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Title: Family Ties with the Monarchs of the Lutheran Movement and

Spread of German Reformation in the Holy Roman Empire

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Abstract

The spread of the Reformation was one of the most important events that happened in Europe. Previous papers about this topic found results about some of the reasons behind the Reformation's spread across the Holy Roman Empire. This paper investigates whether the spread of the Reformation within the states and rulers of the Empire was linked to family ties with some of the monarchs in the Empire. Specifically, to Albert the Duke of Prussia, Frederick I of Denmark, and Frederick the Wise of Saxony. To investigate this idea, datasets about states and cities were used and additionally, a new dataset about the genealogy of the monarchs was introduced. These datasets were used in simple models and network analyses to show that being related to these monarchs increases the chance of individual and state choice of Protestantism with the degree of family relation increasing as well with significant and insignificant results.

Keywords: Holy Roman Empire (HRE), Reformation, Lutheranism, Family Ties, Monarch, Protestantism, Ruler

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1. Introduction and Literature Review

The Lutheran Reformation which created a tremendous divergence from the doctrines of the Catholic Church had an enormous impact on the post-Renaissance European history. It had both direct and indirect effects on the socioeconomic status of Europe as it was shown in Cantoni (2012), Curuk and Smulders (2016), and Becker and Woessmann (2009). The Reformation led to political chaos and many religious wars across the continent. The Holy Roman Empire was at the epicenter of this tumult as it is generally accepted that the nailing of 95 theses of Martin Luther on the door of the church of Wittenberg in 1517, which happens to be a major city in the HRE, marks the beginning of the Reformation. Political figures of Europe started to diverge amongst each other, in terms of religious beliefs and choices which led to great changes in the social and economic status of Europe. It was an urgent need for the continent to change on those subjects because of the immense pressure that leveled up for a long time.

There were some previous regional reformation movements, for example, the Hussite movement in Bohemia, before Luther's movement but they did not spread within the continent like Luther's. There are some factors mentioned in the literature that can explain why Luther's movement was successful. Rubin (2014) and Edwards (1994) show that the printing press is an important reason for the success of the Reformation. Another reason for the success of the Lutheran movement was that the Elector of Saxony Frederick the Wise, who is one of the central figures of this paper, was protecting Martin Luther as explained in more detail by Bonney (1991).

The difference of Luther's movement is that it did not just stay as a religious movement like other movements of the time such as Anabaptists or the Hussites. Curuk and Smulders (2016) claim that the Reformation was not just a religious denomination that came into being. It also coincided with the political shifts and turmoil's that reached the boiling heat much before the Reformation which were caused by the complex balance of power and privileges in the Holy Roman Empire, specifically in German territories. It can be said that the success of the Lutheran movement was also caused by the power struggle between the Emperor and the monarchs of the Empire which led some of those monarchs of the Empire to support the

Reformation. This tension between the Emperor and the states of the Empire started to be uncontainable with the introduction of a new invention which was the printing press.

Some of the papers in the literature claim that the printing press and the support of Frederick the Wise were not the only reasons for the spread of Luther's Reformation across Europe. Curuk and Smulders (2016) showed that the protestant reformation spread more likely in territories that were poor but had great economic potential (specifically agriculture). They did this by assessing the agricultural potential of the cities and showing that there was a negative relation between the population of the cities and adopting the reformation. In addition to this view, Becker and Woessmann (2009) show that even though Protestantism enhanced the economies on regions where it spread (possibly linked to the results from Curuk and Smulders (2016)), they were also affected by the rewards that came with the reformation. These were better education and higher literacy rates. The reason for an increase in these indirect effects of Protestantism can be associated with the translation of the Bible and the end of the Catholic Church's hegemony back in those times.

Cantoni (2012) argues that the distance to Wittenberg, which is considered as the starting place of the Reformation, is an important explanation of spread of the Lutheranism. The paper also looks at the Reformation from a different perspective. The Elector of Saxony who was the ruler in the area of Wittenberg had a key role in the spread of Protestantism. The author claims that the commitment of the Elector of Saxony to the Lutheran cause created an environment that its neighbors can saw it as a positive externality. In other words, a neighbor of a Lutheran state saw this as a signal which indicates that the risks of adopting the new fate were lower and hence, they accepted the new religion easier.

