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

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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 deceased monarch a clear place in the line of succession. When no such heirs were available, succession disputes were more likely, with more distant relatives and female(-line) heirs laying competing claims to the throne. These disputes often produced violent conflicts that destroyed existing state institutions and harmed subsequent economic development. Given these facts, we hypothesize that a shortage of male heirs to a European monarchy in the Middle Ages has a deleterious effect on levels of development across contemporary European regions ruled by that monarchy. We confirm this hypothesis by showing that regions that were more likely to have a shortage of such heirs are today poorer than other regions. This finding highlights the importance of the medieval period in European development, and shows how a sequence of small shocks can work in combination with both institutions and norms in shaping long-run development trajectories.

JEL Classification Codes: O10, N13

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1 Introduction

A large body of existing 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—specifically, the availability of male heirs to Europe's medieval monarchies—contributed to producing a variation in the success or failure of early state-building efforts. The effects of this variation in births appear to have lasted, and can be seen in the contemporary variation in development levels across European regions.

The link between royal births and 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 (e.g. sons and brothers) of the ruling monarch a relatively clear place in the line of succession, but 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. Typically, more distant male relatives would claim the throne over closer female or female-line relatives, leading to a succession dispute. In many cases, these disputes turned into violent wars. These wars in turn destroyed state institutions and reduced political cohesion. Simultaneously, ruling

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

[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] A notable exception is a recent working paper by Dell (2012) on the long term economic consequences of a modest drought in early 20th century Mexico.

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, for example, is one of Europe's most prosperous metropolises today in large part because it enjoyed the uninterrupted reign of a single dynasty in the medieval period for more than three centuries from 987-1316AD. 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. Our theory accounts for this reversal.

Our main empirical finding demonstrates the path dependent effects of the uneven nature of state development in medieval Europe arising due to the availability of male heirs. We show that regions of Europe that were ruled by medieval monarchs who had an abundance of male heirs are today richer than other regions. We are also able to 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 also decreased the frequency of internal wars and coups during the Late Middle Ages, 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.

The rest of this paper is organized as follows. In Section 2, we present the theory that motivates our empirical analysis. Section 3 expands upon the contrasting examples of France

and Naples mentioned briefly above. Section 4 presents our main data. Section 5 presents the baseline results, and some robustness checks. Section 6 presents evidence for the mechanism implied by our theory. Section 7 concludes.

2 Theoretical Background

Our theory connects the availability of male heirs to Europe's monarchies in medieval period to contemporary development via conflict, political instability and state-building. The theory is schematically represented as follows:

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

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 essential for economic development. After briefly reviewing this literature, we provide theoretical background to the first link between male heirs and conflict below.

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]

Complementary to this literature, 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.[5] In the face of high instability, rulers know that they could be

[4]A counterpoint to this literature emerges from the work of North and Weingast (1989) and North (1981). These authors 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. However, 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 whether strong states are good for development, we take the view that state building in medieval Europe was particularly important 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.

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

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.[6] 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 particular, in many previous 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.[7]

Second, most previous work 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 polities 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).

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 structures of 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

[6]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.

[7]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. This distinction was first made by Tilly (1992) who argued that interstate wars in Europe promoted the development of state institutions. 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, would count as both internal and external).

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 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).

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 to show how *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.[8] 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. Clearer succession procedures reduced instability (Herz, 1952). Kokkonen and Sundell (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 (where the order of succession often

[8]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).

gave priority to the monarch's brothers) 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).[9] However, 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.[10] The Hundred Years War is perhaps the best-known 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).[11] Indeed, 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 the Supplemental Appendix we provide a list of 18 known wars 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 on contemporary development—in polities where succession norms are more strongly institutionalized. Put another way, 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

[9]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.

[10]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.

[11]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.

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 focus on in the early part, is that due to 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 affect the the success of medieval state building efforts, and thus long-run 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 generally considered 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. Abulafia (1988), in addition, 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 these conflicts, the nobility were able to regain 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 France, which enjoyed the exceptional stability of its royal family for more than three centuries from 987-1316AD. Every one of the Capetian kings 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 females 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) explains how eleventh 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 course of 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 (through the *quarantaine de la roi*) using a waiting period to prevent private wars and divert disputes into the royal courts.

The end of French good luck came after Charles IV died leaving no sons or brothers 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.

