Online Appendix

A Network of Thrones: Kinship and Conflict in Europe, 1495-1918

Seth G. Benzell and Kevin Cooke

A Appendix A: Data Construction

The data set analyzed in the paper is complex, with many moving parts. This appendix describes the construction of each part, and how the whole is put together.

While elements of our data have been used elsewhere, such as Wright (1942) and Tompsett (2014), both our empirical methodology and the breadth of our data distinguish this paper from the existing literature. We exert significant effort to expand, reconcile, reorganize and improve upon these sources. For example, we re-construct Tompsett's genealogy as a dynamic kinship network and we bring in additional sources to identify when countries exit wars. Our supplementations also make our data set much larger. While we have 87,241 observations in our main regressions, Dube and Harish have 37,116 in their comparable dyad-year regressions.

A.1 Genealogical Data

Our genealogical data is taken from the 2014 update of Tompsett's Royal Genealogy collection. Tompsett's data cover the "genealogy of almost every ruling house in the western world", merging many sources of genealogical records. A substantial portion of Tompsett's data comes from "The Complete Peerage or a History of the House of Lords and all its Members from the Earliest Times" (Cokayne, 1953) and "Europaische Stammtafeln" (Loringhoven, 1964) in their various series and editions. A consultation with New

England Historic Genealogical Society revealed these to be well-regarded and reliable.

Adjustments to Tompsett's data were few, mainly to add birth and death dates for rulers where this information was missing. The total number of adjustments is 125. The full list of changes is included in the data.

A.2 State List

We restrict our analysis to (i) sovereign (ii) hereditary or elective monarchies in (iii) Christian Europe. Of these criteria, the most difficult to operationalize is sovereignty. We used the following procedure in determining whether a state is independent. Any polity we find reference to in Europe over our time period in any listing is given the presumption of sovereignty; this includes the super-national organizations of the Holy Roman Empire (HRE), German Confederation, and the short-lived North German Confederation.

We judge polities to be lacking sovereignty for several reasons. A primary reason for being excluded is via being a province, dependent, or vassal of another state. For example, the Balkan states for most of our time period are vassals of the Ottoman Empire and are thus excluded from the data set.

De-facto sovereignty is often ambiguous for the members of the three super-national organizations to which we attribute sovereignty. For states of the HRE, we attribute sovereignty only to Electors and Austria.[32] For members of the German Confederation, we retain the 11 states with a vote in the Federal Assembly. For the short-lived North German Confederation,

[32]Some prefer the term 'Habsburg Monarchy' or 'Austrian Monarchy' to refer to the Habsburg patriarchal lands in central Europe. However, this is an unofficial term, and our analysis relies on precisely identifying rulers with titles. Therefore we code the ruler of Austria as the individual with the title of Austrian Archduke, with other Habsburg ruled lands (such as Bohemia and Hungary) potentially in the hands of other members of the Habsburg royal family. These countries only drop out of our data following our rules regarding permanent personal union. After that time, what we denote Austria in Figure 9 can be thought of as the Habsburg Monarchy, until the establishment of a successor state (the Austrian Empire and later Austria-Hungary).

we retain the two member Kingdoms and five member Grand Duchies.

A related reason for exclusion is due to being a puppet state set up by a foreign occupier. When a period of foreign occupation or domination lasts 5 or fewer years, and the previous dynasty subsequently regains the throne, we have the two countries in existence and at war throughout. An exception is that a foreign occupation of less than 5 years will be coded as an interregnum if the incumbent ruler formally and substantively abdicates (even if the dynasty eventually regains the throne).[33] When a period of foreign domination lasts for more than 5 years, but the previous dynasty eventually regains the crown, we have the dominated state as not existing during the occupation. This means, for example, that much of the German and Italian speaking world is not sovereign during the height of Napoleon's power. For cases like Spain during the Peninsular War (where a government attempted to organize resistance from the besieged city of Cadiz) where there is at least partially organized resistance with loyalty with the previous ruler, we err on the side of keeping the previous ruler installed and at war throughout. When a foreign installation is permanent, we have the installed leader running the country at the end of hostilities. For states where a de jure country has two rulers simultaneously in different parts for a period of decades (i.e. longer than a civil war), we consider it two separate countries.[34]

Finally, we list only the more powerful member of a pair of states under permanent personal union. Personal unions were a common occurrence in our period in which a single individual would rule two or more countries. When we see a pair of states entering and leaving personal unions (such as due to divergent inheritance laws, as in the case of Hanover and the United Kingdom) in our time period, we list them as separate sovereign

[33]For example, in the Great Northern War the Saxon King Augustus II abdicated his claim to the Polish throne for a short period. This is coded as an interregnum. During these interregnums, as with any period a ruler is not coded, the country drops out of the data.

[34]For Hungary, this means we record a Christian ruler during the century when the better part of the country was ruled by an Ottoman puppet.

states throughout. However, if a personal union lasts continuously until one of the states is abolished (or until the end of our sample period) then we combine the two states into one sovereign entity. We consolidate the two states not at the beginning of the personal union, but rather when the first person to inherit both states simultaneously comes into power.

Of these criteria, the most imperfect is the decision to only list electors of the HRE. Certainly, at least the electors had a degree of sovereignty. The 'Golden Bull of 1356', which fixed the constitutional structure of the HRE, established electoral dignity as non-transferable and conferring a degree of sovereignty higher than normal HRE membership. There is also the fact that by being electors, they had influence over who was elected Emperor, and therefore influence over wars fought by the Empire. The list of electors is very stable over time. When in the course of the Thirty Years War the Emperor transferred the treasonous Electoral Palatinate's vote to Bavaria this led to a major constitutional crisis. Eventually a vote for the Palatinate was restored, but Bavaria retained the Palatinate's electoral status. Along with the creation of the Electorate of Hanover in 1692 (thereby creating an odd number of electors again), these are the only changes in the course of our sample. So we feel comfortable attributing sovereignty to all the electors.

However, there were a handful of states, mostly northern Italian, which were non-Elector members of the HRE that acted with a degree of autonomy, especially in the early part of our sample. These include Savoy, Switzerland, Milan, Modena, Parma, and Florence. Bavaria before achieving its electoral status also participated in wars independently of the HRE. Many of these would be otherwise eliminated for much of their histories for being republics. It would be impossible to include in our analysis the literally hundreds of members of the HRE, each of which had different degrees of sovereignty. This legalistic approach was determined to be the safest one.

In addition to Austria, the following are the member states of the Holy Roman Empire, German Confederation, and North-German Confederation

to which we attribute sovereignty.

1495-1705: *Kingdom of Bohemia*[35]

1495-1871: *Margraviate of Brandenburg (later, Kingdom of Prussia)*

1495-1806: *Duchy of Saxony*

1495-1623: *County Palatinate of the Rhine (later, Electoral Palatinate)*[36]

1623-1806: *Duchy of Bavaria*

1648-1803: *Electoral Palatinate*

1692-1806: *Electorate of Brunswick-Luneburg (later, Electorate of Hanover)*

Napoleon disbands the Holy Roman Empire in 1806, and replaces it with a puppet organization named the Confederation of the Rhine. During this period, many of the above states lost sovereignty.

After the defeat of Napoleon, the German Confederation is founded. For members of the German Confederation, we attribute sovereignty to the 11 states with a vote in the inner session of the Federal Assembly.

1815-1866: *Duchy of Holstein*, *Kingdom of Hanover*, *King of Bavaria*, *Kingdom of Saxony*, *Kingdom of Wuttemberg*, *Electorate of Hesse*, *Grand Duchy of Baden*, *Grand Duchy of Hesse*

1815-1839: *Grand Duchy of Luxembourg*

1839-1866: *Duchy of Limburg*

After the dissolution of the German Confederation, several states are temporarily independent, before being subsumed into the German Empire. Other states become sovereign members of the North German Confederation.

1866-1871: *Saxony*, *Hesse*, *Mecklenburg-Schwerin*, *Mecklenburg-Strelitz*, *Oldenburg*, *Saxe-Weimar-Eisenach*

1866-1871: *Kingdom of Bavaria*, *Kingdom of Wurttemburg*, *Baden*

1866-1918: *Principality of Lichtenstein*

1839-1918: *Grand Duchy of Luxembourg*

[35]We drop Bohemia as an independent state at this point due to our rules concerning permanent personal unions

[36]The electoral dignity of The Palatinate is temporarily transferred to Bavaria during the Thirty Years War. Bavaria comes to control an additional electoral vote.

In Figure 9, we list the full timeline of countries in our data. In order to be in this list, the state must be attributed both sovereignty and a monarch matched to the genealogical data. Hence, countries occasionally drop from the data for a year or two due to interregnums between rulers. Polities change names over time, and here countries are listed on the same row if they are considered successor states and share a fixed effect. For space, shortened or informal names of the polities are used.