Ever since the establishment of the Holy Roman Empire by Charlemagne, family ties are also one of the essential parts of the politics inside the empire and hence, the socio-economical aspects of the empire. The reigning families tend to tighten the family bonds with marriages, treaties, personal relationships, and many more tangible or intangible acts. It is reasonable to think that these marital alliances would be higher with the neighboring states. With the start of the Reformation, religion became an important decider of the family ties of the European monarchs and their decision-making towards the events and the unexpected shocks.

Gender roles were more specific during those times. A member of a ruling family had obligations on familial preferences and restrictions which were shaped by the religion they

follow. Political views were also deeply affected by familial ties. Also, the religious choice of a monarch influenced the alliances that they had. In order to preserve and strengthen those alliances, monarchs had marriages with families who had the same political and religious views. Fleming (1973) saw the marriages between non-Catholic royalties of Europe as an unpredictable tool in politics rather than a direct tool for establishing political ties but in the same paper, Fleming also shows that there were political goals of creating family ties with other royal houses through marriage. According to Cantoni (2012), there was a virtual absence of intermarriages across the Catholics and the Protestants. Also, Cantoni (2012) states that a person either selects a religion or a sect of a religion in accordance with their families or their own attitudes, beliefs, and views about the world. Both of the selection reasons mentioned above can potentially be linked to family ties. The reason for attitudes, beliefs, and views about the world can be linked to family ties because those decisions and behaviors are shaped by the environment that a person grows up and also, people tend to connect with the people who are similar to them and those connections can lead to marriages. The connection for selecting a religion in accordance with your family can be explained for gaining support from the family in the area of politics, seizing a throne or maintaining the throne can be an example, or strengthening the ties between the family for political ties and possible alliances.

In the previous paragraphs, I showed some previous studies about the Luther's Reformation. There are hypotheses which were tested on why and how it succeeded. Also, there are some studies about the effects of the reformation on the countries in which it spread. Even though, the topic of the Protestant Reformation and its spread was researched a lot, there is a gap on whether the family ties between the monarchs affected the spread of the Reformation. Becker et al (2020) claim that social relations were crucial in the spread of Protestantism. In order to show that they checked Martin Luther's personal relationships but still, there is a gap in the aspect of the princes of the Holy Roman Empire. Hence, this paper's motivation is to get into that gap in the field and introduce some certain monarchs and their family ties with the other rulers of the states in the Holy Roman Empire and to see whether these ties affected the spread of the Reformation.

With the motivation which was mentioned above and the literature in the field of Reformation and its spread, this paper will test the hypotheses of whether being related to Prussian, Saxon, and Danish monarchs increases the likelihood of adopting the Reformation for individual monarchs' and whether it affects the choice of religion in the states of the Holy Roman Empire. In order to test this, I will look into how closely the rulers have family ties with the

chosen states' monarchs because the effects can increase with closer kinship. The reason why the monarchs of these three states were chosen is caused by their impact on the reformation back at the start of Luther's movement. Albert the Duke of Prussia made Duchy of Prussia the first official Lutheran state. Elector of Saxony Frederick the Wise was the protector of Martin Luther and the Danish King Frederick I adopted a policy of protecting Lutheran preachers and reformers. Also, after his death, The Count's Feud happened. It was a succession war but as an additional result, the Reformation officially brought to Denmark with the Lutheran son of Frederick, Christian III's victory. Also, one of the daughters of Frederick I was the wife of Albert the Duke of Prussia which will be more relevant with the Network Analysis of this paper. The only exception that can be found in this area was Hendrix (1994), which did not focus its genealogy on the monarchs that I will propose. There is also another issue in the literature which is the usage of social networks for testing hypotheses. There are some studies which entangles with this approach but it is much lesser than the conventional economic analysis approach such as regression analysis.

According to Gramsch-Stehfest (2018), these network analyses focus on interrelations which can't be easily done by conventional analysis and literature. The analysis from that paper explains a certain father-son conflict in the empire in the mid-1200s. Gramsch-Stehfest (2018) claims that this type of analysis not only can explain concrete events such as Count's Feud, which was an event for seizing power in Denmark but was also considered as one of the Religious Wars for Protestantism which is in a way similar with Gramsch-Stehfest father-son conflict, but also can explain long-term structural patterns such as the spread of Lutheran Reformation with focusing on aspects as family ties. This type of analysis was not done much for the Reformation era, which is why this also gives a motivation to use the methods of network analysis to enhance the visualization of the spread of the Reformation via family ties.

