogeniture might themselves have become stronger in places where the abundance of male heirs limited the frequency with which the norm was challenged, in turn reinforcing the norm. We explore a number of these implications in the later part of the paper. However, the main implication of our theory, which we explore first, is that due to the political gender bias against female(-line) succession, and the weak institutionalization of inheritance practices that pervaded all of Europe in the Middle Ages, the availability of male heirs should have affected the the success of medieval state building efforts through its affect on conflict; and thus it should have had a long-run effect on development.

3 Contrasting Examples: Naples and France

One of the most striking examples of how violent conflict could destroy even a highly organized polity comes from the experience of Naples. According to Takayama (1993), the Norman Kingdom of Sicily was one of the best governed medieval polities in the 12th century, with some already strong state institutions, such as a large bureaucracy and tax gathering apparatus that drew on pre-existing Arab and Byzantine traditions. This view is consistent with that of Abulafia (1988), who describes how the *liber augustalis* of Frederick II enshrined a set of limitations on aristocratic and urban power that were remarkable for their time, including a ban on wearing arms in public, a ban on the sale of fiefs, depriving the barons and towns of the right to administer justice, and subjecting clerics to the royal courts.

In the next three hundred years, however, the Neapolitan state was comprehensively destroyed by a series of civil wars brought on by a shortage of male heirs. Six of its monarchs died without sons during the Middle Ages, leading to three destructive civil wars. These wars not only disrupted the operations of the central bureaucracy, but allowed the aristocracy to win back some of their autonomy. Jones (2000) provides the backdrop to the final and most destructive of these wars, which began in 1343 when King Robert died without any living sons, leaving the throne to his grand-daughter Joanna. This led to a series of conflicts over Joanna's marriage, resulting in the murder of her first husband, as well as vicious conflicts between the supporters of Joanna and

the supporters of the more distant male line heir, Charles of Durazzo. The result was a complicated civil war, intertwined with the rivalries of the Neapolitan nobility, as well as with the contending claims of two rival popes. The conflict lasted even after Joanna was strangled in prison in 1381, by which time, the division between supporters of her claim—eventually vested in the kings of France, and the Durazzo claim, eventually vested in the kings of Aragon—ran deep within the kingdom's political class. In the next century and a half, the two factions would conduct five successful coups, usually with the support of foreign money and mercenaries. During this period, the nobility regained most of the autonomy that they had lost in the 12th and 13th centuries.

The experience of Naples can be contrasted to the experience of the Ile-de-France, which enjoyed the exceptional stability of its royal family for more than three centuries from 987-1316AD. Every Capetian king was succeeded by an adult son in this period, a run of genetic good luck unparalleled in all of Europe. Historians, such as Lewis (1981), have argued that dynastic stability was a key factor in the rise of the Capetians from a regional power in the Ile-de-France to become the rulers of a centralized state covering much of Western Europe. Not only were the Capetians spared the problem of internal conflict, but the stability of their dynasty put them in an advantaged position to expand their holdings by marrying their sons to the female heirs of their neighbors. This enabled them to acquire the territories of several rulers who had once rivaled them in wealth and power, including the Counts of Toulouse (1271) and Champagne (1314).

The territorial growth of the French royal domain was accompanied by a series of institutional changes that took place within the domain as well. Baldwin (1991), for example, explains how 11th century France, like most medieval polities, contained a confusing mass of conflicting political authorities—aristocratic, clerical and urban—all claiming the right to tax, administer justice, make war and regulate trade. These claims were difficult for the royal authorities to limit, both because of a lack of a permanent royal administrative presence in the provinces, and because many of these petty lords possessed fortified bases. Baldwin documents how in the 12th and 13th centuries, the Capetians, most notably Philip II Augustus, moved vigorously to limit the power of these rulers, seizing the castles of recalcitrant lords, basing permanent royal representatives (the *ballis*) in the major towns, and by institutionalizing a waiting period to prevent the escalation of private disputes into destructive wars before being diverted into the royal courts (via the *quarantaine de la roi*).

The end of French good luck came after Charles IV died leaving no close male heirs in 1328. The resulting disputes for the French throne between the Dukes of Valois (Charles's closest male-line heirs), and kings of England (who held a closer, but female-

line claim) resulted in the Hundred Years War. This was, nevertheless, the only failure in the male line of the French monarchy between 987 and 1498AD.

4 Data

To measure contemporary development we use the Log of GDP per capita, adjusted for purchasing power, and averaged across 2007-09. These data are from the Quality of Government (QoG) EU Regional Database and are measured at the largest subnational ("NUTS") level by the European Union (Charron, Dijkstra and Lapuente, 2014).

The majority of modern regions can be associated with medieval polities that had a single ruler for most years between 1000-1500AD. We collected data on 812 unique rulers that reigned in this five hundred year period, and associated each to regions for all years in which he or she controlled approximately all of the region that year.[13] For each ruler, we collected data on the numbers of legitimate and illegitimate male and female children, how many of each died as infants, how many were alive at the time of the ruler's death and on how each ruler was replaced. Our coding is based primarily on McNaughton (1973) and Morby (1989). Royal genealogies are one of the few data sources of medieval society that were recorded will some regularity, and overall, we are missing data on only 5.5% of region-years.

We focus on the period 1000-1500AD because data on the children of monarchs are scarce prior to 1000, and European polities already begin resemble much more institutionalized territorial states after 1500. These more institutionalized states, with their written succession laws and control over the nobility, should be less vulnerable to instability caused by a lack of male heirs, though the shortage of male heirs remained a common (but, by comparison, less important) source of territorial conflict in Europe until the 19th century.[14]

We used these data to construct several measures of the likelihood of the availability of male heirs to the rulers of each region for the period 1000-1500AD. Perhaps the most straightforward way is to consider the number of times a monarch died or was replaced without a (legitimate) male heir—an inverse measure of the independent variable. Another way is to take the total number of male heirs of a monarch that were alive at

[13]The coding is based on the *Atlas of Medieval Europe* (Classen et al., 2009). We coded rulers as "ruling" a territory if they exercised autonomous political authority within the territory, even if they acknowledged the suzerainty of another ruler, such as the French king or in the Holy Roman Emperor. These larger rulers were coded as only ruling there own demesne territories.

[14]Examples include the War of the Spanish Succession (1701-14) and the War of the Austrian Succession (1740-48).

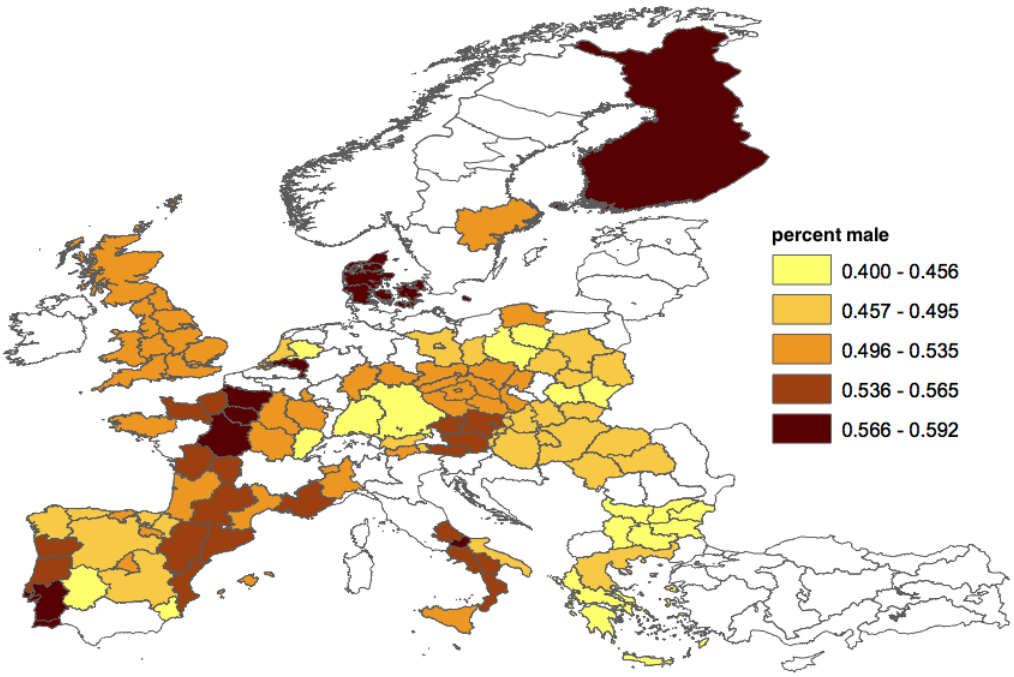

Figure 1. Shaded regions show the proportion of males among the legitimate children of rulers in the period 1000-1500AD. White regions either fall below our 200 year cutoff, or are regions in non-EU states (Turkey, Norway, Switzerland).