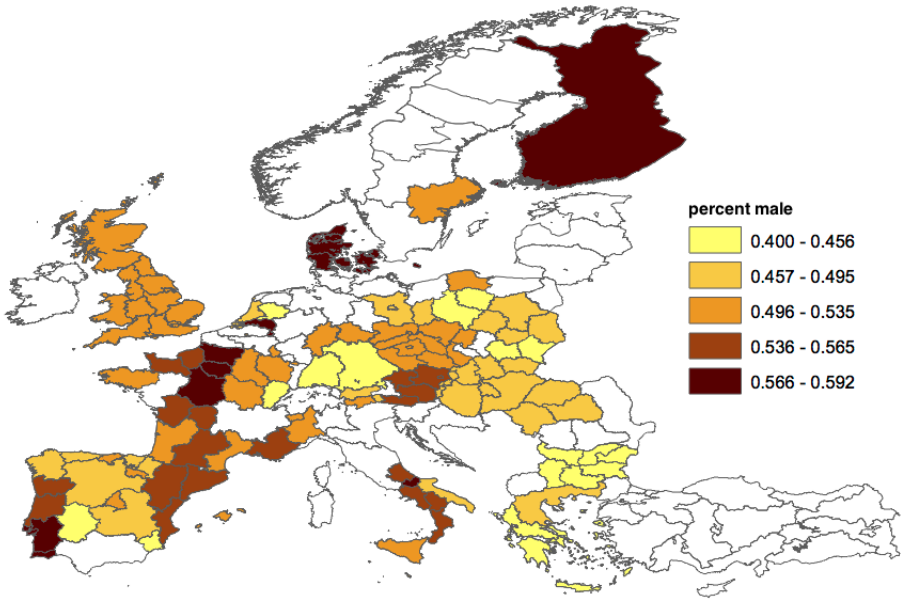

Figure 1. Shaded regions show the proportion of males among the legitimate children of rulers in the period 1000-1500AD. White regions either fall below our 200 year cutoff, or are regions in non-EU states (Turkey, Norway, Switzerland).

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") units used 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 853 unique rulers that reigned in this five hundred year period, and associated them to these regions for all years in which the ruler controlled more than 80% of the region that year. We focus on the period 1000-1500AD primarily because his five hundred year period corresponds to historians' definitions of the "High" and "Late" Middle Ages—periods of early state development in most European regions.[12] For each ruler, we collected data on the numbers of legitimate and

[12]Before 1000, data on the children of monarchs are scarce. After 1500, European polities already resemble much more institutionalized territorial states. These 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 source of territorial conflict in Europe until the 19th century. Examples include the War of the Spanish Succession (1701-14) and the War of the Austrian Succession (1740-48).

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. Since the legitimate brothers of a monarch were also considered to be potential heirs to the throne (including in polities that used primogeniture) we also collected data on the number of brothers that were alive at the time of a monarch's death. 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 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 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—a variable that we call "percent male" and depict in Figure 1. Finally, a sixth measure is the fraction of first born 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 incentive structures. 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).[13] After excluding these

[13]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

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.[14] 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. After excluding these regions, we have 114 regions, depicted in Figure 1, which constitute our baseline sample.

5 Results

5.1 Baseline Estimates

Table 1 presents coefficient estimates from OLS regressions of the effect of each of the six measures of the independent variable on contemporary GDP per capita. The main finding of this table that no matter how we measure it, the likelihood of having of 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%, which is considerably large.

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 Wallachia 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

and political participation, our estimates of the long-term persistence of medieval political patterns are probably more conservative than they otherwise would be.

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

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]*
Effect of 1 s.d. rise	20.5%	20.0%	−85.7%	21.4%	41.0%	26.8%
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 brackets.

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.[15] 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.

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

[15]These macro-polities are Aragon, the Byzantine Empire, Castile, Denmark, England, France, the Holy Roman Empire, Hungary, Poland, Portugal, Scotland, Sicily, Sweden and Wallachia. 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.

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.[16] We also provide some additional evidence in Supplemental 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.[17] 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 probably 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 male-preferred 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 NUTS code.

5.2 The Medieval Polity as the Unit of Analysis

In Supplemental Appendix A.4, we report the results from redefining 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.[18] So, to define the borders of a medieval polity, we would thus 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

[16]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 is has a coast, or is on the Atlantic coast, the age of the state, and heating degree days.