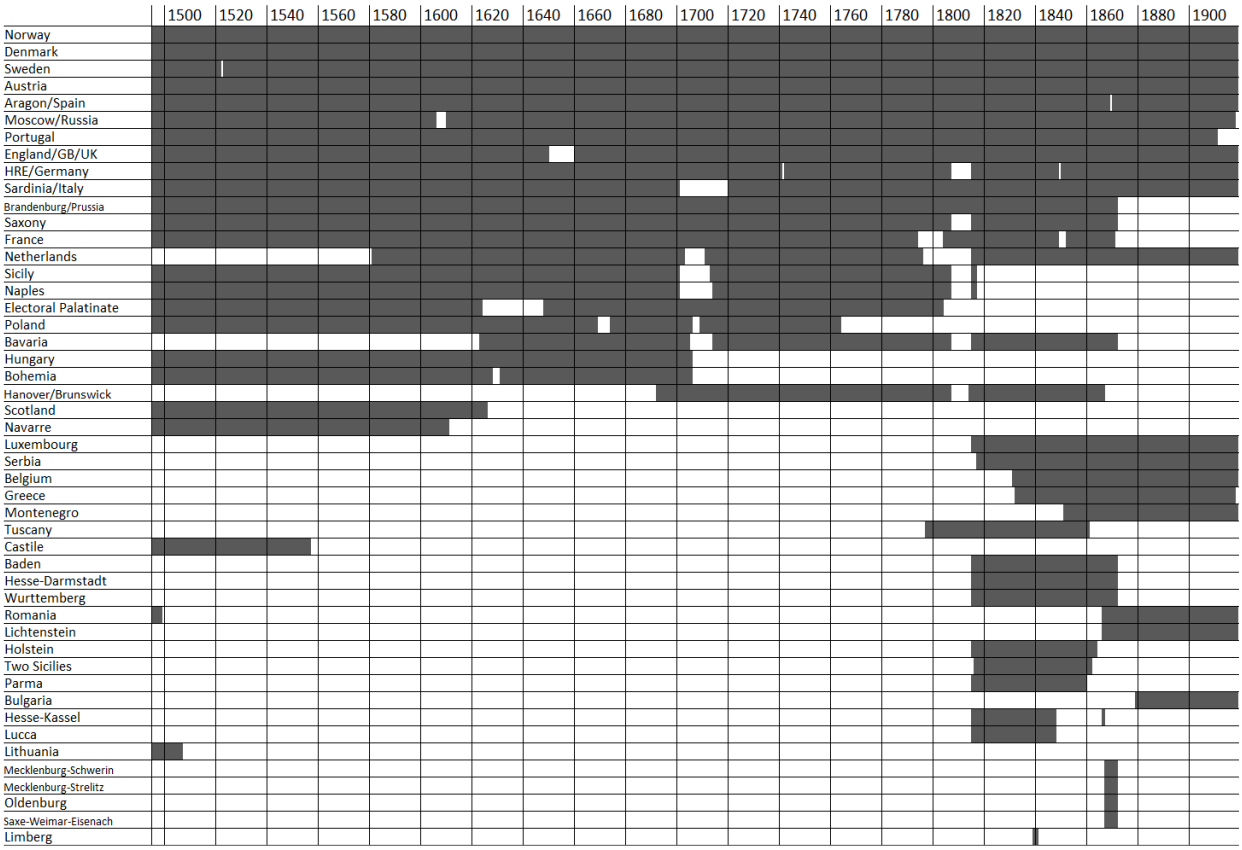


Figure 9Monarchies in the final data set by year. For space, shortened or informal names are used. Monarchies sharing a fixed effect (i.e. successor states) are listed in the same row.

A.3 Data on Rulers

For every year of a sovereign state's existence we attempt to match a ruler from our genealogical data. Our ruler data is primarily derived from Spuler (1977). When multiple dates of rule change are listed, such as the date of the death of a parent and subsequent coronation of their child, the earliest date is used. In elective monarchies, where the next ruler is clear but formal election is delayed this is used to prevent interregnums. For the few occasions in which two simultaneous and cooperative rulers are listed by this or another source, we choose the individual who seemed to be the dominant decision maker. As all of these situations are marriages or involve closely related individuals, this subjectivity does not matter to our results. For the majority of state years where Spuler does not list a ruler, we use Tapsell (1984). A handful of imputations from outside these sources are noted in the data.

In situations where Spuler is ambiguous (i.e. he lists both an incumbent ruler and a claimant) we attempt to keep rulerless periods as brief as possible. During civil wars and succession crises, we have the incumbent ruling throughout the war; if the pretender wins we have him ruling subsequently. When incumbency is seriously in doubt, we err on the side of having the eventual winner ruling throughout. States completely lacking in executive leadership are listed without a ruler, dropping out of our sample. This can sometimes occur as a result of a succession crisis. We attempt to keep such interregnums to a minimum.

Finally, there is the special case of the Netherlands Stadtholder. While the Seven United Netherlands might in some ways be described as a republic (or confederation of republics), in times of foreign conflict, they were represented by a general Stadtholder. Traditionally, this Stadtholder was the Duke of Orange. Foreign countries would maintain royal missions with the Duke, with the understanding that he represented the Netherlands internationally. Therefore, in the years before the Netherlands are a de jure monarchy, we record the Stadtholder or (failing the existence of a general Stadtholder) the

Duke of Orange as the Seven United Netherlands' monarch.

A.4 Data on Wars

The most difficult portion of the data to assemble is the set of war dyads. A war dyad is a pair of states which are at war in a given year. Our goal is to have a list of every conflict involving at least two states with sovereign Christian European rulers. Prior to 1816, there is no standard list of interstate wars. This arises from ambiguity about what a state is, what a war is, and when wars begin or end. Our list is based on Wright (1942), which uses a primarily legalistic definition of war

As supplements, use was also made of Phillips and Axelrod (2005), Langer (1972), Brecke (2012), Levy (1983), and Sarkees and Wayman (2010). For the Thirty Years War, a supplementary source was Parker (1997). For the Schmalkaldic War a supplementary source was "The Age of Reformation" (Smith, 1920).

Before 1816, the best comprehensive list of wars with a clear criteria for inclusion is Wright's.[37] Wright attempts to document every war from 1480-1940. He defines war as "all hostilities involving members of the family of nations, whether international, civil, colonial, or imperial, which were recognized as states of war in the legal sense or which involved over 50,000 troops. Some other incidents are included in which hostilities of considerable but lesser magnitude, not recognized at the time as legal states of war, led to important legal results..." (Wright, p. 636). Wright defines war in the legal sense as "the legal condition which equally permits two or more hostile

[37]In the post-1816 period, the gold standard in war records is the Correlates of War (CoW) database. CoW defines interstate wars as "those in which a territorial state that qualifies as a member of the interstate system is engaged in a war with another system member. An inter-state war must have: sustained combat involving regular armed forces on both sides and 1,000 battle-related fatalities among all of the system members involved. Any individual member state qualified as a war participant through either of two alternative criteria: a minimum of 100 fatalities or a minimum of 1,000 armed personnel engaged in active combat."

groups to carry on a conflict by armed force" (Wright, p. 8).

A.5 Procedure for Generating War List

Because Wright was the best list of wars available when we began our data collection which covers our entire period of interest, it forms the basis of our primary war dyad data. However, a number of difficulties prevent us from relying solely on Wright's text.

First, there are errors to be corrected. For example, in his coding of The Second Northern War (table 35), Hanover is not listed as a participant, despite a footnote noting the year they signed a peace treaty ending their involvement; France is listed as entering the 1st Opium war after the war's conclusion (this entry seems to be correctly attributed to the war a row below); and he fails to record Hungarian participation in Ottoman War of 1537-1542, in which Hungary was the principle theater, and the Austrian Archduke (listed at war with the Ottomans) was in personal union with the Royal Hungarian Crown.

Second, Wright does not report information on war sides and war exit that is important for our purposes. His text only states the time states entered the war, and their primary allegiance to one of two war sides. Therefore, Wright does not comprehensively record examples of parties switching sides during a war, exiting a war early, or compound wars not well described by two completely opposed camps. For example, in the Thirty Years War and French Revolutionary and Napoleonic Wars there are several shifts in the sides of the conflict and examples of states only at war with some members of an alliance group.

Third, because we are primarily concerned with which leaders are fighting wars, we need to understand whether our coded rulers correspond to Wright's understanding of state leadership. For example, Wright records a Polish Russian conflict in which a Russian Tsar intervened to help a Polish King put down anti-Russian insurgents. However, because the Polish King and

Russian Tsar were aligned in this incident, it does not make sense to call it an international war for our purposes.

Finally, our list of states does not perfectly match Wright's (excepting non-European states, theocracies, states in permanent personal unions, states facing interregnums, republics, and a few non-Elector HRE members, our list is a superset of Wright's). Therefore, it is important for us to search for wars including states not in his list.

For every war, Wright lists five pieces of information. These are: The year every state in his list entered the war; the side each state primarily fought on; which of these sides was the war's aggressor; when the war ended; and the war's type (civil, imperial, or balance of power). Occasionally, he also lists the month of the war's inception or close, as well as the number of important battles fought.

To reconcile Wright's schema with our own, we needed the following additional pieces of information.

- Did any states which we code as sovereign but Wright does not participate in any of Wright's wars? Were there any wars between our states involving one or fewer of Wright's?
- In wars involving more than two states, did any state leave the conflict early?
- Did any war participants switch sides over the course of the conflict?
- If the HRE (or German Confederation) is participating, to what extent was it acting collectively?
- Did the conflict involve a succession crisis or civil war, which might lead us to have a different understanding of war 'sides' than Wright?
- Check whether Wright made any unambiguous typos or errors

For every war listed in Wright (1942), we began by searching for a corresponding account of the war in question in Phillips and Axelrod (2005) and Langer (1972). Usually these are sufficient to answer the above questions, but additional sources were consulted when these left the situation unclear. For the Thirty Years War, a supplementary source was Parker (1997). For the Schmalkaldic War a supplementary source was Smith (1920). Any deviation from a nave Wright coding was noted and cited in our data.

For wars involving only one or fewer members of Wright's system, we searched Phillips and Axelrod (2005) and Brecke (2012). Interstate wars appearing in these lists meeting both Wright's legalistic war criteria and not including more than one of Wright's states (we assume that Wright's list is comprehensive for wars including two or more of the states he tracks) were added. Adding wars from scratch in this manner is rare, leading us to add only 25 war-year dyads from five wars.

Levy (1983) and Sarkees and Wayman (2010) were used primarily as sanity checks for clear Wright coding errors. In the data, we record whether our final coding conflicts with Levy (1983). For all but the most complex compound wars, we also record how our final dyadic codings correspond to a naive Wright coding which would ignore the above issues.

A few notes follow on how we proceeded in ambiguous cases.