the time of the monarch's death or replacement, and sum this number over monarchs that ruled in the five-hundred year period. A third way is to construct the weighted average number of male heirs to each monarch using the lengths of the monarchs' reigns as weights. A fourth way is to consider the fraction of years that the region was ruled by a monarch who had a living male heir. A fifth measure is the fraction of males among all legitimate children of all monarchs that ruled the region in the five hundred year period. We refer to this measure as "percent male" and depict it in Figure 1. Finally, a sixth measure is the fraction of firstborn legitimate children of a region's monarchs that were male. We use these measures to estimate the effect of the likelihood of having male heirs on contemporary development. All of these six measures are correlated (in the right way) with each other.

Our empirical approach assumes that political actors in regions with similar cultural biases and exposed to similar incentives. Therefore, to create our baseline sample, we excluded the following region-years from the data: (i) region-years in which the region was controlled by multiple rulers, usually because they were divided among several

petty lords, or because the modern political boundary cuts across a medieval one, (ii) region-years in which the region was not ruled by traditional monarchs, but rather by the church or by urban republics, or was populated by unorganized tribal groups, and (iii) region-years in which the region was controlled by Muslims, who had very different inheritance and marriage practices than non-Muslims in Europe (Blaydes and Chaney, 2013).[15] After excluding these region-years, some regions have very few years of data, so we excluded regions with less than 200 years of data to avoid basing our inferences on regions where the consequences of (Christian) monarchy were historically unimportant.

Finally, in arguing that the long-term consequences of medieval inheritance practices have persisted over time, we have implicitly assumed that there is some level of continuity in the population of European regions between that time and ours. In seven regions of contemporary Poland and the Czech Republic, we know this assumption to be false.[16] These regions were populated by German speakers (and ruled by Germanic rulers during the Middle Ages) but their entire populations were forcibly removed after World War II and replaced by Poles and Ukrainians (Schechtman, 1953). Given a population change of nearly 100%, we have no reason to expect that medieval events could affect contemporary outcomes in these areas by either cultural or institutional means. Therefore, we exclude these regions from the main analysis. This gives us 114 regions, which constitute our baseline sample. These, along with the seven omitted regions, are depicted in Figure 1.

5 Results

5.1 Baseline Estimates

Table 1 presents coefficient estimates from OLS regressions of the effect of each of our six measures of the independent variable on contemporary GDP per capita. No matter how we measure it, the likelihood of having male heirs has a substantial positive effect on contemporary GDP per capita across European regions. For example, a one standard deviation increase in percent male (roughly 0.047) is associated with a rise in GDP per capita of 41.0%, and a one standard deviation increase in firstborn percent male (roughly .180) is associated with a rise in GDP per capita of 26.8%.

[15]The exclusion of the urban republics, which are primarily located in central and northern Italy, is important to note since several influential accounts of the long term influence of medieval politics have focused on the positive impact of these independent city states (Guiso, Sapienza and Zingales, 2008; Putnam, Leonardi and Nanetti, 1994). Since we are excluding the regions of Europe with the highest levels of wealth and political participation, our estimates of the long-term persistence of medieval political patterns are probably more conservative than they otherwise would be.

[16]These are Dolnoslaskie, Jihozapad, Lubuskie, Opolskie, Pomorskie, Severovychod and Severozapad.

In addition to the usual standard errors, Table 1 also reports standard errors clustered at the level of what we call a "macro-polity." Since our unit of analysis is defined by modern region boundaries, these modern regions cannot be considered the unit of treatment. In particular, single medieval rulers often ruled over multiple modern-day regions, suggesting that the treatment was assigned at units larger than the modern region. For example, the three observations in Walachia that enter our dataset all have the same values of our independent variables because all three of these regions were ruled in the medieval period by the same sequence of monarchs. The same is true for the eight observations in Hungary and the five observations in Denmark. Even areas with different sets of monarchs in different periods are not fully independent of each other because of their shared membership in supra-local political units like the Holy Roman Empire, "France," or "Poland." To partially account for this dependence, we classified every modern region as belonging to a particular "macro-polity" that existed at the start of the period of our analysis.[17] The key upside to clustering errors at the macro-polity level is that the borders of these macro-polities are stable, unlike the borders of the medieval polities (see Section 5.2); and, although different rulers ruled over different sets of regions, most of them ruled over regions that belong to a single macro-polity. The obvious downside is that even the macro-polities are not exactly the unit of treatment, and it is possible that standard errors could be negatively correlated within the boundaries of a macro-polity. In addition, since we have only 14 clusters, these standard errors may be downward biased so Table 1 also reports standard errors estimated using the block bootstrap method (Angrist and Pischke, 2008, p. 319-23).

We choose column (5) of Table 1 as our "baseline specification." The challenge with the independent variables used in the first four columns is that they may vary significantly with unobservable characteristics of regions that affect family size and survival rates, which in turn may directly affect development. The measures used in columns (5) and (6) are much less likely to be affected by these confounders. For example, we show in Supplemental Appendix A.1 that percent male variable is balanced across a variety of region characteristics.[18] We also provide some additional evidence in Supplemental

[17]These macro-polities are Aragon, the Byzantine Empire, Castile, Denmark, England, France, the Holy Roman Empire, Hungary, Poland, Portugal, Scotland, Sicily, Sweden and Walachia. While the formal boundaries of "France" did not correspond to the territory ruled by French kings until after 1500, areas within these boundaries came to share a deference to the Parisian court well before 1500, which shaped their political experiences. Some of these polities were divided into warring minor units, but their boundaries continued to provide the structure for political contention.

[18]These include urban density in the year 1000, muslim rule, pagan tribes, the use of elected monarchy, whether the region belonged to the Roman empire, whether it belonged to the Carolingian empire, whether it has a coast, or is on the Atlantic coast, the age of the state, and heating degree days.

Table 1 – Baseline Results with Alternative Independent Variables

Dependent variable is Log of GDP per capita averaged 2007-09

	Total Male Heirs	Weighted ave. # Male Heirs	# of Zero Male Heirs	% Yr with Male Heir	% Male	Firstborn % Male
	(1)	(2)	(3)	(4)	(5)	(6)
Coef. Estimate	0.012	0.248	−0.412	1.647	7.308	1.317
	(0.004)**	(0.079)**	(0.012)*	(0.502)**	(1.118)**	(0.317)**
	[0.006]†	[0.131]†	[0.022]†	[0.826]†	[2.894]*	[0.584]*
	{0.005}*	{0.146}†	{0.021}†	{0.764}*	{3.028}*	{0.570}*
N	114	114	114	114	114	114
R^2	0.085	0.080	0.091	0.072	0.276	0.133

†p < .10; *p < .05; **p < .01

Note: OLS estimates of the effects of various independent variables on Log of GDP per capita adjusted for PPP and averaged between 2007 and 2009. The independent variable in column (1) is total male heirs, in column (2) is the weighted average number of male heirs to each monarch using the lengths of the monarchs' reigns as weights, in column (3) is the number of times a monarch died or was replaced without any male heirs, in column (4) is the fraction of years ruled by a monarch who had at least one male heir at the time of death or replacement, in column (5) is percent male, and in column (6) is the percent of males among only firstborn children of monarchs. Standard errors in parentheses. Standard errors clustered at the macro-polity level in square brackets. Block bootstrapped standard errors in curly brackets.