There are also some other papers that investigate deeply for the effects of family ties in the period after the start of the Renaissance. Benzell and Cooke (2021) show that wars and conflicts in Europe decreased over time and at the same time family ties between the European monarchs increased. This study suggests that family ties affect the political behaviors, alliances, and the status of international relations. In order to obtain this result, they used kinship networks. This could also mean that there is a relationship between wars and family ties. Also, there could be instances that wars affecting the religious choices of states with treaties and forced conversions of the areas which was not investigated in the literature that I have seen. Hence, this paper will use the religious wars between 1517, which is the

widely accepted start date of the Reformation, and 1600 as a control variable and use it to see whether the results are robust.

2. Models and Method

2.1) Network Analysis

One of the main goals of this article is to show the link between the main three monarchs mentioned and the rest of the monarchs from 1460 to 1560. Also, another goal is to show whether this link affects the religious choice of a state. In order to fulfill this ambition, I conducted a network analysis to visualize the ties between monarchs. Hendrix (2014) did something similar to this but focused on the duchy of Lüneburg only. Interestingly, in his genealogical center, Ernest of Lüneburg, was a descendant of Elector of Saxony Frederick the Wise. In addition to this, I have created two figures which show the states who were related with the main monarchs by their overlords and their religious choice.

The first analysis that I conducted centers on the monarchs who are Albert the Duke of Prussia, Elector of Saxony Frederick the Wise, and Frederick 1 of Denmark. It shows their ancestry and their family line after them. The timeline was between 1460-1560. The visualization was done with the family trees with respect to the timeline. It also includes whether the individual family member is protestant or catholic. The individuals who had a 3rd-degree relation with the main monarchs were excluded from this analysis in order to make the family trees more readable and less complex than they should be.

In addition to the family trees, I constructed two social network analyses for related-unrelated Protestant states and related-unrelated Catholics using the spring layout method in order to balance the node positioning. The difference between states being related or not was done accordingly to the Weighted Degree of Relation variable. If the variable was greater than 10, then it would mean the individual state is related with the three main monarchs. The cutoff was chosen as 10 because, in the original degree of relation variable, 10 was the lowest point for a relation between the main monarchs and other rulers on the spectrum of the variable. Also, the mean for the Weighted Degree of Relation was 8.79, therefore it would serve as a good cutoff to separate the states. These analyses were conducted to provide a visual aid to

see if there is any correlation between being related to the three main monarchs and the state's choices for adopting the Reformation.

2.2) Fully Interacted Model of Family Ties

The first part of the question that I try to answer is whether being related to the three main monarchs increases the likelihood of adopting the Protestant fate. In order to find out how an individual monarch's choice of religion is affected by their kinship with the Prussian, Saxon, and Danish monarchs if they are related, I will construct a Fully Interacted Model of Family Ties which can be seen below.

$$Protestant_i = \alpha_0 + \alpha_1 * Monarch_i + \alpha_2 * Monarch_i * BeyondRef + \alpha_3 * BeyondRef + \alpha_4 * notbornprot_i + \alpha_5 * notbornprot_i * Monarch_i + \alpha_6 * notbornprot_i * Monarch_i * BeyondRef_i + \varepsilon_i \qquad (1)$$

The unit that I will use is individual which denotes as i. This unit specifically shows the individual monarchs in the dataset. The dependent variable $Protestant_i$ is a dummy variable which shows whether an individual ruler was Protestant or not. $Monarch_i$ is a set of dummy variables. These dummies show whether an individual monarch has family ties with the respective monarch from the main 3 monarchs. This means that this model works as an initial exploration and diverges to three models for 3 different main monarchs which was mentioned in the previous chapter. $notbornprot_i$ is a dummy variable that shows whether an individual monarch was not born as a protestant. The variable $BeyondRef$ is also a dummy variable which shows whether an individual monarch lived beyond 1517. This is used in order to eliminate individual monarchs who did not see the Reformation but was essential to assess the family ties of the monarchs in the dataset. α_6 is the coefficient for the interaction term and it assesses the effect of being related to the respective monarch, being alive after the start of the Reformation, and not being born as a protestant on adopting Protestantism.

The reason behind for using this model is to explore and understand the individual effects of the main three monarchs. The effects of being related to these monarchs can be different and with this examination, it will be an assessment of whether the actions of these monarchs were effective in their kin.