For states in personal unions (like Denmark with Norway and the various crowns held simultaneously by the Spanish rulers), if we code one state at war we assume the other is at war as well, unless we find evidence otherwise. For the Austrian Habsburgs, we extend this principle to Bohemia and Hungary (when their titular rulers are close relatives of the Austrian Archduke rather than the Archduke or Holy Roman Emperor himself).[38] By construction, we never have a ruler of two nations at war with himself.[39]

[38]For more information on the unusual unity of the Austrian Habsburgs, and its legal and normative foundations, see Tapi (1971), especially p. 38-39. For information on how Habsburg unity was facilitated by an honest and informal communication style, see Fichtner (2016)

[39]However, we do have observations of Habsburgs at war (during the Habsburg

Only extremely rarely does this principle come into conflict with our deference to Wright's list of wars. This is because he rarely lists two countries in personal union separately in his lists of states. The one significant exception is Hungary (a state for which Wright has several coding anomalies, such as stating they do not participate in several Habsburg-Ottoman wars taking place in Hungarian lands). In these cases, we stick to the principle that states in personal unions are typically united in their efforts, and look for evidence beyond Wright for coding them otherwise.

Wright lists some wars as being fought by the 'German Empire'. For the bulk of our period this is the HRE. Later in the sample, this is the North German Confederation, German Confederation, or German Empire. When the HRE fights conflicts we look at evidence from our sources on this conflict and other concurrent conflicts whether the HRE acting at that moment in a united or divided manner. If there is no evidence of disunion, it is assumed that the 'German Empire' fighting entails the Habsburg crowns and all electors fighting alongside the Holy Roman Emperor. Otherwise, we mark the HRE as being divided and cite individually which of its members participated.

A.6 Data on Formal Alliances

Data on formal alliances is derived from Gibler (2008) and Levy and Thompson (2005). This data is not used in this paper, but appears in the data files. Gibler accumulates a comprehensive database of every formal alliance since 1648. Gibler's list of states follows the CoW criteria for system membership and also almost fully encompasses our list. Levy and Thompson's list, while going back to 1495 only contains alliance behavior for the 'great powers'.

Brother's War between Rudolf II and his cousin Matthias who became King of Hungary in 1608). There is even arguably an observation of a Habsburg at war with himself – Franz Joseph as Emperor of Austria declared war on himself as King of Hungary in putting down the revolution of 1848. For our purposes, this is treated as a civil war, and is therefore not recorded.

Levy gives alliance targets explicitly, but Gibler's targets were determined from Gibler's summary. If the target of an alliance involves a succession crisis we leave out the target.

A.7 Data on Covariates

Covariates are assembled from a variety of publicly available sources. Religion corresponds to the religion a ruler publicly professed. When no explicit reference to a ruler's religion can be found, the state or dominant domestic religion is used. During the early phases of the Protestant Reformation, it is often unclear when a ruler fully converts to a Protestant sect. For example, a ruler might be privately sympathetic to a Lutheranism, and aid the spread of those ideas, but not publicly convert himself. We always erred on the side of caution in such cases, and consider a ruler as converting to Protestantism only we found evidence they publicly did so. Outside this period, coding the religion of rulers was straightforward.

Coding capital locations was usually straightforward as well. In the rare cases a state had multiple political centers of power, we selected the dominant one. The one instance in which this selection was not straightforward was for the capital of the Holy Roman Empire. This entity had multiple legislative, executive, and judicial centers. Until 1532 we selected Frankfurt as the capital, due to its role as the traditional location for the selection and coronation of Emperors. After 1532 we selected Regensburg, which held periodic Imperial Diets through 1663, and a permanent one after that date. These locations have the added benefit of being near the HRE's center of mass.

Landlocked-ness and country adjacency were derived from Reed (2016). This map series gives the political borders for Europe and the Middle East at five week periods from the 11th century to the present. Generally, coding is straightforward. For countries that are briefly occupied, the occupied and occupying country are considered adjacent so long as the two countries were

adjacent beforehand. Countries that gain control of new regions according to Reed gain the adjacency of the regions they subsume. However, in the case of a non-permanent personal union, the adjacencies of the countries are considered separately. For example, during the Kalmar Union the King of Denmark ruled Norway in a personal union. However, because for reasons discussed above, Norway is listed as an independent state, Denmark is not coded as adjacent to Russia. Conversely, because Croatia is in a permanent personal union with Hungary throughout our sample, Croatia is not listed as an independent state, and Hungary inherits Croatia's adjacency.

A.8 Combining Data Sources

The above data were all collected at the monthly level. However, spotty monthly data makes a monthly analysis impractical. This and other information collected but not used is included in the data files.

When reading the data from the excel data into Stata, we only upload country years in which there is a ruler correctly matched to the Tompsett data. Only twice do we identify a ruler who was not able to be matched to Tompsett's genealogy.

Rulers are read in as beginning their reign at the start of the year in which their reign commences. Similarly, if a country covariate changes during the course of the year, it is read as having changed at the beginning of the year. If the covariate shifts several times during a year, only the last value is read into the final data. Wars are read in as starting at the beginning of the year they commenced, and ending at the end of the year they ended.

A.9 Shortest Path Deaths

For each individual who dies between a pair of ruling monarchs, we record several attributes. Tompsett records the year of death for almost all individuals, and frequently records the location of death. With encyclopedias as

our primary source, we filled in missing years and death location information. We also recorded whether the individual was a monarch, whether their death was unexpected, and whether their death may have been stress related, the countries the individual was most associated with, and the cause of death. Table 10 reports several covariates for individuals dying on a shortest path. Further details, including notes and references, are included in the associated data files.

In determining whether a death was unexpected, we evaluated whether based on common knowledge about individual's medical and other status one year before their death, a death in the subsequent year would be surprising to leading policymakers. Information about the health of aristocrats was a matter of interest, and it is likely that anticipated deaths would have an effect on international politics.[40] We were cautious in the coding of unexpected deaths, and restrict this subsample to a fraction of deaths that were clearly surprising. For this reason, we excluded the deaths of anyone older than 65, anyone with more than a year of fragile or declining health, anyone diagnosed with a terminal condition more than one year previous, anyone with more than a year of severe mental illness, and pregnant women who had a history of difficult or near-fatal births.[41]

[40] A good example of how knowledge of ill health disseminated comes from the case of Frederick V, the 'Winter King' of Bohemia mentioned in the background section. A boating accident that had injured him and claimed the life of one of his sons occurred in 1629. A year later, after a partial recovery, Frederick's family doctor told another royal doctor that "in the opinion of one who had known his constitution from birth" it was unlikely the monarch would live another two years. The other doctor then wrote about this to the English Secretary of State. Frederick would die two years later (Oman, 2000).

[41] While unexpected deaths from pregnancies and births do occur, we consider many deaths from childbirth to be unsurprising. The idea that childbirth was a dangerous, yet essential part of being a royal woman was common. An example of this attitude in action comes from Maria II, Queen of Portugal (r.1834-1853) who, after a history of distocic births was warned by her doctors about serious risks she would face in future pregnancies. Maria II famously rejoined, "If I die, I die at my post."

B Appendix B: Demographic Trends

Figure 10 displays the amount of individuals alive in our royal data in every year starting in 1495. Note that the amount of royals alive increases dramatically over time. This is consistent with the increasing longevity of notable people documented in de la Croix and Licandro (2015).

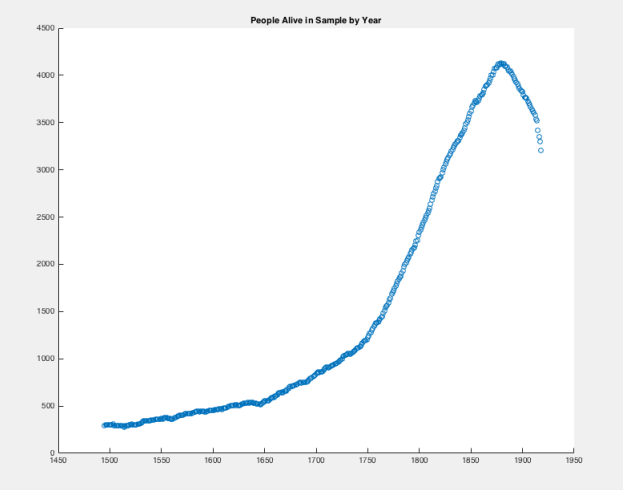


Figure 10Number of Individuals Alive in Geneological Data By Year

Table 10Shortest Path Death Characteristics, Part 1

Year of Death	Name	Monarch	Unexpected	Stress Related	Cause of Death
1495	Alfonso II / Naples			Yes	Final Illness; after >1 year of deteriorating health
1496	Isabella of Portugal				Dementia
1498	Isabella of Asturias		Yes	Yes	During Childbirth; She acted dangerously during pregancy
1502	Arthur Tudor				Final Illness; after >1 year of deteriorating health
1503	Elizabeth of York / Plantagenet		Yes		Post partum infection
1506	Alexander of Poland	Yes			???
1506	Philip I the Handsome / Hapsburg	Yes	Yes		Typhoid
1515	Louis XII / France	Yes			Severe Gout for >1 year
1517	Maria of Aragon				???
1521	Christina / Saxony-Wettin				???
1521	Manuel I the Fortunate of Portugal	Yes	Yes		Plague
1525	Isabella Hapsburg			Yes	Final Illness; after >1 year of deteriorating health
1534	Barbara / Poland				???
1535	Catherina / Saxe-Lauenburg		Yes		Fall
1536	Catherine of Aragon				At the time unknown; today heart cancer; sick for >1 year
1539	Isabella of Portugal				Died in Pregnancy; delicate health for >1 year
1541	Margaret Tudor		Yes		Palsy; contemporaries thought she would recover
1544	Anthony II / Buono de Lorraine				???
1545	Elizabeth Hapsburg				Final Illness; after >1 year of deteriorating health
1547	Francis I of France/de Valois/	Yes		Yes	Final Illness; after >1 year of deteriorating health
1547	Albert V von Meckleburg-Schwerin				Old Unremarkable
1554	Joao / Portugal				Tuberculosis; Ill health througout life, possibly diabetes
1555	Elizabeth Oldenburg				Old Unremarkable
1558	Charles V of Spain/Habsburg/	Yes			Malaria; had suffered from severe gout for several years
1560	Francis II / France de Valois	Yes	Yes	Yes	Ear Condition (Mastoiditis?) after a few months of illness
1567	Anna Hohenzollern				???
1568	Elizabeth de France		Yes		During Childbirth
1571	Joachim II Hector / Hohenzollern	Yes			Old Unremarkable
1573	Joana Hapsburg				???
1574	Charles IX / France de Valois	Yes		Yes	Tuberculosis; health declined >2 years earlier after perpetrating the St. Bartholomew's Day Massacre
1580	Anne of Austria/Habsburg/		Yes		Unspecified Illness
1582	Elizabeth of Hesse				???
1585	Anna of Denmark-Oldenburg				Final Illness; after >1 year of deteriorating health
1592	John III / Sweden Vasa	Yes			???
1598	John George / Bradenburg Hohenzollern	Yes			???
1610	*Henry IV of France de Bourbon*	*Yes*			*Assassination*
1611	Christian II / Saxony /Wettin	Yes			???
1611	Margaret of Austria / Habsburg		Yes		During Childbirth
1612	Anne Catherine / Hohenzollern				???