Appendix A.2 that the effect of environmental factors on sex ratios is unlikely to be accounting for the effect of percent male on contemporary development.[19] Nevertheless, between the last two measures (percent male and firstborn percent male) we face a tradeoff. Whereas firstborn percent male cannot be affected by endogenous stopping rules, percent male can—though it is unlikely that it would be heavily affected since it is an average over many children. On the other hand, percent male is a less noisy measure of the availability of male heirs than is firstborn percent male, which may possibly account for why the measured effect in column (6) is attenuated in comparison to that of column (5). Since we find limited evidence for stopping rules in Supplemental Appendix A.3, we resolve this tradeoff in favor of the percent male measure. Figure 2 shows the bivariate relationship between percent male and GDP per capita with units labeled by their NUTS region code.

[19]It is well known in the demography literature that sex ratios can be affected by environmental factors. For example, the economic stress caused by German re-unification caused the proportion of male births to rise by 0.004. However, the difference in our percent male variable between the richest and poorest quartiles of European regions is much larger at 0.047. Figure A.1 in the supplemental appendix provides additional such evidence that our results are probably not being driven by the effect of environmental factors and parental traits on sex ratios.

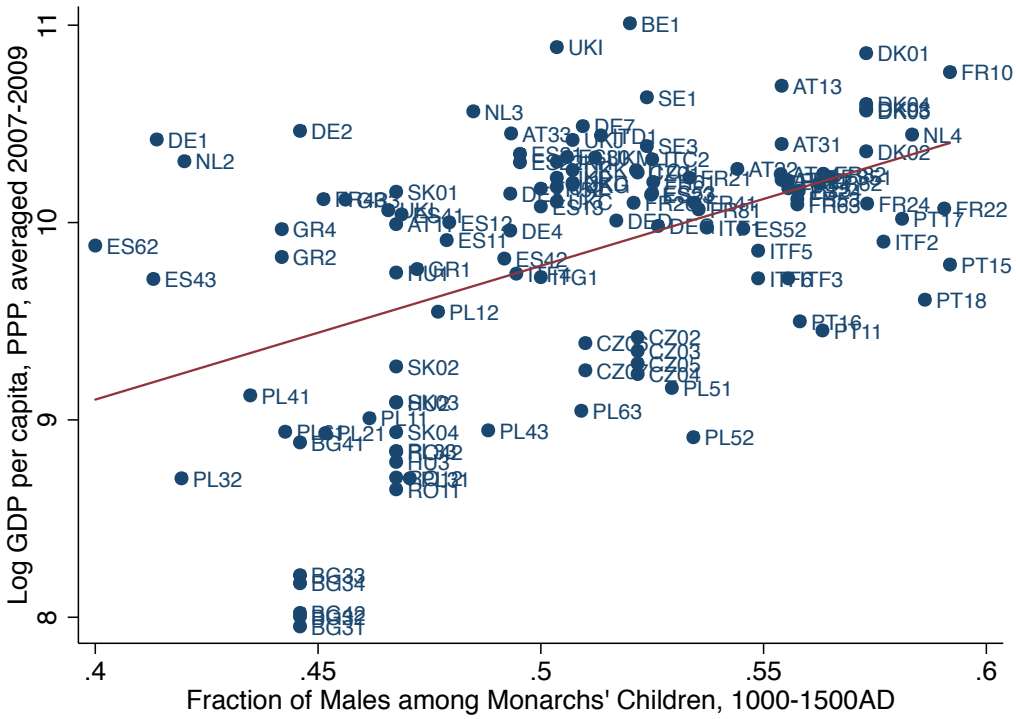

Figure 2. The fraction of males among all legitimate children of monarchs in the period 1000-1500AD plotted against Log of GDP per capita adjusted for purchasing power and averaged between 2007-09. The unit of data are NUTS regions, and data points are labeled by their NUTS code. The Ile-de-France is FR10 and the Subcarpathian province is PL32.

5.2 Alternative Samples and Specifications

In Supplemental Appendix A.4, we report results from an alternative analysis where we redefine the unit of analysis to be the "medieval polity" in particular year. A medieval polity in year 1000, for example, consists of the area that was ruled by a particular ruler in year 1000. Medieval borders are changing rapidly and dramatically over the five-hundred-year period of our analysis, as medieval rulers gained and lost territory frequently.[20] So, to define the borders of a medieval polity, we need to fix a particular year, which conceals much of the internal variation in dynastic experiences and dramatically reduces the number of observations for any particular year since most rulers ruled over multiple regions. Despite this, our percent male variable has a discernible effect on contemporary GDP per capita when we redefine the unit of analysis to be the medieval

[20]For example, the kings of England gained and lost much of modern France in our period, and the kings of Castile gradually gained a great deal of territory from their Muslim neighbors.

polity by fixing political boundaries at the turn of each century from 1000-1500AD. In addition to this, we also report the results of a specification where we use "treatment units" as the units of analysis.[21]

In Supplemental Appendix A.5, we report some additional robustness checks. First, as Figure 1 indicates, there are substantial differences in our main independent variable across larger regional blocs, raising concerns that our estimates are being driven by particular clusters of regions. For example, most of Poland is poorer than most of France, and has much lower values of percent male. We address this concern by redoing the analysis after removing various various geographic clusters of macro-polities, and showing that the effect of percent male on contemporary development is positive and relatively stable across these subsamples. Second, we show that our results are also robust to introducing modern country-fixed effects. We note, however, that the estimate of the effect of percent male from this specification potentially suffers from serious post-treatment bias, since the map of Europe changes frequently and very dramatically after 1500 and these changes may be correlated with region characteristics. Third, we show that our results are robust to including the seven omitted regions of Poland and the Czech Republic. Fourth, we show that they are robust to varying the 200 year cutoff that defines the baseline sample. Fifth, we show that our results are robust to removing capital regions from the analysis.[22] Finally, we show that the results are robust to removing foreign rulers as well. We recomputed the percent male measure after removing the children of monarchs who came to power through a coup and were not members of the dynasty that was in place, and find that this variable still has a large positive effect on contemporary GDP per capita. This suggests that our results are not driven by the possibility that monarchs with more male heirs conquered more polities, especially richer ones, and are thus over-represented in the data.

5.3 Multiple Male Heirs

In Supplemental Appendix A.6, we investigate whether having multiple male heirs is harmful for development, because perhaps it leads these heirs to conflict over succession.

[21] Treatment units are the largest clusters of geographically contiguous NUTS regions for which the percent male variable does not vary. The results are very similar to the results from our baseline specification.

[22] Regions containing a country capital may be dramatically different from other regions in terms of development. For example, GDP per capita in the Ile-de-France ($66,229 in 2009), for example, is much higher than in other French regions (the second highest is Rhône-Alpes at $40,833). However, we note that estimates from this specification may also suffer from post-treatment bias since becoming a capital region may be affected by percent male, as we argued above in the case of Paris.

We find no support for this hypothesis: having multiple as opposed to only one male heir is not any more harmful for development, and may be beneficial. The result is not surprising, given that most polities had relatively clear succession orders for close males relatives of the monarch regardless of the succession rule. For example, in polities that used primogeniture, the monarch's oldest male son is first in the line of succession, followed by the second oldest male son, etc. Each potential male successor is likely to have known his position in the succession hierarchy. Nobles would have clear and coordinated expectations regarding the succession hierarchy as well. Where a female or female-line heir fell in the order of succession was, on the other hand, much less clear. Therefore, in the absence of close male relatives, succession disputes could be common, but they were unlikely to be common when the monarch had many potential male successors.