[17]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.

[18]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.

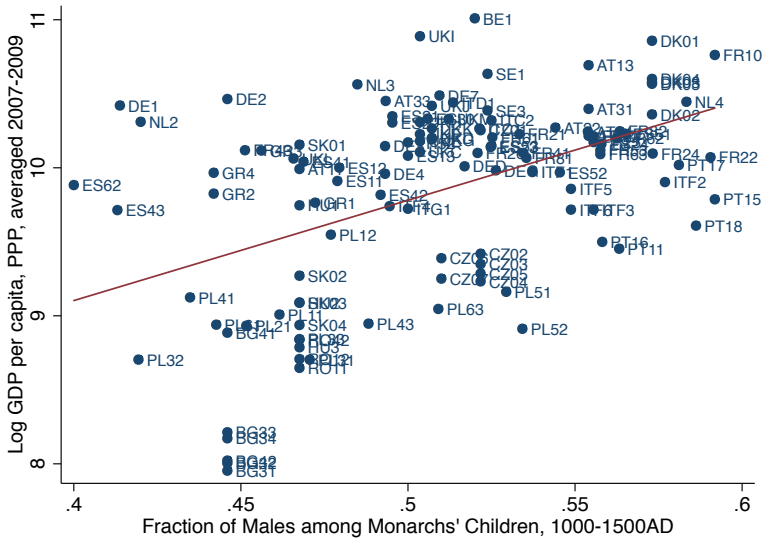

Figure 2. The fraction of males among all legitimate children of monarchs in the period 1000-1500AD plotted against Log of GDP per capita adjusted for purchasing power and averaged between 2007-09. The unit of data are NUTS regions, and data points are labeled by their NUTS code. The Ile-de-France is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

male variable has a positive and significant effect on contemporary GDP per capita when we redefine the unit of analysis to be the medieval polity by choosing the political boundaries at the turn of each century between 1000 and 1500AD.

5.3 Regional Blocs and Cross-National Differences

Figure 1 shows substantial differences in our main independent variable across larger regional blocs (such as "Northern Europe" or "Eastern Europe"), raising concerns that our estimates are spuriously capturing broad differences between these blocs. For example, most of Poland is poorer than most of France, and has much lower values of percent male. To address these concerns, we look within the larger regional blocs in Supplemental Appendix A.5. We show that the effect of percent male on contemporary development is positive when we look exclusively within Northern Europe, as well as when we look exclusively within Eastern Europe. We show that it also holds when we introduce modern country-fixed effects.

5.4 Alternative Samples and Specifications

Supplemental Appendix A.5 reports some additional robustness checks. First, we show that our results are robust to including the seven omitted regions of Poland and the Czech

Republic, as well as varying the 200 year cutoff that defines the baseline sample. We also show that our results are robust to removing capital regions from the analysis.[19] 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 recomputed variable still has a positive and significant effect on contemporary GDP per capita. This suggests that our results are not driven by the possibility that monarchs with more male children conquered more polities, especially richer ones, and are over-represented in the data.

5.5 Multiple Male Heirs

Supplemental Appendix A.6 investigates whether having multiple male heirs is harmful for development, because perhaps it leads these heirs to conflict over succession. 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 should not be surprising. 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.

5.6 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.[20] Though illegitimate children are very 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

[19]This may be a concern given that 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).

[20]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.

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 $s.e. = 0.506$, $N = 107$, $R^2 = 0.031$). 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.

5.7 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 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 ten times. The mean number of deletions needed was 398 ($s.d. = 9.19$, $min = 380$, $max = 410$), 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.

5.8 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

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]
Effect of 1 s.d. rise	7.5%	17.2%	17.9%	17.4%	18.1%	22.3%	26.4%
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 brackets.

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. This suggests that it is difficult to reject the hypothesis that the distribution of percent male in the data is consistent with luck.

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 (as implied by the mechanism summarized in Section 2) 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 over the time period that we study, 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 essen-

Table 3 – Male Heirs, Coups and Conflicts

	Coups per year	Wars per year
	(1)	(2)
% Male	-0.057	-0.503
	(0.014)**	(0.216)*
	[.038]	[.280]†
N	117	86
R^2	0.120	0.061
	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 brackets.

tially 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. This is consistent with theories of development in which shocks affect trajectories rather than levels of development. Also, note that the significance of the estimates appears to diminish, which is consistent with the idea that other intervening shocks made the relationship between percent male and urbanization more noisy over time; but these shocks have not undone its effects.