Table 10 Continued: Shortest Path Death Characteristics, Part 2

Year of Death	Name	Monarch	Unexpected	Stress Related	Cause of Death
1616	Johann Adolf /von Holstein-Gottorp/				???
1619	Anne / Denmark / Oldenburg				Dropsy after 2 years of illness
1625	James I Stuart	Yes			Stroke; Sickly in last >1 year of life
1631	Constance of Austria Hapsburg		Yes	Yes	Stroke
1632	Frederick V of Palatinate/Wittelsbach/	Yes			Fever; persistent ill health after boating accident (which killed his son and injured him) 2 years earlier
1640	George William /Hohenzollern/	Yes			Old Unremarkable
1643	Louis XIII / France de Bourbon	Yes		Yes	Tuberculosis and other diseases; after long period of deteriorating health
1644	Elizabeth / France de Bourbon				???
1644	Cecille Renate Hapsburg		Yes		Puerperal fever
1646	Maria Anna of Spain/Habsburg/			Yes	During Childbirth
1647	Christian Oldenburg				???
1649	*Charles I Stuart*	*Yes*			*Executed*
1657	Ferdinand III of Hapsburg	Yes			???
1659	Anne-Eleanor of /Hesse-Darmstadt/				???
1660	Mary Henrietta Stuart		Yes		Smallpox
1663	Edward of Bavaria/Wittelsbach				???
1663	Marie Christine de Bourbon				Final Illness; after >1 year of deteriorating health
1665	Philip IV of Spain/Habsburg/	Yes		Yes	Dysentery; depression and poor health >1 year previous
1670	Henrietta Anne Stuart				Gastroenteritis after three years of severe stomach pain
1671	Sophie Eleanor Wettin				???
1675	Charles Emmanuel II / Savoy				???
1678	Louis VI of/Hesse-Darmstadt				???
1680	Marie Hedwig / Hesse-Darmstadt		Yes		After Childbirth
1680	John George II / Saxony / Wettin	Yes			Old Unremarkable
1683	Elizabeth Henrietta / Hesse-Cassel		Yes		Smallpox
1685	Sophia Amerlia / Brunswick				???
1685	Charles II / Palatinate Wittelsbach	Yes			???
1685	Charles II Stuart	Yes	Yes		Uremia
1689	Marie Louise /d'Orleans/		Yes		Appendicitis
1690	Mary Anne Christine of Bavaria			Yes	Final Illness; after >1 year of deteriorating health
1693	Ulrica Eleanor / Denmark - Oldenburg				Unspecified; Fragile health after difficult childbirth >1 year prior
1694	Mary II Stuart		Yes		Smallpox
1695	Christian Albrecht / Holstein-Gottorp				???
1696	Mariana of Austria/Habsburg/				Breast Cancer
1697	Charles XI / Sweden von Simmern	Yes			Abdominal Cancer
1699	Christian V / Denmark Oldenburg	Yes	Yes		Due to injuries from hunting accident
1699	Maria Sophia / Palatinate Wittelsburg		Yes		Erysipelas
1700	Charles II of Spain Habsburg	Yes			Genetic Conditions; poor health throughout life

Table 10 Continued: Shortest Path Death Characteristics, Part 3

Year of Death	Name	Monarch	Unexpected	Stress Related	Cause of Death
1702	*Frederick IV /von Holstein-Gottorp/*	Yes			*Artillery Fire in Battle*
1705	Louise Dorothea / Hohenzollern	Yes			During Childbirth; poor health for >1 year previous
1705	Leopold I Habsburg	Yes			Heart disease; fragile health >1 year earlier
1705	Sophia Charlotte		Yes		Pnuemonia
1708	George / Denmark / Oldenburg			Yes	Severe asthma; and dropsy after >1 year of illness
1710	Louis III of Bourbon/de Cond/				"Hopelessly Insane" for several years prior to death
1711	Louis /de France/		Yes		Smallpox
1714	Charles du Berry		Yes		Due to injuries from recent hunting accident
1714	Mary Louise Gabrielle de Savole		Yes		Tuberculosis; ill towards end of life
1715	Charlotte / Brunswick-Wolfenbettel		Yes		After Childbirth
1720	Eleanor Magdalene of Neuburg Wittelsburg			Yes	Final Illness; after >1 year of deteriorating health
1720	Marie Anna de Conti				Syphilis; detected >1 year previous
1723	*Philippe Duc / Chartes d'Orleans*				*Executed*
1740	Charles VI /Habsburg/	Yes	Yes		Accidental Mushroom Poisoning
1741	Elizabeth /de Lorraine		Yes		Puerperal Fever
1745	Charles VII Albert of Bavaria	Yes		Yes	Severe Gout
1746	Philip V of Spain/de Bourbon/	Yes		Yes	Melancholia; depressed for years before death
1750	Elizabeth / Brunswick-Wolfenbettel				???
1751	Louisa / Hanover		Yes		Miscarriage Complications
1757	Sophia Dorothea / Hanover				???
1758	Augustus William / Hohenzollern		Yes		Brain Tumor, not detected
1758	Maria Magdalena Joseph / Bragana				Severe Asthma throughout her life made worse by obesity late in life
1759	Anne / Hanover			Yes	Dropsy; after >1 year of poor health
1759	Elizabeth de France		Yes		Smallpox
1760	Mary Amalia Saxony/Wettin/		Yes		Tuberculosis
1763	Isabelle of Parma de Bourbon				After Childbirth; fragile from several previous miscarriages
1763	Federick Augustus II of Saxony (III of Poland) Wettin	Yes	Yes		Horse Riding Accident
1763	Frederick Christian / Saxony Wetting	Yes	Yes		Smallpox
1766	Frederick V /Denmark/Oldenburg	Yes			Final Illness; after >1 year of deteriorating health
1775	Caroline Matilda / Hanover		Yes	Yes	Scarlet Fever
1776	Natalie Wilhemina / Hesse-Darmstadt		Yes		During Childbirth
1780	Louise Amelia of/Brunswick/				???
1781	Maria Anne / Spain de Bourbon				Heart Disease; manifested 3 years before death
1782	Louis Ulrika / Prussia / Hohenzollern				???
1785	Mary / Spain de Bourbon				???
1787	Frederick / Hesse-Cassel				Old Unremarkable
1788	Augusta Caroline / Brunswick		Yes		During Childbirth
1788	Gabriel Antonio Francis de Bragana		Yes		Smallpox
1790	Elizabeth Wilhelmine von Wurttemberg				???
1792	Maria Luisa / Spain de Bourbon				Final Illness; after >1 year of deteriorating health
1792	Leopold II /Habsburg-Lotharingen/	Yes	Yes		Other Non-infectious; Sudden

Table 10 Continued: Shortest Path Death Characteristics, Part 4

Year of Death	Name	Monarch	Unexpected	Stress Related	Cause of Death
1793	*Louis XVI of France*	*Yes*			*Guillotine*
1797	Frederick William II / Hohenzollern	Yes		Yes	Final Illness; after >1 year of deteriorating health
1801	Alexandra Pavlovna /Romanov		Yes		Puerperal fever
1802	Louise de Bourbon		Yes		During Childbirth
1803	Louis I of Parma/de Bourbon/				Epileptic Crisis after declining health for >1 year
1804	Caroline of Parma/de Bourbon		Yes		Fever
1805	Frederica Louise / Hesse-Darmstadt				Stroke after years of fragility
1806	Frederick Ferdinand /Hapsburg-Lotharingen/				???
1806	Antonia of Sicily de Bourbon		Yes		Tuberculosis
1807	Maria Theresa of/Naples/		Yes		Complications from Childbirth
1808	Mary-Elizabeth / Padua Zhringen				???
1808	Christian VII of Denmark/Oldenburg/	Yes	Yes	Yes	Stroke
1810	Louise of /Mecklenburg-Strelitz/			Yes	Final Illness; after >1 year of deteriorating health
1813	Sophia Magdalena /Oldenburg/			Yes	Stroke; Worsening health >1 year previous
1814	Clementina / AustriaHabsburg Lotharingen				???
1814	Josphine de /Tascher/				Pnuemonia
1816	Frederick I /Wurttenberg	Yes			???
1816	Friedrich Wilhelm / Nassau-Weilburg				???
1816	Marie Ludovika Hapsburg		Yes		Tuberculosis
1817	Charlotte Augusta / Wales / Hannover				Postpartum bleeding; signs of poor health >1 year earlier
1818	(First name unknown) Hanover				???
1818	Isabella / Portugal Bragana				During Childbirth; Previous childbirth was near fatal
1819	Charles IV / Spain de Bourbon	Yes			Final Illness; after >1 year of deteriorating health
1819	Catherine / Russia Pavlovna Romanov		Yes		Pnuemonia and Erysipelas
1820	*Ferdinand Charles / Berry de Bourbon*				*Assassination*
1820	Wilhelmina Caroline / Oldenburg				Old Unremarkable
1820	Edward Augustus/Hannover		Yes		Pnuemonia
1821	Napoleon I Bonaparte	Yes			Final Illness; after >1 year of deteriorating health
1821	Caroline / Hesse-Darmstadt				Old Unremarkable
1821	William IX Hesse-Cassel	Yes			Old Unremarkable
1823	Catherine / Baden/Zhringen				???
1824	Ferdinand III / Hapsburg-Lotharingen	Yes			???
1824	Marie Louise / Spain de Bourbon	Yes			Cancer
1824	Victor Emmanuel / Sardiniade Savoy	Yes			Old Unremarkable
1825	Maximillian I Joseph / Wittelsbach	Yes			Old Unremarkable
1825	Alexander / Pavlovich / Romanov	Yes		Yes	Typhus; after >1 year of deteriorating health (esp. mental)
1826	Leopoldine /Habsburg-Lotharingen			Yes	Final Illness; after >1 year of deteriorating health
1827	Marie Charlotte / Sardinia Savoy				???
1827	Theresa / Hapsburg-Lotharingen				Final Illness; after >1 year of deteriorating health
1827	Ferdinand / Saxe-Coburg-Gotha				Old Unremarkable