5.4 Illegitimate Children Placebo Test

Since norms against succession by illegitimate children were very strong—though broken in a few notable cases by dynamic men—we have no reason to think that the sex ratio of illegitimate children should have influenced medieval politics.[23] Though illegitimate children are likely to be underreported, we have data on several hundred in our period. We ran an OLS model of the effect of the percent of illegitimate male children among all illegitimate children of European monarchs that ruled a particular region of Europe between 1000-1500AD on our main dependent variable, Log of contemporary GDP per capita—the same specification as in Table 1 column (5), but with percent male among illegitimate children as the independent variable. The coefficient estimate in a sample only slightly smaller than our baseline sample was small, barely discernible, and actually *negative* at -0.504 ($s.e. = 0.273$, macro-polity clustered $s.e. = 0.506$, block bootstrapped $s.e. = .573$, $N = 107$, $R^2 = 0.031$). This provides additional justification to our claim that the large positive results we find in our baseline estimates are probably not being driven by underlying environmental differences.

5.5 Sensitivity to Biased Recording of Legitimate Males

Although royal genealogies are some of the best sources of data from the medieval period, one may be concerned that biased recording in the numbers of legitimate males may be driving our results. For example, rulers in already stronger states may have been more

[23] William the Conqueror, for instance, was an illegitimate son of Robert I, Duke of Normandy. On the other hand, there is no example of succession by or through an illegitimate daughter in our data.

capable of "legitimizing" an illegitimate heir, or claiming a son that is not theirs. The data do not show signs of biased recording, however. For example, the monarchs in our data had male children 50.4% of the time, corresponding to a ratio slightly below that of the contemporary western world (Grech, Savona-Ventura and Vassallo-Agius, 2002).

Nevertheless, to address the concern that biased recording is driving our results, we report the results of a sensitivity analysis in which we continued to randomly delete legitimate male heirs of rulers that ruled regions with higher than median contemporary GDP per capita until the effect of percent male on GDP per capita in the specification of column (5) in Table 1 lost significance at 10%. We did this a hundred times. The mean number of deletions needed was 397 ($s.d.$ = 10.25, min = 360, max = 430), or 14.5% of male heirs. Thus, we estimate that more than one in seven legitimate princes in the wealthiest regions would have to be illegitimate for our results to be explained by biased recording. This is a fairly conservative analysis since it assumes that *only* the monarchs of the wealthiest regions could legitimize their illegitimate heirs— i.e., none of the monarchs of the poorest regions could.

5.6 Luck

Our interpretation of the effect of percent male on contemporary development is that "luck" has played an important role in setting development paths. The balance tests and evidence on environmental factors reported in Supplemental Appendix A.1 and A.2 support this interpretation. We now report some additional evidence that the percent male variable can be interpreted as luck. Fixing the total number of children of each ruler, we randomly and independently drew a new sex for each child of each ruler, with the probability of a male draw fixed at 0.51. This number corresponds to the modern sex ratio at birth estimated for North America and Europe, where sex-selective abortions are much rarer (almost nonexistent) in comparison to the rest of the world (Grech, Savona-Ventura and Vassallo-Agius, 2002). We then computed values of percent male for each region from the simulated data. For each of the 1000 simulations, we then did a Kolmogorv-Smirnov (KS) test of the hypothesis that our empirically observed distribution of sex ratios in European regions are from the same distribution as the simulated sex ratios. Only 6.4% of p-values were below 0.10 and only 2.4% were below 0.05.[24] This suggests that it is difficult to reject the hypothesis that the distribution of percent male in the data is consistent with luck.

[24] 9.7% were below 0.15, 15.2% were below 0.2 and 63.4% were below 0.5.

Table 2 – Tracing the Effects Through Time

Dependent variables are Log of Urban Density, various years

	1000	1300	1400	1500	1600	1700	1800
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
% Male	1.541	3.371	3.505	3.402	3.529	4.286	4.982
	(1.103)	(1.567)*	(1.705)*	(1.765)†	(2.105)†	(2.327)†	(2.563)†
	[1.195]	[1.804]†	[1.370]*	[2.143]	[2.006]	[2.371]†	[3.097]
	{1.309}	{1.989}†	{1.479}*	{2.083}	{2.316}	{2.142}*	{2.975}†
N	114	114	114	114	114	114	114
R^2	0.017	0.040	0.036	0.032	0.025	0.029	0.033

†p < .10; *p < .05; **p < .01

Note: OLS estimates of the effects percent male on Log of Urban Density in the years 1000, 1300, 1400, 1500, 1600, 1700 and 1800 in columns (1)-(7) respectively. Urban Density is defined as (1+urban population) divided by area of the region in square km. Standard errors in parentheses. Standard errors clustered at the macro-polity level in square brackets. Block bootstrapped standard errors in curly brackets.

6 Evidence for the Mechanism

6.1 Effects Through Time

If the availability of male heirs in the medieval period has had a persistent effect on development then we should be able to trace the effects of our main explanatory variable, percent male, on measures of economic development over time. Direct measures of development are generally not available prior to the late 20th century, so we use urbanization data from Bairoch (1991) to measure development, which is the standard practice in the literature (see, e.g., DeLong and Shleifer, 1993; Acemoglu, Johnson and Robinson, 2002). Table 2 shows that there is essentially no relationship between percent male and urban density in the year 1000, as our theory would predict. However, in the year 1300 we begin to see a positive relationship, which gets stronger in subsequent centuries, implying a growing divergence in economic prosperity over time. A one standard deviation increase in percent male is associated with a 17.2% increase in urban density in 1300, which rises steadily to reach a 26.4% increase in 1800 urban density, which is just over three fifths of the effect size we estimate in our baseline specification in column (5) of Table 1. These increasing effects are consistent with theories in which shocks affect trajectories rather than levels of development. Also, note that the precisions of the estimates in Table 2 appear to diminish over time, which is consistent with the idea that other intervening shocks made the effects of percent male less precise over time, though they have not completely undone these effects.

Table 3 – Male Heirs, Coups and Conflicts

	Coups per year	Wars per year
	(1)	(2)
% Male	-0.056	-0.571
	(0.014)**	(0.224)*
	[0.038]	[0.302]†
	{0.034}†	{0.343}†
N	117	86
R^2	0.117	0.072
	Ascension by coup	War
	(3)	(4)
Lagged Legitimate Male Heirs	-0.647	-0.106
	(0.126)**	(0.024)**
Region Fixed Effects	No	Yes
Decade Fixed Effects	No	Yes
Observations	1,399	51,349

† p<0.1, * p<0.05, ** p<0.01

Note: OLS estimates of the effects of percent male on the number of violent transitions per year and the number of internal wars per year in columns (1) and (2) respectively. Column (3) and (4) in the lower panel are estimates from a panel logistic regression of the effect of the lagged number of legitimate male heirs on whether or not ascension by the next monarch involved a violent transition, and the effect on wars respectively. The unit of analysis in model (3) is the monarch-polity, and in model (4) is the region-year. Standard errors in parentheses. Standard errors clustered at the macro-polity level in square brackets. Block bootstrapped standard errors in curly brackets.