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

Table 4 – Coups, Conflicts and Development

	Log GDP per capita		Quality of Government	
	(1)	(2)	(3)	(4)
Coups	-43.252		-73.692	
	(6.758)**		(11.455)**	
	[10.587]**		[26.525]*	
Wars		-1.255		-2.147
		(0.340)**		(1.095)†
		[0.358]**		[1.885]
N	114	83	114	83
R^2	0.268	0.270	0.051	0.054

† 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.

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 year. Since war data from 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 effect of the lagged number of legitimate male heirs on the occurrence of a violent transition is negative and highly significant. 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

Table 5 – State Capacity 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 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.

under Table 4 for details). This provides some plausibility to 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 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 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. At the same time, 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. In this section, we are interested in understanding how the effects of our percent male variable vary with the degree of institutionalization of inheritance norms.

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.[21] 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.[22]

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 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 insti-

[21]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.

[22]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]*
Z	4.883	5.110	5.973	0.055
	(1.203)**	(1.083)**	(1.387)**	(0.564)
	[1.865]*	[2.743]†	[2.567]*	[1.009]
% Male × Z	−8.750	−10.033	−11.634	−0.067
	(2.314)**	(2.117)**	(2.701)**	(1.121)
	[3.648]*	[5.219]†	[4.754]*	[1.990]
N	114	114	114	114
R^2	0.414	0.399	0.381	0.277

†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, and column (3) with the number of women rulers. Standard errors in parentheses.

tutionalization 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.[23]

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 was very 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

[23]Given the focus of the recent literature on the importance of primogeniture, we also show in Supplemental Appendix A.7 that the institutionalization of this particular succession rule varied with the availability of male heirs. There, we show that percent male has a positive and significant effect on 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 had a positive and significant effect on the probability that primogeniture was adopted in the subsequent year.

by the result of column (4) in Table 6, which shows that the effect of percent male does not vary in any discernible way 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 balanced across a variety of region characteristics, including urban density in 1000AD, which is a measure of pre-existing economic development;

Table A.1 – Balance Tests

Dependent variable is % Male

	Coef.	N	R^2
Urban Density in 1000AD	0.0106	120	0.016
	(0.00929)		
Muslim Rule in 1000AD	0.00548	123	0.001
	(0.0130)		
Pagan Tribes in 1000AD	-0.0223	123	0.014
	(0.0198)		
Elected Monarchy in 1000AD	0.0530	123	0.000
	(0.436)		
Roman Empire	0.0139	123	0.021
	(0.0164)		
Carolingian Empire	0.0225	123	0.052
	(0.0158)		
Coastal	0.0230	123	0.062
	(0.0139)		
Atlantic Coast	0.0141	123	0.014
	(0.0158)		
State Age in 1000AD	-7.47	121	0.000
	(67.10)		
Heating Degree Days	-3.74	116	0.003
	(10.10)		

† p<0.1, * p<0.05, ** p<0.01

Note: OLS estimates of the effect of different variables on percent male. The first, 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. Coastal and Atlantic Coast are indicators for whether the region has a coast, and specifically an Atlantic one. State age in 1000AD is a measure from Bockstette, Chanda and Putterman (2002) 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. Standard errors in parentheses.

state age in 1000AD, 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 proxied by whether the region used elections to select its monarchs in 1000AD, and whether it had pagan tribes in 1000AD. The data for these measures are described in more detail in the note below the table.

A.2. Environmental Factors and Sex Ratios

One possible critique of our main finding in column (5) of Table 1 in the main text 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 characterisitics, 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*