2.3) Assessment of the effects of the degree of family ties

One can argue that the degree of family ties, such as being a son of that monarch and being a nephew of that monarch, can increase or decrease the chance of adopting the Protestantism. In order to assess the degree of relationship between individual monarchs and the main 3 monarchs and how they affect the choice of religion by the monarchs I have chosen to use the equation below.

$$Protestant_i = \delta_0 + \delta_1 * DegRel_i + \varepsilon_i \qquad (2)$$

The variable $DegRel_i$ is a continuous variable between 0 to 100, which allocates how closely related that individual is to the monarchs. In total there were 11 dummies created to explain the relationship between a main monarch and an individual monarch, so there are 10 unit jumps between types of relationship in the spectrum of this variable to mimic the relationships. The dummies reflect the commonly accepted deonyms for family relationships. These dummies were Self, Child/Grandson, Brother/Sister, Father/Mother, Niece/Nephew, Uncle/Aunt, Spouse, Grandfather/Grandmother, Cousin, 3rd Degree, No Relation. Every single monarch who was on the monarchs dataset was categorized under these dummies. The order of the allocation is done with respect to the order given above with Self being the highest and No Relation being the lowest. The dependent variable $Protestant_i$ is the same variable from equation (1).

The reason why the effects of the degree of family ties on the choice of religion are examined is again the same as the previous model. The aim of this equation is to see how much or even if being closer to the main monarchs' in terms of family ties, increased the likelihood of converting to Protestantism. The increase in the degree of relation with the main monarchs can be a strong signal to adopt the Protestantism.

2.4) Assessment of the degree of family ties and relation to the main monarchs

I have chosen to use two different models for estimating the effects for individual and state choices for Protestantism. The reason for this choice is that individual choice and state choices could differ because the control variables that can affect these choices are different and the ruler of the state being a Protestant can affect the state choice of religion which

creates causality issues. Also, there are more than 1 ruler of each state in the timeline that I use, different degrees of relations, and different choices of religion per monarch. For answering the questions that I arose, whether being related to Prussian, Saxon, and Danish monarchs increases the likelihood of adopting the Reformation individually and in the states of the Holy Roman Empire, I have decided to use two different models which are below respectively.

$$Protestant_i = \beta_0 + \beta_1 * DegRel_i + \beta_2 * BeyondRef + \beta_3 * BeyondRef * DegRel_i + \varepsilon_i \quad (3)$$

$$Protestant_s = \gamma_0 + \gamma_1 * W_{DegRel_s} + \gamma_2 * protruler_s + \gamma_3 * W_{DegRel_s} * protruler_s + \alpha X_s + \varepsilon_s \quad (4)$$

The dependent variable $Protestant_s$ is a binary variable whether a state was protestant or not at the year 1600 and $Protestant_i$ also works as a binary variable which determines an individual monarch was protestant or not. $DegRel_i$, $BeyondRef$ are the same as the previous equations. β_3 is the coefficient for the interaction term to specify the effects of family ties for converting with respect to the degree of relation of the rulers who lived beyond the start of the Reformation with the main three monarchs. The $protruler_s$ is a binary variable which shows whether the state had a protestant ruler or not in the timeline between 1517 to 1560. Also, to use only one degree of relation with the main monarchs, I weighted the degree of relation of each state's ruler and took the average which I discuss more in detail in the Data section of this paper. This variable was named as W_{DegRel_s}.

X_s is a vector which is stacked with various control variables and α is a vector of coefficients of those variables. The control variables which were chosen are as follows: whether the state has a university or not, whether it is an Ecclesiastical territory in the year 1500, whether the ruler of the city is an Elector of the HRE, number of cities in each state, populations of states at 1500, whether the states had a printing press until 1560, distance of each state to Wittenberg and whether the state was part of Religious Wars between 1517 to 1560 at HRE. The variables except wars were also used as controls in Cantoni (2012) and Curuk and Smulders (2016) or similar variables were used. The reason for these variables were chosen as

controls, as also indicated in papers mentioned before, is that these variables also affect the Reformation and adoption of the Protestant religion.

2.5) Robustness

There will be several additional tests for checking the robustness to assure the results are valid. In order to assure this, the control variables, which were used in most of the papers on the topic about the spread of the Reformation, will work as robustness tests. The reason for selecting these variables is that all of the variables could have affected the spread of the Reformation positively or negatively and those effects could lead to an overestimation or an underestimation of the results of this paper. Additionally, I will use a new control variable which is the Religious Wars between the states of the Holy Roman Empire. Wars that were done in the period of Reformation could generate circumstances that are forced conversion and conversion in order to get allies.