6.2 Coups, Conflict and Quality of Government

Our theory says that the likelihood of having male heirs affects the occurrence of conflict and political instability, which in turn affect contemporary development via state-building. Table 3 provides evidence for the first link in this mechanism. Column (1) of the upper panel shows that percent male has a negative effect on the frequency with which monarchs that were removed from power in a coup in a given region—either by being killed or by being forcibly deposed—which we treat as a proxy for political instability. Column (2) shows that percent male has a negative effect on the frequency of internal wars. The internal war data is based on all wars mentioned in Kohn (2013), with a war being coded for every region-year in which fighting occurred within the region that

Table 4 – Coups, Conflicts and Development

	Log GDP per capita		Quality of Government	
	(1)	(2)	(3)	(4)
Coups	-43.705		-74.301	
	(6.822)**		(11.573)**	
	[10.553]**		[26.636]*	
	{16.389}**		{34.253}*	
Wars		-1.228		-1.864
		(0.324)**		(1.051)†
		[0.388]**		[1.929]
		{0.524}*		{1.880}
N	114	83	114	83
R^2	0.268	0.151	0.269	0.037

† p<0.1, * p<0.05, ** p<0.01

Note: OLS estimates of the effects of the number of coups and the number of wars on measures of contemporary development. The development measure in columns (1) and (2) is Log of GDP per capita, adjusted for PPE and averaged 2007-2009. In columns (3) and (4) it is a composite measure from the QoG EU Regional Database containing three sub-composites: "Quality," "Impart" and "Corrupt," all of which are contemporary measures based on surveys conducted in the last ten years. "Quality" is a composite measure of the quality of healthcare provision, public education and law enforcement, the extent to which corruption exists in regional elections, and the extent to which the media reports corruption by politicians. "Impart" is a measure of impartiality in the provision of heath, education and law enforcement. "Corrupt" is a measure of the control of corruption in the provision of health, education and law enforcement as well as perceived control on corruption in the public sector. Standard errors in parentheses. Standard errors clustered at the macro-polity level in square brackets. Block bootstrapped standard errors in curly brackets.

year.[25] Since Kohn's data for Eastern Europe are very poor, we drop Eastern Europe when we use war as a dependent or independent variable. Columns (3) shows that in a panel logistic regression with monarch-polity as the unit of analysis, the estimated effect of the lagged number of legitimate male heirs on the occurrence of a violent transition is negative. Column (4) shows that the same is true with war as the dependent variable, and region-year as the unit of analysis.

Table 4 provides evidence for the second and third links in the mechanism. Columns (1) and (2) show that the number of medieval coups and internal medieval wars are negatively correlated with contemporary GDP per capita. Columns (3) and (4) show that they are negatively correlated with contemporary Quality of Government, which is a measure of the quality of contemporary state institutions from the QoG EU Regional Database (see the note under Table 4 for details). This provides some plausibility to

[25] We combined information from Kohn (2013) with information from Classen et al. (2009) and modern region boundaries to code these wars.

Table 5 – State Development for Three Polities in 1500

Polity	1500 Revenues	% Male	Coups	Wars	GDP pc	QoG
Castile	2.55	.490	2.36	0.207	$23,859	-0.609
England	3.46	.519	7.70	0.190	$30,200	1.180
France	5.67	.551	2.30	0.088	$27,169	0.350

Note: Various statistics for the three polities for which we have state revenue data from 1500 and exchange rate estimates. The 1500 revenue data were collected by Bonney (1995) and are reported in the European Regional Finance Dataset. We converted the data from local currency into ducats (Venetian gold coins) and normalized by the area of the polity in 1500. Percent male is an average across the regions of the polity. Coups is the average number of coups that occur across the regions of the polity. Wars is the average proportion of region-years in which an internal war was fought. GDP per capita is modern income estimated in 2009 for the modern state or region that corresponds to the 1500 polity. QoG is the average Quality of Government measure described in the note below Table 4.

the second and third links in our mechanism. Because we do not have measures of state quality from the medieval period with wide enough coverage, we are not able to provide any more direct evidence for the second link. However, Table 5 presents data on state revenues collected in 1500 for three polities for which we have revenue data and exchange rates (so as to make them comparable). Stronger states were able to collect larger revenues. The data suggest that the Castilian state was weaker than the English or French states, and had more frequent internal wars, though it had fewer coups than did England. Our measures of contemporary development (GDP per capita and Quality of Government) are also lower in Castile than they are in England or France. Thus, the data are largely consistent with the idea that internal political conflicts are associated with lower levels of medieval state development, and greater medieval state development is positively associated with contemporary development.

6.3 The Institutionalization of Inheritance Norms

Different areas of medieval Europe had different inheritance norms, and different levels of institutionalization of these norms. For example, many areas of the former Carolingian Empire practiced Salic law, which prohibited inheritance through female lines of decent. Polities that were not part of the former Carolingian Empire may have had equally high amount of un-coordinated, or un-institutionalized, cultural gender bias against female-line inheritance, but they did not institutionalize a tradition that outright prohibited it. Here, we are interested in understanding how the effects of our percent male variable vary with the degree of institutionalization of inheritance norms.

For the case of Salic law, theory is silent as to whether we should expect percent male to have a higher or lower effect on contemporary development in Salic law regions than elsewhere. If cultural gender bias was much higher in Salic law regions than elsewhere, violent conflicts resulting from succession disputes could be more common in Salic law regions when percent male is lower and close male relatives are scarcer. Alternatively, because succession disputes often arose from female-line heirs prosecuting their claims to the throne, violent conflict might actually be rarer in regions that practiced Salic law because female-line heirs in these regions would less frequently dispute successions by more distant male-line relatives when close male relatives were not available. In this case, percent male might have a smaller effect on development in areas that practiced Salic law, because gender bias is so highly institutionalized that conflict between male- and female-line heirs is rarer. The results of column (1) in Table 6 support the second perspective: percent male has essentially no effect on contemporary development in areas that practiced Salic law, whereas it has a very large effect on contemporary development in other regions.

Another instance of variation in the degree of institutionalization of succession rules comes from comparing the tribal areas that practiced Germanic law to those that were exposed to Roman legal traditions. Because Germanic law tended to be less codified than Roman law, we would expect to see the effect of percent male be lower in the non-tribal areas that were exposed to Roman law than in the tribal areas that practiced Germanic law.[26] This hypothesis is confirmed by column (2) of Table 6, which shows that in the non-tribal polities of medieval Europe that had Roman and Greek traditions, the effect of percent male is significantly lower than it is in the tribal areas that had more weakly institutionalized succession rules. Again, the historical evidence points to political instability being greater in the tribal areas than in polities that drew on their Roman and Greek traditions to establish coordinated rules governing succession when close male relatives were unavailable.[27]

A third instance of variation in the degree of institutionalization of inheritance norms comes from comparing monarchies that used primogeniture as their succession norm for more years to those that use primogeniture in fewer years. According to Kokkonen and

[26]The tribal regions, like the regions that practiced Salic law, had more precise and more deeply specified succession rules that their citizens and nobles could rely on even when the monarch had no close male relatives. However, this is very much a distinct analysis than the analysis of Salic law versus non-Salic law regions, as evidenced by the fact that the 42 Salic law regions in our sample are exactly evenly divided between the sets of 54 non-tribal polities and 63 tribal polities.

[27]For example, the average number coups from 1000-1500AD for tribal areas is higher, at 4.746, than for non-tribal areas, at 3.056, with the difference being statistically significant at the 1% level.