Table 10 Continued: Shortest Path Death Characteristics, Part 5

Year of Death	Name	Monarch	Unexpected	Stress Related	Cause of Death
1829	Mary Josepha / Wettin		Yes		Fever
1830	Francis I / Sicily de Bourbon	Yes			???
1830	Charlotte / Spain de Bourbon				Final Illness; after >1 year of deteriorating health
1831	Konstantin Pavlovich /Romanov/		Yes		Cholera
1832	Caroline / Hapsburg-Lotharingen				???
1833	Ferdinand VII of Spain/de Bourbon/	Yes			Final Illness; after >1 year of deteriorating health
1834	Pedro IV of Portugal/de Bragana/			Yes	Tuberculosis; declining health at end of life due to war
1835	Catherine von Wurttemberg				???
1835	Francis II Hapsburg-Lotharingen	Yes	Yes		Sudden Fever
1836	Christine of Sardinia		Yes		After Childbirth
1836	Charles / Hesse-Cassel				Old Unremarkable
1837	Wilhelmina / Hohenzollern			Yes	Final Illness; after >1 year of deteriorating health
1837	William IV Henry / Hanover	Yes			Old Unremarkable
1838	Maximillian Saxony Wetting				Old Unremarkable
1839	Marie Frederica / Hesse-Cassel				Old Unremarkable
1840	Frederick William III / Hohenzollern	Yes			Old Unremarkable
1841	Augusta Hohenzollern				???
1844	Ernest I/Saxe-Coburg-Saaifeld				Old Unremarkable
1844	Cecilie / Holstein-Gottorp		Yes		Puerperal fever (Childbirth)
1847	Joseph / Austria Hapsburg-Lotharingen				Old Unremarkable
1847	Charlotte / Saxe-Hildburghausen				Old Unremarkable
1848	Amalie /von Wrttemberg/				???
1848	Maria Isabella / Spain de Bourbon				???
1848	Christian VIII / Denmark Oldenburg	Yes			Blood Poisoning; fragile health >1 year previous
1849	William II of Netherlands von Nassau	Yes			???
1849	Ferdinand / Austria-EsteHapsburg		Yes		Typhus
1850	Adolphus Frederick of Cambridge/Hanover/				???
1850	Louise Marie d'Orleans		Yes		Tuberculosis
1851	Leopold de Bourbon				???
1851	Auguste Wittelsbach				Old Unremarkable
1852	Leopold I / Baden Zhringen	Yes			???
1852	Maria Sophia Frederic / Hesse-Cassel	Yes		Yes	Old Unremarkable
1852	Paul Charles Frederick von Wurttemberg				Old Unremarkable
1852	Maximillian / Leuchtenberg				Unspecified - Hereditary
1853	Maria II / Portugal Bragana	Yes	Yes		During Childbirth
1854	Therese of /Saxe-Hildburghausen/				???
1854	*Charles III / Parma de Bourbon*	Yes			*Assassination*
1855	Charles de Molinade Bourbon				???
1855	Maria Dorothea /von Wrttemberg/				???

Table 10 Continued: Shortest Path Death Characteristics, Part 6

Year of Death	Name	Monarch	Unexpected	Stress Related	Cause of Death
1855	Nicholas I Pavlovich/Romanov	Yes	Yes	Yes	Pnuemonia
1857	Victoria / Saxe-Coburg Gotha		Yes		After Childbirth
1858	Margaret / Saxony Wettin		Yes		Typhoid
1859	Anna / Saxony Wettin		Yes		After Childbirth
1859	Ferdinand II / Sicily de Bourbon	Yes			Final Illness; after >1 year of deteriorating health
1859	Marie Pavlovna Romanov				Old Unremarkable
1860	Alexandra (Charlotte)/Hohenzollern				Unspecified; after >1 year of deteriorating health
1861	Albert Augustus Saxe-Coburg-Gotha		Yes	Yes	Contemporaries: Typhoid Fever (Moderns: Undiagnosed Stomach Cancer)
1861	Victoria Mary Louisavon/Saxe-Coburg				Old Unremarkable
1861	Frederick William IV / Hohenzollern	Yes		Yes	Series of strokes beginning >1 year before death
1862	Mathilde / Wittelsbach				???
1863	Frederick Ferdinand Oldenburg				???
1863	Federick VII of Denmark Oldenburg	Yes	Yes		Erysipelas
1864	Maximilian II /Wittelsbach/	Yes			Final Illness; after >1 year of deteriorating health
1864	William I / Wurttemberg	Yes			Old Unremarkable
1865	Sophie Wilhelmina / Holstein-Gottorp				Old Unremarkable
1867	William X / Hesse-Cassel				???
1867	*Maximillian / Habsburg-Lotharingen*				*Executed*
1869	Caroline de Bourbon				Tuberculosis; depressed for >3 years prior due to death of eldest son
1870	Louise Augusta / Hohenzollern				???
1870	Frederick Charles Augustus / Wurttemberg				Ulceration due to hunting accident >1 year previous
1871	Louise von Nassau				Pnuemonia; after long illness
1872	Amelia Maria / Gloria Saxe-Weimar				???
1872	Charles XV / Sweden-Bernadotte	Yes			Final Illness; after >1 year of deteriorating health
1873	Auguste Bernadotte		Yes		Pnuemonia
1877	Marie / Saxe-Weimar-Eisenach				Old Unremarkable
1879	Henry / Netherlands / Nassau				???
1880	Marie of Hesse-Darmstadt				Unspecified; after >1 year of deteriorating health
1881	*Alexander II Nicholoevich/Romanov*	*Yes*			*Assassination*
1881	August / Saxe-Coburg-Gotha				Unspecified - Old
1883	Frederick Francis Ilvon / Mecklenburg	Yes			???
1883	Charles / Hohenzollern				Old Unremarkable
1884	Leopold George Duncan Albert/Wettin				Heamophilia
1885	Alfonso XII of Spain	Yes			Tuberculosis and Dysentery; after long period of deteriorating health
1888	Hlne Henrietta von Nassau				???
1888	Frederick III/Germany/Hohenzollern		Yes	Yes	Cancer of the Larynx (not detected until <1 year of death)
1889	Lues I Portugal / Saxe-Coburg Gotha	Yes			???
1889	Rudolf / Habsburg-Lotharingen		Yes	Yes	Double Suicide
1890	Anton d'Orleans				???

Table 10 Continued: Shortest Path Death Characteristics, Part 7

Year of Death	Name	Monarch	Unexpected	Stress Related	Cause of Death
1890	Marie Louise Augusta / Saxe-Weimar				Old Unremarkable
1891	Alexandra / Schleswig-Holstein-Soderburg		Yes		Birth complications after a fall
1891	Nicholas Nicholajievic Romanov				Oral and Brain Cancer Leading to Insanity
1894	Louis Philippe d'Orleans				???
1894	Alexander III Alexandrovich/Romanov	Yes	Yes		Kidney Nephritis
1895	Marie Louise Charlotte / Hesse-Cassel				Old Unremarkable
1896	Henry Maurice Von Battenburg		Yes		Malaria
1896	Louis d'Orleans				Old Unremarkable
1896	Karl Ludwig / Hapsburg-Lotharingen				Typhoid two years after debilitating stroke
1897	Sophie of Bavaria		Yes		Died in a Fire
1897	Wilhelm / Baden-Zhringen				Old Unremarkable
1898	*Elizabeth of Bavaria*				*Assassination*
1899	Sophie of Lichtenstein				???
1899	Marie Louise / Parma de Bourbon			Yes	Pnuemonia + Childbirth; frail health >1 year previous
1900	*Humbert I / Italy de Savoy*	*Yes*			*Assassination*
1900	Francis d'Orleans				Old Unremarkable
1900	Alfred Ernest Albert/Wettin				Throat Cancer
1901	Victoria Adelaide Mary/Wettin				Breast Cancer
1902	Maria Henrietta Hapsburg-Lotharingen				Final Illness; after >1 year of deteriorating health
1903	Elisabeth / Hapsburg-Lotharingen				???
1905	Philip / Flanders Saxe Coburg				???
1905	Leopold / Hohenzollern-Sigmaringen		Yes		Apoplexy
1907	Amulf Wittelsbach				???
1908	*Carlos I / Portugal / Saxe-Coburg Gotha*	*Yes*			*Assassination*
1909	Karl Theodor Gackl				???
1910	Edward VII Wettin	Yes		Yes	Several heart attacks over course of >1 year
1912	George Romanowsky				???
1912	William IV / Luxembourg von Nassau	Yes			Final Illness; after >1 year of deteriorating health
1912	Frederick VIII /Schleswig-Holstein/	Yes	Yes	Yes	Paralysis attack
1912	Marie Hohenzollern-Signaringen		Yes		Pnuemonia
1912	Maria Gabriele / Bavaria				Renal Failure; after previous poor health
1913	William George I of Hellenes/Schleswig	Yes	Yes		Murdered non-political
1915	Constantine Romanov				Unspecified; Health and Spirit Crushed by Death of Son >1 year earlier
1917	Louise Margaret / Prussia/Hohenzollern		Yes		Influenza
1918	Eduard Georg Wilhelm von Anhalt				???