3. Data

3.1) Data Gathering

The data which is about the connection of princes, archbishops, dukes, and other rulers with the main three monarchs' which this paper focuses on was searched through the internet, papers, and books but unfortunately, there are not many studies about the family ties of the monarch's and hence the data was collected from German and English Wikipedia, Britannica, and some of the royal families' websites. The dataset starts with the rulers of each state in the year 1460 and continues for rulers until 1560. The dataset was constructed with the columns of monarch names, which dynasty they belonged to, whether they are protestant or not, whether they were born as protestant or not, and dummy variables that determine their relation to the main three monarchs of this paper in the form of possible relations which are their selves, children, siblings, parents, nieces or nephews, uncle or aunts, spouses, grandparents, cousins, third-degree relatives and finally no relation. There are also three additional dummy variables for determining which monarch out of the three main monarchs they are related to. These variables are named after the monarch that it represents such as if the variable shows whether an individual monarch is related to Albert I, then the individual monarch has the value of 1 in the column of Albert I. Another variable which was created is about the degree of their relation to the relevant monarch which is on the spectrum between 100 to 0 with respect to the order of 11 variables mentioned above as 100 being their selves

and 0 meaning no relation. Besides the variables mentioned above, I have also created 2 variables which are Related and BeyondRef. Both of these variables are also dummies. Related is a dummy whether the individual monarch is related or not to the main three monarchs and the second variable determines whether the individual monarch lived after the generally accepted starting point of the reformation, which is 1517. Finally, there are dummies for each state of the Holy Roman Empire to link all of these monarchs to those states. However, the dataset does not include free imperial cities because of the Imperial Immediacy[1] and the nature of these cities.

Imperial Immediacy can create a bias towards the Imperial cities of the Empire because they were in a closer relationship with the Emperor and they relied more on him. The nature of these cities also creates another problem. They were more democratic and free places. This creates an easier environment for the spread of the Reformation. Also, frequent changes of the rulers of these cities due to elections and most of the elected individuals being from smaller houses or even sometimes from non-royalty makes these Imperial cities excluded from the dataset. As I mentioned above, frequent elections would make these individuals' actions limited and ineffective in the long run. Their factions or alliances would be more relevant to estimate their effectiveness on the spread of the reformation but finding information about that is a difficult task to be done by historians and other researchers who have more experience with the social and political history of the Holy Roman Empire. In addition to this, when I explore the dataset of Cantoni (2012), I have seen that nearly all of the imperial cities were converted to Protestantism with the exception of historically important ones in terms of the Empire and the Catholic Church such as Aachen, which was the capital of Charlemagne who was the founder of the Empire and the ceremonial crowning place for the Emperors of the Holy Roman Empire. Also, these states do not have the same system as the other imperial cities. Most of them are ruled by bishops or archbishops who need the blessing of the Pope for the legitimacy of their rule. In overall, I have decided to exclude most of these cities. The impossibility to find some of the city's mayors and their close link to the Catholic Church and the Emperor could create an underestimation problem for the results. On the other side, the additional freedom that these cities had, can overestimate the spread of the Reformation.

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[1] Imperial Immediacy was a privilege about constitutional and political status in the Feudal Laws of the Holy Roman Empire. Mostly imperial cities and sometimes other states and individuals are given freedom from local authority of any lords, dukes or electors and directly put into the authority of the emperor.

The Holy Roman state and city datasets which contain most of the variables that were going to be used in the main model estimations are from Cantoni (2012) and Bairoch, Batou, and Chèvre (1988) which Cantoni (2012) dataset was based on. There were several different datasets obtained. From those, the dataset which focuses on states of the Holy Roman Empire is chosen in order to match them with their respective monarchs in the period between 1460 to 1560. Also, the city dataset was checked as well and some possible control variables were also chosen to implement on the merged dataset which is explained in section 3.2 with more details.

The Protestant variable which represents whether the state is protestant at 1600, is essential for this thesis and it will be taken from Cantoni (2012). The dataset also contains viable additional data which will be used in the Robustness tests mentioned above. The control variables, except the data for wars was mentioned in section 2.2. These variables are also from the dataset mentioned above and the city dataset.