Table 6 – Interactions with Inheritance Norms and Women Rulers

Dependent variable is Log of GDP per capita

$Z =$	Salic	Nontribal	Primog.	Women
	(1)	(2)	(3)	(4)
% Male	8.891	12.312	11.829	7.436
	$(1.261)^{**}$	$(1.495)^{**}$	$(1.551)^{**}$	$(1.427)^{**}$
	$[3.632]^{*}$	$[4.617]^{*}$	$[3.747]^{**}$	$[3.084]^{*}$
	$\{3.860\}^{*}$	$\{5.825\}^{*}$	$\{4.770\}^{*}$	$\{3.448\}^{*}$
Z	4.883	5.110	5.973	0.055
	$(1.203)^{**}$	$(1.083)^{**}$	$(1.387)^{**}$	(0.564)
	$[1.865]^{*}$	$[2.743]^{\dagger}$	$[2.567]^{*}$	[1.009]
	$\{2.008\}^{*}$	$\{3.899\}$	$\{3.573\}^{*}$	$\{1.458\}$
% Male $\times$ Z	-8.750	-10.033	-11.634	-0.067
	$(2.314)^{**}$	$(2.117)^{**}$	$(2.701)^{**}$	(1.121)
	$[3.648]^{*}$	$[5.219]^{\dagger}$	$[4.754]^{*}$	[1.990]
	$\{3.991\}^{*}$	$\{7.479\}$	$\{6.611\}^{\dagger}$	$\{2.974\}$
N	114	114	114	114
R^2	0.414	0.399	0.381	0.277

$^{\dagger}p < .10$; $^{*}p < .05$; $^{**}p < .01$

Note: OLS estimates of models interacting percent male with other variables, with Log of GDP per capita as the dependent variable. Column (1) is the interaction with regions that used Salic law, column (2) with non-tribal regions that adopted Roman law as opposed to Germanic law, column (3) with the fraction of years that the region used primogeniture as its succession rule, and column (4) with number of women rulers. Standard errors in parentheses. Standard errors clustered at the macro-polity level in square brackets. Block bootstrapped standard errors in curly brackets.

Sundell (2014) and Blaydes and Chaney (2013), European polities gradually began to adopt primogeniture as their succession rule during the period of our study, increasing its institutionalization over time. Thus, regions that used primogeniture for more years are likely to be those in which inheritance norms were better institutionalized. Column (3) of Table 6 shows that the effect of percent male varies with the fraction of years that a polity used primogeniture in ways similar to how the effect varies with whether or not a polity used Salic Law or Roman Law: the effect of percent male is weaker in polities that increased the degree of institutionalization of their succession rule by adopting primogeniture.[28]

[28]We also show in Supplemental Appendix A.7 that the institutionalization of primogeniture varied with the availability of male heirs. We show that percent male positively affects the fraction of years that a polity used primogeniture as its succession rule, and that the legitimate number of male heirs available to the ruling monarch positively affects the probability that primogeniture is adopted in the subsequent year.

The results of Table 6 columns (1) - (3) suggest that the degree of institutionalization of succession rules matters more for explaining variation in the effect of percent male on contemporary development, than does any possible variation in gender bias that might account for variation in the adoption of these norms. Indeed, political gender bias is likely to have been high across all of Europe. This view is supported by the fact that there is a total of only 91 women rulers in our data (only 10.6% of the total number of rulers). It is also supported by the result of column (4) in Table 6, which shows that the effect of percent male does not discernibly vary with the number of female rulers.

7 Conclusion

Europe today—prosperous as it is in comparison to many other parts of the world—exhibits a great deal of internal variation in development levels across its regions. In this paper, we argued that a substantial part of this variation is due to the uneven development of state institutions across medieval European polities. We showed that the likelihood of the availability of male heirs to a European region's monarchies in the period 1000-1500AD has a positive effect on contemporary development in that region. Since the unavailability of male heirs was an important driver of internal conflict and political instability, which in turn affected state development, our approach enabled us to sidestep the problem that reliable measures of medieval state development are scarce, as well as the fact that medieval state development could have been affected by a host of unobservable region characteristics that directly affect contemporary development.

Besides emphasizing the importance of state building in general, our results show the pre-1500 period specifically was an important period in the political development of the modern world, and that within Europe the political trajectories of regions may have diverged much earlier than is sometimes argued. The emergence of the first modern states in this period was so important, and the states themselves so fragile, that even small disruptions could have long term consequences—consequences that we have shown are measurable even after centuries of revolution, industrialization, war and institutional growth. In addition, our results reinforce the findings of the political economy of development literature on the negative effects of violent conflict, and the importance of political stability for development.

Finally, our findings emphasize the importance of chance, and how chance works in combination with both culture and institutions in shaping development paths. In regions where accidents of male birth allowed for a series of uncontested leadership transitions, rulers were able to build the state institutions necessary to support economic

development. In areas burdened by a greater potential for politically instability, the path to economic prosperity was much more arduous. Far from being determined solely by natural resources, disease environments, preexisting political institutions, or even the plans of their rulers, the fortunes of regions like Naples and France were influenced by accidents of biology. As such, the results provide both a rejoinder to a focus on large structural predictors of social scientific phenomena, reminding us of the chaos of politics in an unpredictable world.

A. Supplemental Appendix

A.1. Balance Tests

Table A.1 shows that percent male is largely balanced across a variety of region characteristics, including urban density in 1000, which is a measure of pre-existing economic development; state age in 1000, and whether the region was ruled by Romans, Carolingians or Muslims, which together may proxy for existing levels of state institutions; and geographic measures such as whether the region is on the Atlantic coast, and overall climatic variation (the number of degree-days that the average temperature deviates from room temperature); existing levels of institutionalization, as indicated by whether the region used elections to select its monarchs in 1000, and whether it had pagan tribes in 1000. The data for are described in more detail in the note below the table.

Table A.1 – Balance Tests

Dependent variable is % Male

	Coef.	*s.e.*	clust. *s.e*	b.b. *s.e.*	N	R^2
Urban Density in 1000AD	0.010	0.008	0.009	0.011	121	0.015
Muslim Rule in 1000AD	0.005	0.014	0.013	0.017	124	0.001
Pagan Tribes in 1000AD	−0.022	0.017	0.020	0.029	124	0.015
Elected Monarchy in 1000AD	0.032	0.304	0.255	0.171	124	0.000
Roman Empire	0.013	0.009	0.016	0.020	124	0.020
Carolingian Empire	0.022	0.008*	0.016	0.017	124	0.051
Atlantic Coast	0.014	0.011	0.016	0.016	124	0.014
State Age in 1000AD	−0.102	0.385	0.630	0.754	122	0.001
Heating Degree Days	−2.984	5.696	9.790	9.647	117	0.002

† p<0.1, * p<0.05, ** p<0.01

Note: OLS estimates of the effect of different variables on percent male. Each row is a separate univariate regression. The first variable, Urban Density in 1000AD, is the size of urban population divided by the area of the region. Muslim Rule, Pagan Tribes and Elected Monarchy are indicators for whether these existed in the region in 1000AD. Roman Empire, Carolingian Empire are indicators for whether the region ever belonged to these empires. Atlantic Coast is an indicator for whether the region has an Atlantic coast. State age in 1000AD is a measure from Bockstette, Chanda and Putterman (2002) on state antiquity, and Heating Degree Days, collected from the Eurostat database, is the number of degree-days in a year that the average temperature of the region deviates from room temperature. Samples include the baseline sample and the the seven regions from the Czech Republic and Poland. The third, fourth and fifth columns are standard errors, macro-polity clustered standard errors and block bootstrapped standard errors.

A.2. Environmental Factors and Sex Ratios

One critique of our main finding in column (5) of Table 1 is that the sex ratio of children is endogenous to a social or environmental traits of the region. While this may be plausible given the fact that a large literature in demography has showed that sex ratios at birth are affected by environmental or parental characteristics, we present evidence here casting doubt on the concern that it is heavily influencing our results.

Before presenting this evidence, we note that the children of monarchs in all regions, even poor ones, were likely to have had access to very high absolute levels of nutrition and attention by the standards of the time. Conditional on being a monarch, we suspect that regional differences in the immediate biological environment of rulers in different regions should be small. Moreover, the effects of environmental factors on sex ratios found in the demography literature tend to be very small, and owe their discovery to the very large datasets common in this literature. Relative to the effects found in the demography literature, the differences we find between rich and poor regions are extremely large, as shown in Figure A.1. The figure shows the effect sizes of various environmental factors, events or family/parental traits on the percent of male births from previous studies, as well as the differences between the top and bottom quartiles of modern regional GDP per capita in the percent male variable of this paper (see the note below the figure). The economic stress of the German re-unification, for instance, caused the ratio of male births to increase by .004. World War II, a calamitous event, had an even smaller effect on the precent of male births in Europe. The difference in our percent male variable between the richest and poorest quartiles of European regions, by contrast, is .047. We take these comparisons to indicate that any pre-existing difference in the ratio of male children is probably too small to be driving our results.