This series of tables lists the causes of death and other covariates for individuals dying along the shortest path. Individuals with political causes of death, indicated with italics, are excluded from the analysis.

C Appendix C: Network Concepts

We contend that kinship connections have a causal relationship with interstate conflict. In order to test this hypothesis, we use a suite of tools from network theory. This section offers a brief introduction to the concepts we employ.[42]

A kinship network consists of a set of living individuals, I, and the kinship relations between them. Individuals are nodes of the network and their immediate kinship relations are edges. Specifically, two individuals are said to have an immediate kinship relation if they are spouses, siblings, or parent and child. We construct a kinship network for the European nobility in every year from 1495-1918.

Each year's network can be represented by an adjacency matrix, A_y. A_y is an $|I_y| \times |I_y|$ square matrix, where $|I_y|$ is the number of living individuals in year y. The $(i,j)^{th}$ entry in the matrix is 1 if individuals i and j are linked and 0 otherwise. Formally, these are undirected, unweighted graphs. Another useful concept is the degree matrix, D_y. D_y is the diagonal matrix where $D_{y,(i,i)} = \sum_{j \in I} A_{y,(i,j)}$. The $(i,i)^{th}$ entry of D_y is equal to the number of immediate kinship relations individual i has in year y.

The network of kinship relations evolves yearly. The set of nodes varies as individuals are born and die. Edges can either exist from birth or be formed through marriage. They can be dissolved through divorce.

In order to study this changing kinship network, we introduce summary measures of the kinship network distance between a pair of rulers. We focus on three such measures. These are shortest path length, resistance distance, and distance to common ancestor.

Shortest path length is a straightforward yet powerful measure of the kinship distance between two individuals. Consider two nodes i and j. The shortest path length between them is the minimum number of edges that

[42]For a more thorough introduction to network methods in economics, see Jackson (2008).

must be traversed to move from node i to node j. If a path exists, we say the pair is connected. When no path exists, shortest path length is defined as infinite. The longest finite path observed in our sample is of 30 degrees.

The weakness of the shortest path measure is that it only takes into account a single path. Resistance distance also measures kinship distance, but considers all simple paths between two nodes.[43] When these paths are non-overlapping, this measure can be calculated as the reciprocal of the sum of the inverse path lengths of all simple paths from i to j. More generally, resistance distance can be calculated by

$$R_{(i,j),y} = \Gamma_{(i,i),y} + \Gamma_{j,j} - 2\Gamma_{(i,j),y}$$

where $\Gamma_{(i,j),y}$ is the $(i,j)^{th}$ entry of the Moore-Penrose pseudo-inverse of $(A_y - D_y)$.[44] This measure was popularized by Klein and Randic (1993) who prove it is a metric in the mathematical sense.

Resistance distance, $R_{(i,j),y}$, is less than or equal to the shortest path distance. When there is no shortest path, we similarly define resistance distance to be infinity. The resistance distance is decreasing in the number of simple paths connecting two nodes. Resistance distance will also be shorter when these paths are shorter and have fewer nodes in common. As this distance metric takes into account all paths between two nodes, it is a natural counter-part to the shortest path distance. Resistance distance has been widely used in the physical and applied sciences, but has been much less prevalent in economics.[45]

Finally, we measure the blood relationship of a pair by the distance to their nearest common ancestor. None of these ancestors need be alive. This

[43] A simple path from i to j is a non-repeating sequence of edges starting at i and ending at j.

[44] $(A_y - D_y)$ is known as the Laplacian representation of the network

[45] An alternative all-paths measure is the hearing matrix defined in Banerjee et al. (2016). Assuming fixed transmission probability, the $(i,j)^{th}$ entry of that matrix is the expected number of times a message originating at node i will be heard by node j after T periods. Resistance distance is strongly inversely correlated with hearing closeness.

measure is constant for a pair of rulers. To calculate it, we construct a single directed network of all individuals in the data. Unlike the (undirected) network above, in this network links only run in one direction - from children to their parents.

For individuals i and j, we find the set of ancestors common to both individuals. Distance to one of these shared ancestors is defined to be the maximum of shortest path distance to the ancestor from either i or j. The minimum of these distances across the set of shared ancestors is our measure of blood distance for the pair. So, if a pair of rulers' closest common ancestor is a mutual great grandparent, their blood distance is 3. If one ruler's grandparent is another ruler's great grandparent, their blood distance is still 3. If a pair do not share a common ancestor, this measure is undefined. If a common ancestor exists, we say the pair is blood connected. The maximum distance searched is 7 generations back.

D Appendix D: Network Connection Across Dyads and Time

Table 11 shows the number of years of coexistence, share of years at war, and average inverse shortest path length for some dyads of particular interest.

Within this subset countries that are closely connected, such as France and its neighbors, tend to be more proximate and closely connected. A notable exception is Austia and Spain, which were ruled by close Habsburg cousins for centuries. The correlation of the average inverse path length and share of years at war is .175 in the above subsample.

Figure 11 plots the overall relationship, at the dyad level, between average connectedness and war frequency. Observations are weighted by the amount of years the dyads coexist. Weighting observations in this way, there is almost no relationship between the two variables. Overall, the pattern is consistent with our hypothesis that network ties were intentionally directed towards

Dyad	**Years**	**War Frequency**	**(Path)$^{-1}$**
France-Spain	362	0.290	0.180
France-Austria	363	0.248	0.124
England-France	353	0.238	0.060
France-Prussia	363	0.204	0.021
Russia-Sweden	418	0.167	0.051
England-Spain	413	0.157	0.075
Russia-France	359	0.078	0.013
Austria-Prussia	377	0.077	0.052
Sweden-Austria	423	0.066	0.033
Russia-Spain	418	0.053	0.021
Austria-Spain	421	0.047	0.252
England-Prussia	367	0.025	0.148
England-Austria	414	0.024	0.066
Russia-Austria	419	0.019	0.036
Sweden-France	362	0.017	0.018
Sweden-England	413	0.015	0.079

Table 11Years of coexistence, share of years at war, and average inverse shortest path length for several dyads of interest. For space, shortened or informal country names are used. Monarchies sharing a fixed effect (i.e. successor states) are combined for the purpose of calculating dyad averages. Dyad years of personal union are excluded.

counterparts with a high latent risk of conflict.

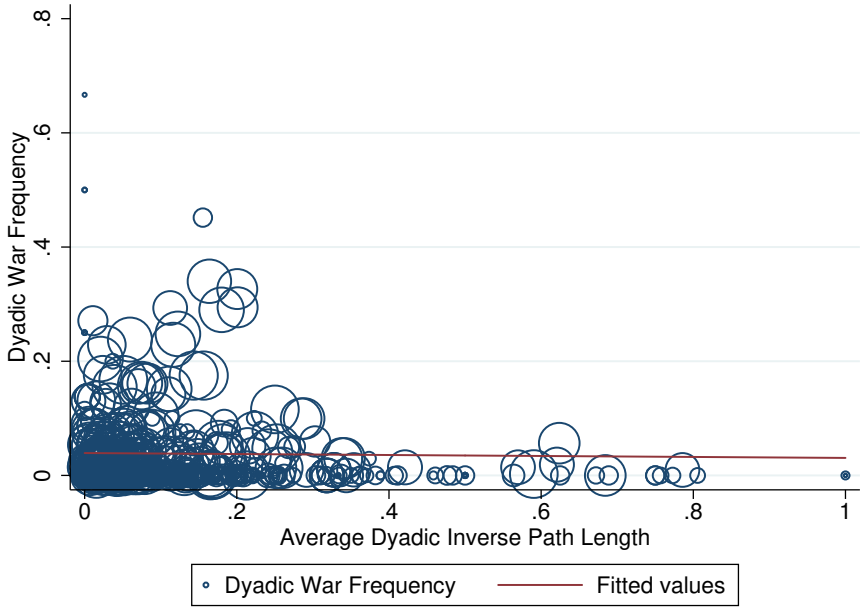


Figure 11Average inverse path length and war frequency at the dyad level. Observations are weighted by the number of years states in a dyad coexist. Personal union dyad years excluded.

Table 12 reports the correlation between war and kinship connection under several variations of equation 1. This table is discussed in the main text of the paper.

Figure 12 displays trends in the share of states ruled by related monarchs over time. 62 percent of dyad-years have ruler pairs with a blood connection. The share of dyads with any common ancestor increases strongly over time, from a low of 14.3 percent in the first year observed to a high of 98.8 percent in 1815. After this peak the blood connected share decreases again by about 40 percentage points, with a nadir around 1900. On average 17 percent of

Table 12OLS Results

	(1) War	(2) War	(3) War	(4) War
$(\text{Path})^{-1}$	-0.0275	-0.0282		
	(0.0183)	(0.0162)		
$(\text{Resistance})^{-1}$			-0.00683	-0.00695
			(0.00538)	(0.00466)
Genetic Tie		0.0123		0.0113
		(0.0109)		(0.0112)
Same Religion		-0.0208		-0.0215
		(0.00843)		(0.00846)
Adjacent		0.0310		0.0311
		(0.0185)		(0.0186)
Neither Landlocked		-0.00662		-0.00697
		(0.00646)		(0.00652)
ln(Distance)		-0.00391		-0.00377
		(0.00339)		(0.00332)
Pair FE	X	X	X	X
Year FE	X	X	X	X
N	88419	88419	88419	88419

Standard errors are robust to 2-way country clustering.

dyad-years' rulers share a common grandparent or more recent ancestor. 20.6 percent share a common great grandparent or closer.

While the share of states being ruled by related monarchs grows, the share ruled by closely related monarchs (i.e. those of blood degree three or less) shows no clear trend. The fact that there is no clear trend in the share of closely blood connected rulers should partially alleviate the concern that an increase in living kinship connection, while directly decreasing the chance of war, had an indirect effect in the opposite direction by creating more opportunities for succession crises. In both this figure and Figure 13 personal union observations are not dropped.