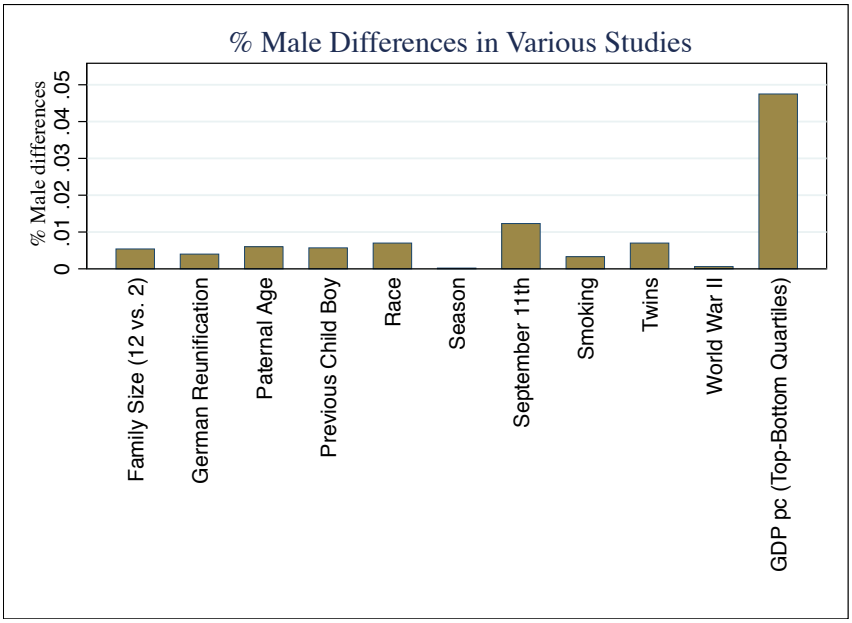

Figure A.1. The bars represent observed differences between the proportion male in treatment and control groups in selected studies. Visaria (1967), for instance, found that the percent of male births was .514 for whites and .507 for blacks, giving a treatment effect of .007. Other determinants are season (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.

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.

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

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	-0.5825**	-0.4160†	0.3227	-0.4151	0.8477*	0.5335
	(0.1430)	(0.2167)	(0.2286)	(0.3448)	(0.3775)	(0.4010)
N	1,677	1,397	1,204	953	818	663
R^2	0.0116	0.0033	0.0016	0.0019	0.0064	0.0022

** 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.

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, 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 any kind of sex-dependent stopping rule being in place. 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, and the the likelihood that the monarch chooses to have a third child is decreasing in the number of males among the first two children. But after two children 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 in the reverse direction at $k=5$. Since most monarchs had several children, 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. The Medieval Polity as the Unit 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

Table A.3 – The 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

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

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.

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 were divided among medieval rulers. As the table shows, 1100 is the only year in which our estimates fall just short of being significant at 10%.

A.5. Regional Blocs and Additional Checks

Columns (1) and (2) of Table A.4 show that the effect of percent male is positive when we look exclusively within Northern Europe, and within Eastern Europe, respectively, but is weaker in Northern Europe than it is in Eastern Europe.[24]

Column (3) shows that our result does not hold in Southern Europe, where we have only thirty observations across five countries, namely Greece Italy, Malta, Portugal and Spain. However, columns (4) and (5) show that this null-result for Southern Europe is driven mainly by the five regions of Portugal, which are underperforming today even though Portugal was relatively stable, politically, during the Middle Ages and performed very well, economically, in the Late Medieval and Early Modern periods.[25] Portugal began a prolonged economic

[24]Our definition of Northern Europe includes Austria, Belgium, Denmark, Finland, France, Greece, Luxembourg, Netherlands, Sweden, the UK and former West Germany. Eastern Europe includes Bulgaria, the Czech Republic, former East Germany, Hungary, Poland, Romania and Slovakia. We choose to treat East and West Germany separately because they had very different political institutions for a large part of the 20th century; however, the choice to do this does not affect our results at all. In particular, our results hold even if we put all of present Germany in Northern Europe or even if we put all of it in Eastern Europe.

[25]In 1500, Lisbon was one of Europe's largest cities, and one of its most important commercial centers, as the center of the spice trade. At this time, Portugal was also the third most urbanized state in Europe (after

Table A.4 – Regional Blocs and Country Fixed Effects

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

	(1)	(2)	(3)	(4)	(5)	(6)
% Male	1.579	15.877	−0.837	0.814	1.665	1.594
	(0.784)*	(3.033)**	(1.060)	(1.108)	(0.703)*	(0.850)†
	[1.452]	[4.325]*	[0.179]*	[1.590]	[1.127]	
N	53	31	30	25	78	114
R^2	0.074	0.486	0.022	0.023	0.069	0.878
Sample/Specif.	N. Europe	E. Europe	S. Europe	S.E.-Port.	W.E.-Port.	Country FE