A.3. Male-Preferred Stopping Rules

Another concern with our approach is that the sex ratios of royal children are the product of male-preferred fertility stopping rules within families. We showed in Table 1 of the paper that such stopping rules are not affecting our results by showing that the percent of *firstborn* children that are male also has a significant and sizable effect on contemporary development. Since the sex of the firstborn child is also an indicator (albeit an imperfect one) of the likelihood of that male heirs are available, but cannot be affect by *any* kind of stopping rule, this shows that our results are not driven by any biases created by gender-related stopping rules. We also argue that the effects of percent male that we estimate are also unlikely to be affected by a male-preferred stopping rule.

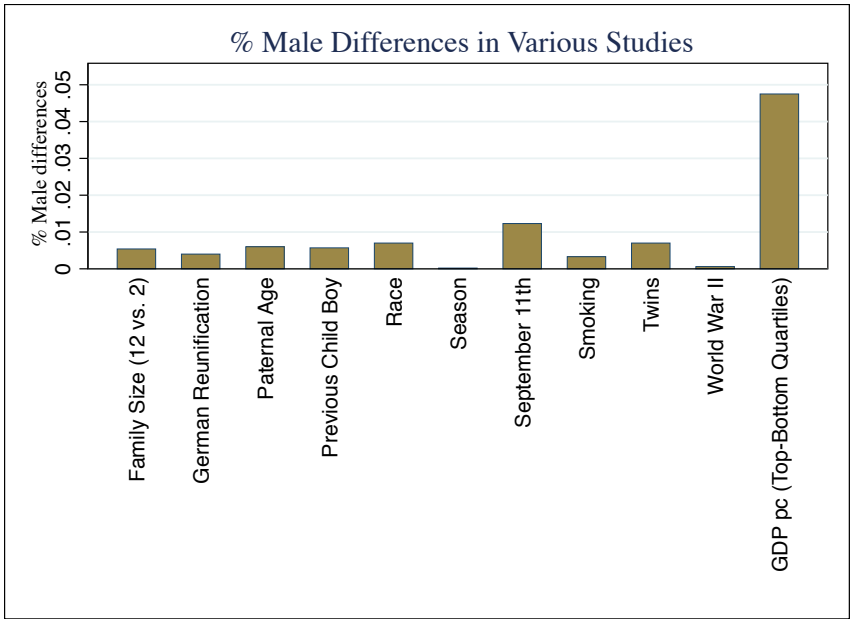

Figure A.1. Bars represent observed differences between the proportion male in treatment and control groups in selected studies. Visaria (1967), for instance, found that the percent of male births was .514 for whites and .507 for blacks, giving a treatment effect of .007. Other determinants are season (Lyster, 1971), gender of the previous child (Malinvaud, 1955), family size (Malinvaud, 1955), the calamity of World War II (MacMahon and Pugh, 1954), smoking (James, 1987), twin births (Jacobsen, Møller and Mouritsen, 1999), paternal age (Jacobsen, Møller and Mouritsen, 1999), the calamity caused by the September 11th terrorist attacks (Catalano et al., 2006), and the stress of German re-unification (Catalano, 2003). The bars on the right shows the comparable figure for our percent male variable, comparing percent male for the poorest and richest quartiles using our measure of GDP per capita, adjusted for PPP, and averaged between 2007-09.

The concern is that because monarchs had strong incentives to continue their dynasties, it is plausible that they would keep having children until they had sufficiently many boys, skewing the distribution of the sex ratio within a family. Within a nuclear family, it is possible that such stopping rules have large effects on the sex ratio averaged across families. In larger populations, however, the effect of such stopping rules can only have a small effect on the population sex ratio, so long as the probability of producing a boy is constant across couples. This fact is a basic result in mathematical demography (Keyfitz et al., 2005). Without sex-selective abortions that directly affect the underlying probability of male births, any stopping rule would merely change the distribution of boys and girls across nuclear families, with some parents keeping their families small after having a boy and others having many girls in order to have a boy. This is why we construct the percent male measure by calculating proportion of male children among *all* children of monarchs over the five-hundred-year period of our study,

Table A.2 – Stopping Rules

Dependent variables are the decision to have the $k+1$th child

	$k=1$	$k=2$	$k=3$	$k=4$	$k=5$	$k=6$
% Male among first k children	-0.741^{*}	-0.387	0.170	-1.438^{*}	-0.350^{*}	-0.634
	(0.253)	(0.336)	(0.386)	(0.625)	(0.588)	(0.447)
N	532	440	367	272	227	170
R^2	0.018	0.003	0.001	0.021	0.001	0.003

** p<0.01, * p<0.05, † p<0.1

Note: Logistic regressions of the decision to have the $k+1$th child on the fraction of males among the first k children. Standard errors in parentheses.

rather than averaging percent male across nuclear families. Furthermore, it is unlikely that male-preferred stopping rules are affecting our results since under a male-preferred stopping rule, the fraction of male children within a family (or in a small population of families) should be *negatively* correlated with family size (Keyfitz et al., 2005), but we have no evidence of this in our data. In fact, the fraction of legitimate male children in a polity is actually positively correlated with the average number of legitimate children of rulers in the 500 year period of our study, with a correlation coefficient of +0.34.

Finally, Table A.2 shows very limited evidence for the any kind of sex-dependent stopping rule. The likelihood that a medieval European monarch has a second child when the first one is male is lower than when the first one is female, but after the first child there is no discernible effect of the sex ratio among the first k children on the choice to have the $k+1$th child, except at $k=4$. We take this as additional evidence that stopping rules are probably not seriously influencing our estimates of percent male's effect on contemporary development.

A.4. Medieval Polity & Treatment Units as Units of Analysis

Table A.3 shows that our results are largely robust to redefining the unit of our analysis to be the medieval polity by choosing the political boundaries at the turn of each century in the five hundred year period of our analysis. A "medieval polity in year 1000," for example, consists of the area that was ruled by a particular ruler in year 1000. We computed contemporary GDP per capita for such polities by taking a population weighted average of GDP per capita across modern regions spanned by these polities. Again, our coding is not perfect because some modern regions that we discarded were divided among medieval rulers.

Table A.3 – Medieval Polity as the Unit of Analysis

Dependent variable is Log of GDP per capita averaged 2007-09

	(1)	(2)	(3)	(4)	(5)	(6)
% Male	4.133	3.146	5.679	4.939	3.979	5.472
	(2.272)†	(2.013)	(2.240)*	(2.185)*	(2.068)†	(2.684)*
N	25	32	33	33	28	20
R^2	0.123	0.128	0.151	0.141	0.124	0.187
Medieval Polity Year	1000	1100	1200	1300	1400	1500

†p $< .10$; *p $< .05$; **p $< .01$

Note: OLS estimates of the effect of percent male on Log of GDP per capita using the medieval polity as the unit of analysis. Since medieval borders are changing, we define these polities at snapshots of 100 year intervals. Standard errors in parentheses.

In yet an alternative approach, we show that are results are largely similar when we use "treatment units" as our units of analysis. We define a "treatment unit" to be the largest cluster of geographically contiguous NUTS regions for which the percent male variable does not vary. For example, Walachia, would be considered a single unit of observation since all three modern NUTS since the same sequence of rulers ruled all three regions of Walachia. When we use the baseline specification of column (5) in Table 1 to estimate the effect of percent male with treatment units as the units of analysis, we get a coefficient of 6.483 ($s.e.$ = 1.198, macro-polity clustered $s.e.$ = 2.905, block bootstrapped $s.e = 2.751$, $N = 98$, $R^2 = 0.234$).