Figure 13 displays the trend in the share of rulers closely connected by living kinship ties over time. Recall that if a pair of rulers have married grandchildren, they have a shortest path distance of at most 5. If a pair of rulers have grandchildren who are married to a set of first cousins, the rulers have a blood distance of at most 7. Trends in the share of dyads with a close resistance distance and shortest path distance match each other closely. This information is presented at the decade level, because the share of states connected has much higher year to year variance than the blood connection data.

Figures 14a through 16d show the evolution of kinship ties between pairs of states. The capitals of the countries are represented by dots, with lines connecting countries that share a living kinship tie. Most notable is the increase in connection density over time. Also interesting is the eventual integration of Russia into the network of European royal families. This occurred in 1711 through the marriage of Peter the Great's heir to German princess Charlotte Christine of Brunswick-Lneburg. This broke the tradition of the Russian royal family only marrying domestic nobility.[46]

Another interesting feature of these figures is that polities traditionally

[46]The marriage was part of Peter's Westernization reforms. These reforms also included moving the capital to St. Petersburg.

considered closely kinship connected are not always connected by our living kinship measure. Consider the case of Austria and Spain. In 1550, Aragon and Castile were connected to Austria through a personal union – Charles V ruled all these domains and more. In 1600, various Spanish, southern Italian, and central European crowns were held by Habsburgs, but by different branches of the family. The two empires were reconnected by the marriage of Anne of Austria to her uncle Philip II of Spain (Charles V's son) but were disconnected again with her death in 1580. This explains the two clusters' disconnection in Figure 12(c). The frequent inbreeding of the Spanish and Austrian branches of the Habsburg family led to infamous genetic disorders. Most notable was the imbecility of Charles II of Spain. His lack of Habsburg issue led to the War of Spanish Succession with his death in 1700. Instigating the war, Louis XIV of France had installed his Grandson (Philip V) as King of Spain. This created the tie between Spain and France seen in Figure 13(a). However, by the end of the war in 1715, France and Spain were not connected by living kinship ties, despite both being ruled by Bourbons (Figure 13(b)). In 1711 Philip V's father, (Louis XIV's son) had died, severing the living kinship (but not blood) connection between the pair.

D.1 Genetic Ties and War

Table 13 details the association of conflict with genetic distance. Genetic distance is measured as the number of family tree steps to a common ancestor. It regresses war against genetic connection of various degree, dyad and year fixed effects, and selected covariates. Brothers have a genetic distance of 1, first cousins have a genetic distance of 2, and so on.

Table 13Genetic Distance and War

	War	War	War	War
Genetic Distance 1	-0.0192	-0.0225	0.00168	0.00164
	(0.0131)	(0.0155)	(0.0130)	(0.0142)
Genetic Distance 2	0.0260	0.0212	0.0157	0.0171
	(0.0186)	(0.0162)	(0.0171)	(0.0186)
Genetic Distance 3	-0.00177	-0.00455	0.0211	0.0221
	(0.00975)	(0.0104)	(0.0148)	(0.0150)
Genetic Distance 4	-0.00737	-0.0115	0.00961	0.00929
	(0.00996)	(0.0111)	(0.00985)	(0.0100)
Genetic Distance 5	-0.000978	-0.00124	0.0180	0.0190
	(0.00928)	(0.00904)	(0.00979)	(0.00971)
Genetic Distance 6	0.00330	0.00286	0.0158	0.0149
	(0.0120)	(0.0108)	(0.00977)	(0.00987)
Genetic Distance 7	-0.0117	-0.0103	0.00481	0.00525
	(0.00919)	(0.00731)	(0.00518)	(0.00573)
Same Religion		0.00348		-0.0229
		(0.0129)		(0.00967)
Neither Landlocked		0.0157		-0.00861
		(0.00855)		(0.00792)
ln(Distance)		0.00393		-0.00262
		(0.00610)		(0.00649)
Adjacent		0.0454		0.0309
		(0.0128)		(0.0245)
Constant	0.0397	-0.00383	0.0314	0.0605
	(0.00986)	(0.0473)	(0.00450)	(0.0512)
Pair FE			X	X
Year FE			X	X
N	88426	88426	88419	88419

This table reports OLS estimates of the association between genetic distance and war. The omitted group is dyad with no genetic tie. Personal unions are not included in the analysis. Standard errors clustered two-way by country are reported in parenthesis.

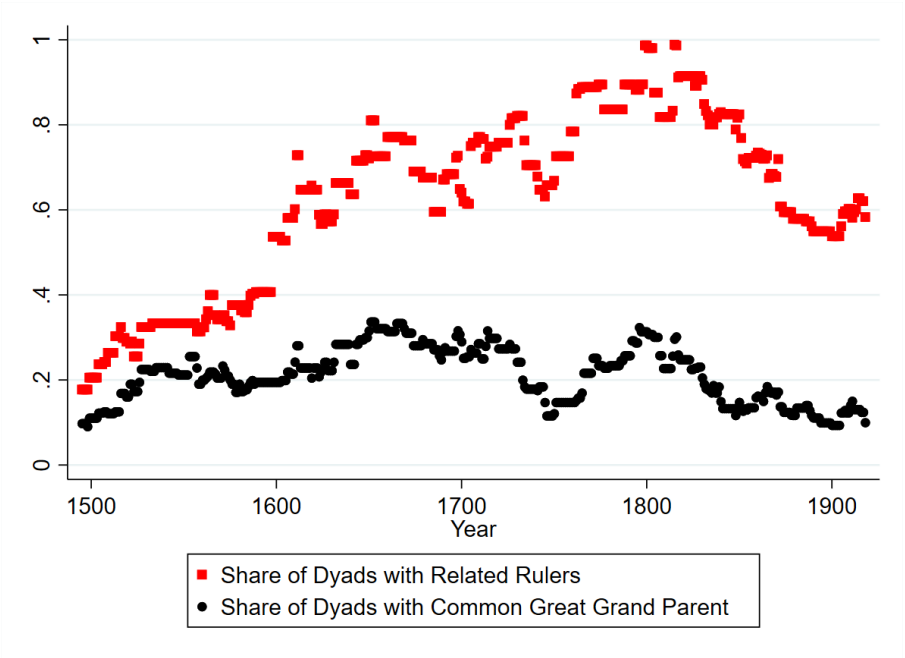


Figure 12Share of Dyads Ruled by Blood Related Monarchs

We do not have an instrument for the genetic relationship of rulers. However, this form of connection is partially exogenous to the international political situation in the short run. Any endogeneity of genetic distance to long term political relationships are partly accounted for by pair fixed effects. Across specifications, there is no clear significant relationship between genetic distance and war. Interestingly however, across specifications, having a genetic distance of 2 has a positive point estimate on the chance of war, though this effect is not significant. An increased chance of war due to genetic connections is consistent with Spolaore and Wacziarg (2016). They find that genetic similarity between the citizens of nations is strongly correlated with international conflict. Erasmus (1516) too was aware of the role of genetic relationships in creating conflict. He wrote

> *Why, then, is there most fighting among those who are most closely related? Why? From [dynastic inheritants] come the great-*

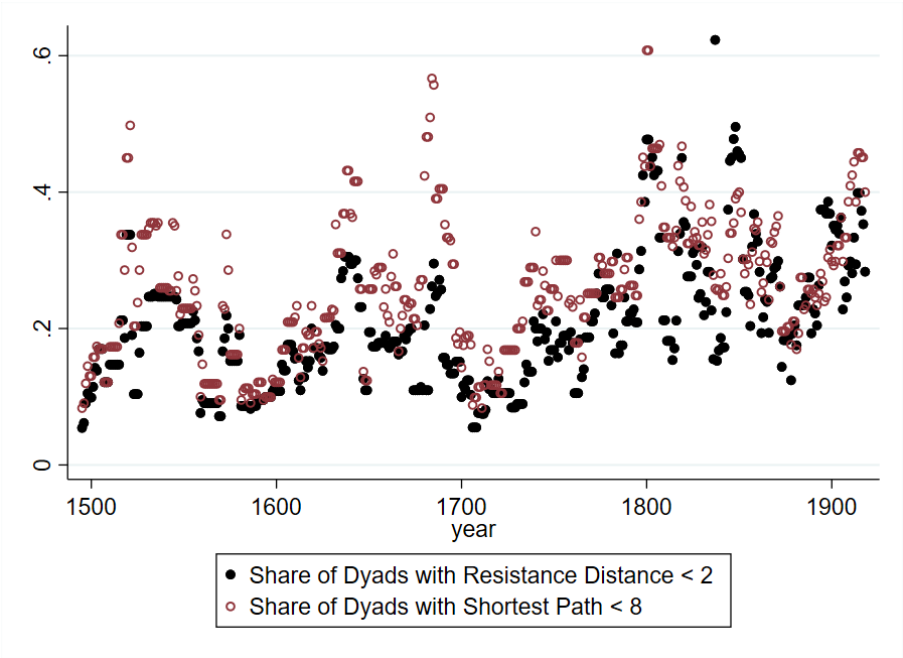
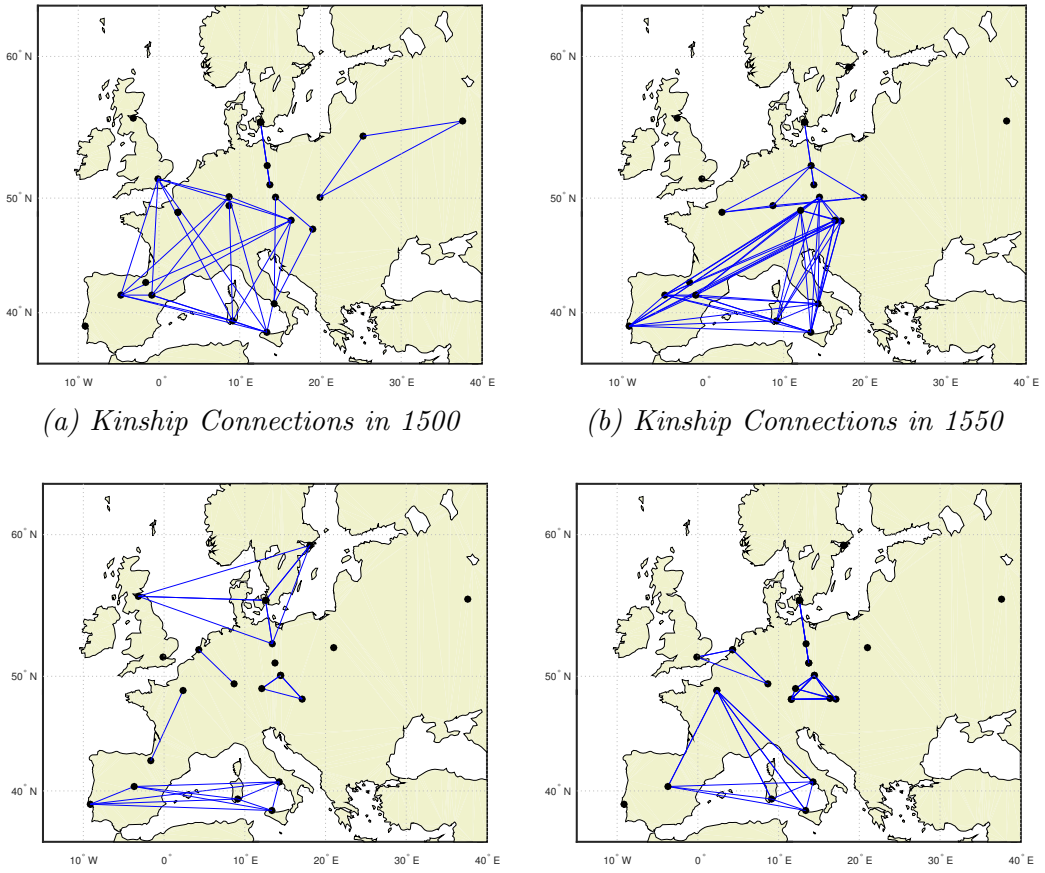