†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. Columns (1) - (3) are subsamples of eleven countries in Northern Europe, seven in Eastern Europe and five in Southern Europe, respectively. Column (4) remove the five regions in Portugal from the Southern Europe sample while in column (5) adds all of the observations in Northern Europe to the Southern Europe sample without Portugal (giving us "Western Europe" without Portugal). Column (6) is the baseline sample with country dummies included. Standard errors in parentheses. Standard errors clustered at the macro-polity level in brackets.

decline in the Early Modern period. One event in this period, particularly relevant to our theory, was the failure of the House of Avis to produce any male heirs in the period just after 1500. This led to Portugal's annexation by the King of Spain (the female-line heir). The long period of absentee rule that ensued is associated with the beginning of Portuguese decline (see, e.g., Kindleberger, 1996, p. 71).

Lastly, column (6) 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 unobservable factors that affect contemporary development in ways that bias our results. Nevertheless, it is reassuring that our main result holds even when we account for cross-national differences through modern country fixed effects. Columns (1) - (5) of Table A.5 report the results of additional robustness checks.

Italy and the Netherlands) and nearly twice as urbanized as Britain (calculated using the urban density data that we discuss in Section 6.1). Outside Europe, Portuguese sailors were building an expansive empire through conquests in Brazil and many parts of Africa and Asia.

Table A.5 – Robustness to Defining Different Samples

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

	(1)	(2)	(3)	(4)	(5)
% male	6.957	7.327	7.054	7.147	6.017
	(1.163)**	(1.124)*	(1.231)**	(1.177)**	(1.415)**
	[2.750]*	[2.949]*	[2.663]*	[3.036]*	[1.425]*
N	121	120	93	98	113
R^2	0.231	0.265	0.265	0.277	0.296
Sample	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. In column (1), we return the seven omitted regions in the Czech Republic and Poland to the baseline sample. Columns (2) and (3) vary the 200 year cutoff described in Section 4.2 to 100 years and 300 years, respectively. Column (4) removes regions containing modern country capitals. Column (5) recomputes 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. Standard errors in parentheses. Standard errors clustered at the macro-polity level in brackets.

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:

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

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 ($s.e. = 0.647$, $N = 114$, $R^2 = 0.177$).

A.7. Gradual Institutionalization of Inheritance Norms

As mentioned above, most 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 $s.e. = 1.103$, $N = 124$, $R^2 = 0.094$). 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.

DATA BY REGION

Country	NUTS Region	Yrs of Data	Monarchs	Legit. Boys	Legit. Girls
Austria	Burgenland	455	47	36	41
Austria	Karnten	469	37	36	29
Austria	Niederostrerreich	497	45	41	33
Austria	Oberosterreich	497	45	41	33
Austria	Steiermark	437	36	37	31
Austria	Tirol	457	48	37	38
Austria	Wien	497	45	41	33
Belguim	Brussels	498	42	39	36
Bulgaria	Severen Tsentralen	294	41	33	41
Bulgaria	Severoiztochen	294	41	33	41
Bulgaria	Severozapaden	294	41	33	41
Bulgaria	Yugoiztochen	294	41	33	41
Bulgaria	Yugozapaden	294	41	33	41
Bulgaria	Yuzhen Tsentralen	294	41	33	41
Czech Republic	Jihovychod	438	43	51	49
Czech Republic	Jihozapad	421	43	48	44
Czech Republic	Praha	421	43	48	44
Czech Republic	Severovychod	420	43	48	44
Czech Republic	Severozapad	420	43	48	44
Czech Republic	Stedni Morava	437	43	51	49
Czech Republic	Stredni Cechy	421	43	48	44
Denmark	Hovedstaden	490	50	51	38
Denmark	Midtylland	491	50	51	38
Denmark	Nordjylland	491	50	51	38
Denmark	Sjaelland	491	50	51	38
Denmark	Syddanmark	491	50	51	38
East Germany	Brandenburg	339	34	36	37
East Germany	Saxony	487	37	61	57
East Germany	Thuringia	371	32	30	27
Finland	Finland	251	15	21	15
France	Aquitaine	483	41	49	44
France	Basse-Normandie	500	49	83	65
France	Bourgogne	500	43	50	46
France	Bretagne	500	42	39	39
France	Centre	500	42	90	67
France	Champagne-Ardenne	486	48	64	56
France	Franche-Comte	497	42	37	45
France	Haute-Normandie	500	49	83	65
France	Ile-de-France	500	44	86	60
France	Languedoc-Roussillon	496	44	68	59