A.5. Alternative Specifications and Samples

In Tables A.4 and A.5 we present the results of various additional robustness checks. Table A.4 shows that our results are largely robust to removing various groups of macro-polities from the specification in column (5) of Table 1 in the main text. Column (1) of Table A.5 shows that our results hold not just across the borders of modern states, but also within them. This column reports our estimate of the effect of percent male on contemporary development when we introduce country dummies to our baseline specification. Here, the estimated effect of percent male diminishes to approximately one fifth of its effect without the country dummies, but is still significant at the 10% level. However, it is important to note that this estimate almost certainly suffers from post-treatment bias, primarily because the political map of Europe changed frequently and very dramatically even after 1500 and these changes might be correlated with region characteristics in ways that bias our results. Column (2) adds the seven omitted regions

Table A.4 – Robustness to Removing Groups of Macro-polities

Dependent variable is Log of GDP per capita averaged 2007-09

	(1)	(2)	(3)	(4)	(5)
% Male	6.588	10.311	8.714	5.161	5.738
	(1.224)**	(1.516)**	(1.196)**	(1.052)**	(1.233)**
	[2.730]*	[3.245]*	[3.018]*	[3.109]	[3.656]
	{2.515}*	{3.557}**	{2.774}**	{3.120}†	{4.098}
N	96	81	87	94	98
R^2	0.236	0.369	0.385	0.208	0.184
Removing	Britain and Scandinavia	France and Iberian Penin.	Holy Roman Empire	Southeast Europe	Northeast Europe

†p < .10; *p < .05; **p < .01

Note: OLS estimates of the effects of percent male on Log of GDP per capita for three subsamples and one specification that includes country fixed effects. Column (1) of Table A.4 removes England, Scotland, Denmark and Sweden. Column (2) removes France, Castile, Aragon and Portugal. Column (3) removes the Holy Roman Empire. Column (4) removes the Byzantine Empire, Sicily and Walachia. Column (5) removes Poland and Hungary. Standard errors in parentheses. Standard errors clustered at the macro-polity level in square brackets. Block bootstrapped standard errors in curly brackets.

from Poland and the Czech Republic to our baseline sample. Columns (3) and (4) vary the 200 year cutoff that defines the baseline sample to 100 years and 300 years. Column (5) removes the capitals of modern regions. The estimates from this specification probably also suffer from post-treatment bias since becoming the capital of a region may be linked to percent male, as in the case of Paris. In column (6), we recompute percent male after removing the children of monarchs who came to power through a coup and were not members of the dynasty that was in place and use this recomputed measure of the independent variable in the baseline specification.

A.6. Multiple Male Heirs

One might think that having multiple legitimate male heirs may lead these heirs to conflict over succession, resulting in more destructive conflict, weaker states and weaker development outcomes. To examine this possibility, we test the hypothesis that increasing the fraction of monarchs with multiple legitimate male heirs at the expense of the fraction of monarchs with only one legitimate male heir (i.e., holding fixed the fraction of monarchs with only no legitimate male heirs at the time of their death) is harmful for development. Specifically, we estimate the following model by OLS:

$$\text{Log GDP per capita}_j = \beta_0 + \beta_1 \text{ Zero Heirs}_j + \beta_2 \text{ More than one Heir}_j + \varepsilon_j$$

Table A.5 – Robustness to Defining Different Samples

Dependent variable is Log of GDP per capita averaged 2007-09

	(1)	(2)	(3)	(4)	(5)	(6)
% Male	1.594	7.083	7.418	7.221	7.147	5.850
	$(0.850)^{\dagger}$	$(1.148)^{**}$	$(1.109)^{**}$	$(1.212)^{**}$	$(1.177)^{**}$	$(0.905)^{**}$
		$[2.757]^{*}$	$[2.944]^{*}$	$[2.658]^{*}$	$[3.036]^{*}$	$[1.334]^{**}$
		$\{2.931\}^{*}$	$\{2.522\}^{*}$	$\{2.684\}^{**}$	$\{3.204\}^{*}$	$(1.291)^{**}$
N	114	121	120	93	98	121
R^2	0.878	0.261	0.275	0.281	0.277	0.260
Samp./Specif.	Country FE	Baseline + 7 regions	100 year cutoff	300 year cutoff	Capitals Removed	Foreigners Removed

$^{\dagger}p < .10$; $^{*}p < .05$; $^{**}p < .01$

Note: OLS estimates of the effect of percent male on Log of GDP per capita under alternative samples and specifications. Column (1) is the baseline specification but with modern country dummies included as covariates. Column (2) returns the seven omitted regions in the Czech Republic and Poland to the baseline sample. Columns (3) and (4) vary the 200 year cutoff described in Section 4 to 100 years and 300 years, respectively. Column (5) removes regions containing modern country capitals. Column (6) recomputes percent male after removing the children of monarchs who came to power through a coup and were not members of the ruling dynasty. Standard errors in parentheses. Standard errors clustered at the macro-polity level in square brackets. Block bootstrapped standard errors in curly brackets.

where Zero Heirs$_j$ is the fraction of monarchs of region j that had zero legitimate male heirs at the time of death or replacement, More than one Son$_j$ is the fraction of monarchs of region j that had multiple legitimate male heirs at the time of death or replacement, and ε_j is the error term. The hypothesis is that $\beta_2 \leq 0$. We can soundly reject this hypothesis: the OLS estimate of β_2 is 2.208 ($s.e. = 0.647$, macro-polity clustered $s.e = 1.220$, block bootstrapped $s.e. = 1.422$, $N = 114$, $R^2 = 0.177$).

A.7. Gradual Institutionalization of Inheritance Norms

Mmost European polities eventually adopted primogeniture as their succession norm at some point during the five-hundred-year period of our analysis (Kokkonen and Sundell, 2014; Blaydes and Chaney, 2013). However, according to Kokkonen and Sundell (2014), primogeniture was often abandoned in many cases even after it was adopted. For example, according to Kokkonen and Sundell (2014), Bohemia adopted primogeniture in 1230, abandoned it in 1305, readopted it in 1346, and abandoned it in 1419. Notably, both adoptions of primogeniture occurred under sovereigns with multiple male heirs, while both abandonments of it occurred under monarchs with no children. The experience of Bohemia suggests that the availability of male heirs could be an important determinant of which regions adopted primogeniture early, or for longer periods.

We find indirect evidence for the hypothesis that polities might have strategically adopted and abandoned primogeniture depending on the abundance or shortage of male heirs. For example, we find in an OLS specification that percent male has a positive effect of on the fraction of years in the five hundred year period of our analysis that a polity used primogeniture as its succession rule ($coef. = 2.349$, $s.e. = 0.660$, macro-polity clustered $s.e. = 1.103$, block bootstrapped $s.e. = 1.176$, $N = 124$, $R^2 = 0.094$). We also find in a panel logistic regression that the adoption of primogeniture (1 if adopted, 0 if not) is positively affected by the lagged legitimate number of male heirs ($coef. = 0.100$, $s.e. = 0.005$, number of regions = 82). These results provide evidence that the availability of male heirs also affected the speed and degree of institutionalization of succession norms.

A.8. List of Succession-Related Internal Wars

War	Start Date	End Date
Aragonese Civil War	1347	1348
Aragonese Neapolitan War	1435	1442
Bausenesque War	1144	1162
Castilian Civil War	1474	1479
Champagne Succession	1216	1222
Danish Civil War	1137	1157
English "Anarchy"	1138	1154
Franco Austrian War	1477	1493
Greater Poland Civil War	1382	1384
Hundred Years War	1337	1360
Hungarian Civil War	1301	1308
Hungarian Civil War	1439	1440
Naples Civil War	1380	1384
Navaresse Succession	1276	1277
Neapolitan Adventure	1348	1352
Norman Conquest	1066	1071
Scandinavian War	1448	1471
Thurugian Succession	1247	1264

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