Figure 13Share of Dyads With Rulers Sharing Close Network Ties

> *est changes of kingdoms, for the right to rule is passed from one to another: something is taken from one place and added to another. From these circumstances can come only the most serious and violent consequences; the result then, is not an absence of wars, but rather the cause of making wars more frequent and more atrocious...*

In principle, increases in peace from the creation of living kinship ties might, in the long run, be offset by decreases due to the creation of shared ancestries. However, the share of monarchies with rulers sharing a great grandparent is relatively constant over time.



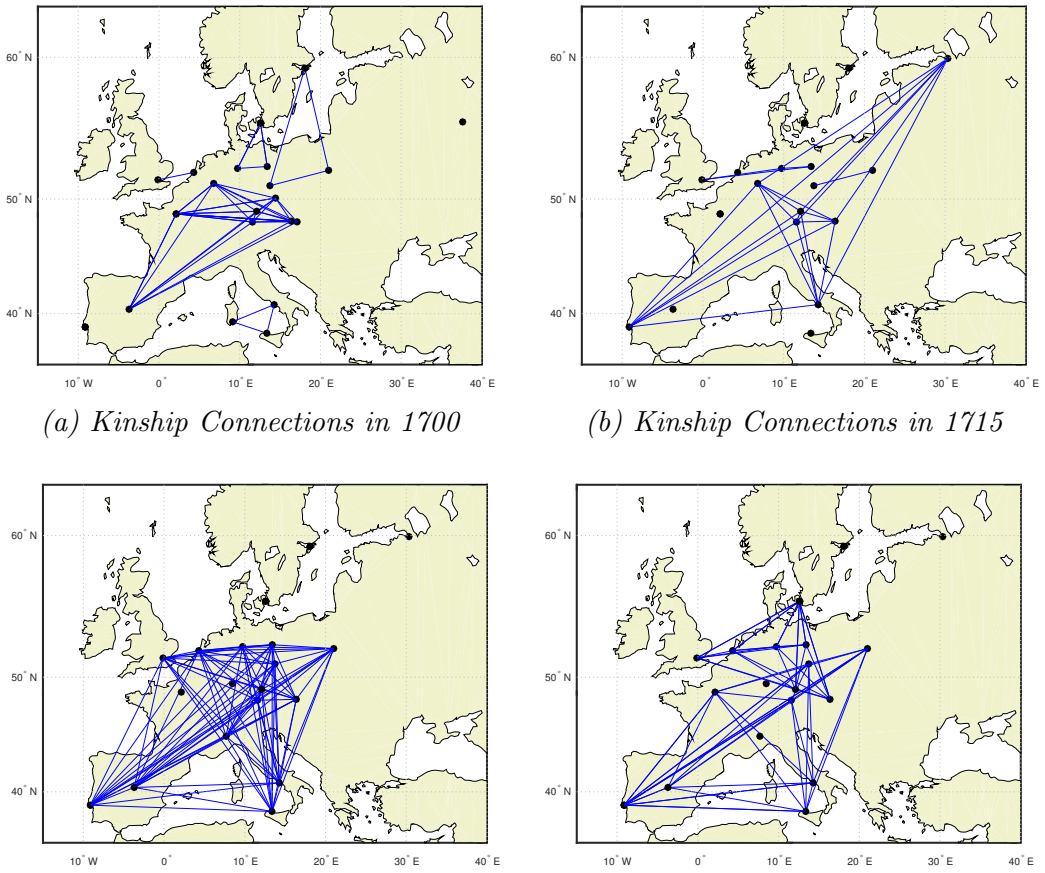
(a) Kinship Connections in 1500

(b) Kinship Connections in 1550

(c) Kinship Connections in 1600

(d) Kinship Connections in 1649

Figure 14Living kinship connections among the monarchies of Europe in 1500, 1550, 1600, and 1649 (after the Peace of Westphalia). In the above maps, black dots represent capitals. Lines represent living kinship connections between rulers (i.e. a line connects the capitals if their rulers share a living family tie).



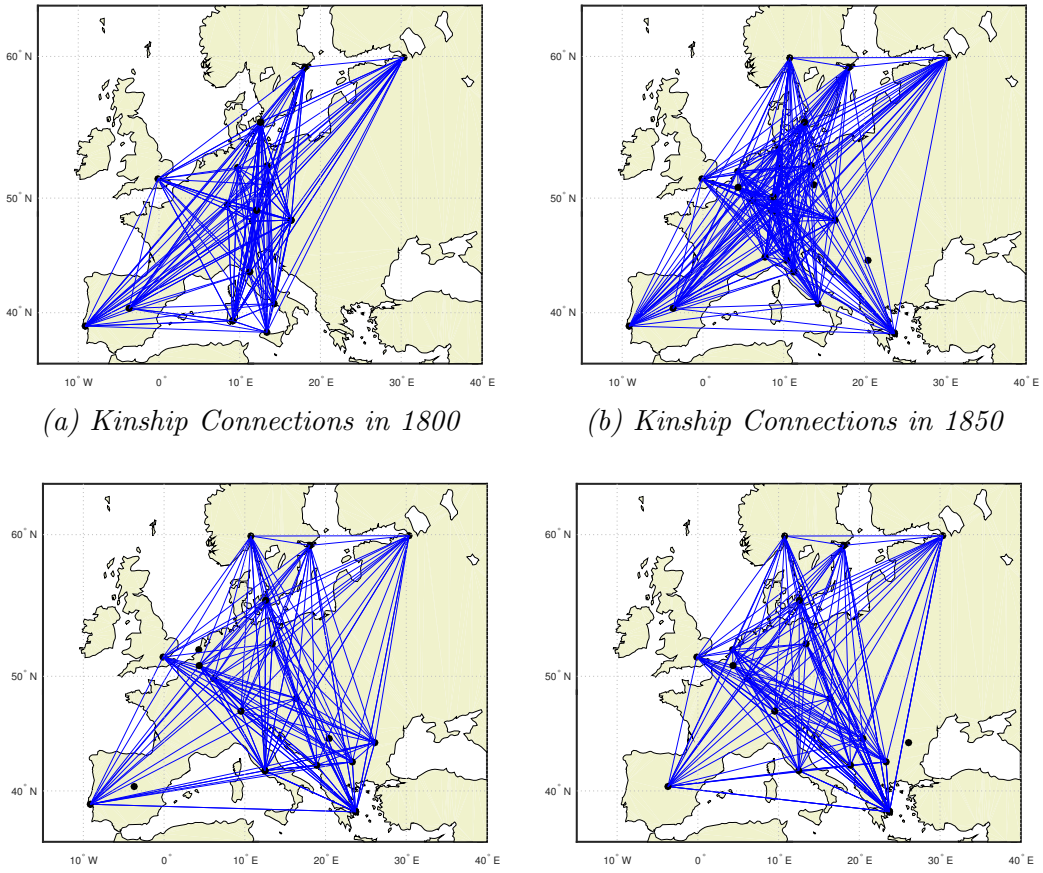
(a) Kinship Connections in 1700

(b) Kinship Connections in 1715

(c) Kinship Connections in 1739

(d) Kinship Connections in 1750

Figure 15Living kinship connections among the monarchies of Europe in 1700, 1715 (after the War of Spanish Succession), 1739 (before the War of Austrian Succession), and 1750. In the above maps, black dots represent capitals. Lines represent living kinship connections between rulers (i.e. a line connects the capitals if their rulers share a living family tie).



(a) Kinship Connections in 1800

(b) Kinship Connections in 1850

(c) Kinship Connections in 1900

(d) Kinship Connections in 1913

Figure 16Living kinship connections among the monarchies of Europe in 1800, 1850, 1900, and 1913 (before World War I). In the above maps, black dots represent capitals. In the left figure, lines represent living kinship connections between rulers (i.e. a line connects the capitals if their rulers share a living family tie).