Country	NUTS Region	Data	Monarchs	Boys	Girls
France	Limousin	500	51	81	64
France	Lorraine	500	45	62	54
France	Midi-Pyrenees	285	30	63	49
France	Picardie	396	38	74	52
France	Poitou-Charentes	491	51	81	64
France	Provence-Alpes-Cote d'Azur	420	40	40	31
Greece	Attica	432	48	26	31
Greece	Kentriki Ellada	201	26	19	24
Greece	Nisia Aigaiou-Kriti	201	26	19	24
Greece	Voreia Ellada	313	38	34	38
Hungary	Dunantel	493	48	36	41
Hungary	Kozep-Magyarorszag	493	48	36	41
Hungary	Eszak es Alfold	493	48	36	41
Italy	Abruzzo	449	40	36	31
Italy	Basilicata	499	48	45	37
Italy	Bolzano	333	23	19	18
Italy	Calabria	499	49	45	37
Italy	Campania	371	36	35	28
Italy	Molise	467	44	45	33
Italy	Piemonte	454	45	61	56
Italy	Puglia	499	48	45	46
Italy	Sicilia	429	39	39	39
Italy	Valle d'Acosta	499	48	63	57
Luxembourgh	Luxembourgh	477	37	36	34
Malta	Malta	374	36	33	37
Netherlands	Oost-Nederland	319	24	21	29
Netherlands	West-Nederland	500	46	48	51
Netherlands	Zuid-Nederland	213	17	14	10
Poland	Dolnoslaskie	458	43	54	48
Poland	Kujawsko-Pomorskie	322	26	27	34
Poland	Lodzkie	469	47	36	42
Poland	Lubelskie	488	41	40	45
Poland	Lubuskie	488	50	62	65
Poland	Malopolskie	488	48	42	51
Poland	Mazowieckie	308	32	31	34
Poland	Opolskie	241	26	39	34
Poland	Podkarpackie	207	16	13	18
Poland	Pomorskie	242	28	28	27
Poland	Swietokrzyskie	489	36	36	41
Poland	Wielkopolskie	483	47	50	65
Portugal	Alentejo	268	21	34	24
Portugal	Algarve	251	19	29	20

Country	NUTS Region	Data	Monarchs	Boys	Girls
Portugal	Centro	433	32	48	38
Portugal	Lisboa	344	27	43	31
Portugal	Norte	499	35	49	38
Romania	Centru	493	48	36	41
Romania	Nord-Vest	493	48	36	41
Romania	Vest	493	48	36	41
Slovakia	Bratislavska kraj	455	47	36	41
Slovakia	Stredne Slovensko	455	47	36	41
Slovakia	Vechodne Slovensko	455	47	36	41
Slovakia	Zepadne Slovensko	455	47	36	41
Spain	Aragon	466	37	53	42
Spain	Cantabria	500	38	49	49
Spain	Castilla y Leon	401	31	30	34
Spain	Castilla-La Mancha	290	25	30	31
Spain	Catalunya	499	40	61	47
Spain	Comunidad Foral de Navarra	499	42	53	54
Spain	Comunidad Valenciana	263	21	30	25
Spain	Comunidad de Madrid	415	31	43	42
Spain	Extremadura	270	21	19	27
Spain	Galicia	499	35	34	37
Spain	Illes Balears	271	21	21	19
Spain	La Rioja	499	38	53	48
Spain	Pais Vasco	499	42	53	54
Spain	Principado de Asturias	500	37	35	38
Spain	Region de Murcia	235	21	14	21
Sweden	Ostra Sverige	445	38	33	30
UK	East Midland England	501	42	55	51
UK	East of England	501	42	55	51
UK	London	501	42	55	51
UK	Northeast England	501	42	55	51
UK	Northwest England	501	42	55	51
UK	Scotland	469	39	42	40
UK	South East England	501	42	55	51
UK	South West England	501	42	55	51
UK	Wales	215	21	23	21
UK	West Midland England	501	42	55	51
UK	Yorkshire-Humber	501	42	55	51
West Germany	Baden Wuttemberg	268	39	24	34
West Germany	Bavaria	250	37	33	41
West Germany	Berlin	339	34	36	37
West Germany	Hessen	318	22	27	26

LIST OF SELECTED SUCCESSION-RELATED 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	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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