In order to check the robustness, it was mentioned in the previous sections that wars of that period are going to be examined. The dataset for wars was created from the internet sources and literature. It contains wars about religion in the Empire. The wars which were included are between 1517 and 1600 because the dataset which was obtained has the variable for Protestantism at 1600 and the generally accepted year for the start of the Reformation is 1517. The war data is focused on the participants in those wars which basically shows which states participated in the wars for religion and whether they were protestant or not for compatibility with the states dataset. The wars which were used are the German Peasants' War, Count's Feud, Münster Rebellion, Schmalkaldic War, Second Schmalkaldic War, Cologne War, and Strasbourg Bishops' War.

3.2) Data Cleaning and Merging

The gathered data was created in accordance with the variables mentioned above in the sections above. Similar approaches were done by Curuk and Smulders (2016) and Cantoni (2012). Most of the Imperial Cities and columns of Salem and the County of Mansfeld were dropped. The states Salem and Mansfeld were dropped because reliable data about the rulers of those states cannot be found by me and for the Imperial Cities, the explanation was done in the previous chapter. Additional unnecessary variables were dropped. The wars dataset was

also created in accordance with the datasets mentioned above, therefore there was no need for a cleaning procedure.

Some of the monarchs in the gathered dataset had family ties with more than one of the main three monarchs. In some cases, same level of family relation was observed. This could have been a problem with the estimations. In instances where this problem was encountered, closer family tie was prioritized and if the same level of family problem was observed, the paternal side of the individual ruler was chosen as the primary relation with respect to the Agnatic Succession[2] of that period.

Finally, the monarch's dataset and state datasets were merged into one dataset. A variable called protruler was created for each state in order to see which states had at least one protestant ruler between 1517 and 1560. The monarchs who died before 1517 were dropped. The degree of relation of monarchs from the monarch's dataset was used in the merged dataset but using every single monarch could create problems. If I had taken that route, then I would have had to duplicate every single state row for every single monarch, and it would complicate everything. This means that I would have to create multiple rows for every single state for every single monarch.

In order to surpass that problem, I took the weighted averages of states' degrees of relations. In other words, for every single state, I took the weighted averages of the degree of relation with respect to their individual monarchs. I separated the averages as 0,75 and 0,25. In these 0,75 and 0,25 groups, every single monarch had an equal contribution. This means that the subgroups of 0.75 and 0.25 were summed within their respective groups and divided by the number of individuals who contributes to that subgroup and then both of the subgroups were summed together and the number was obtained. The separation of subgroups was done by whether an individual monarch was not born as a protestant and born as a protestant respectively. This was done in order to prioritize the conversion to the Protestant fate because converting is a much harder decision rather than continuing the fate a person was born with. Also, the related variable and the variables which shows who they were related to with the 3 main monarchs were added to the dataset.

In addition to these variables, there are also two additional variables were created as control variables. Press until 1560, was taken from the city dataset. The year 1560 was selected

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[2] A law for most of the European monarchies at the time of reformation which gives priority or restricts the inheritance of throne to the male descendants only.

because the monarch's dataset ends in 1560. The distance to Wittenberg, which is the city where the Reformation had started, was created with the longitude and latitude variables which were on the state dataset and the specific longitude and latitude for Wittenberg which was also put on the dataset to get the distance with respect to the formula below.

$$D = \text{acos}[\sin(lat) * \sin(latw) + \cos(lat) * \cos(latw) * \cos(lonw - lon)] * R \quad (5)$$

R corresponds as the radius of the earth in km which is 6371. lat and lon are the latitudes and longitudes for individual states and w means it's the values for Wittenberg. D is the individual states' distance to Wittenberg.

3.3) Descriptive Statistics and Heat Map with Pairwise Correlations

Figure 1 represents the pairwise correlations between variables in the states dataset. When the cell color is closer to red, it means that there is a positive correlation between the two variables and if it is closer to blue, then there is a negative correlation. The strength of the correlation increases with the color becoming more intense. The map also consists of some variables which were not used in any part of the estimations or analysis but were part of the initial dataset such as dummies for linking which of the main monarchs the state was related. These dummies originated from the monarchs dataset and they were part of the final version of the state dataset because they were used to merge the original state dataset and the monarchs dataset. Latitude, Longitude, rad_lat and rad_long variables were only used to calculate the distance to Wittenberg of each individual state. The u_1500 variable, which was the population values of each state at the year 1500, was not used because the logged version of the variable was used in the estimation models. There were positive correlations between protestant_s, W_Delreg, and protruler. The variables show whether the state was protestant or not, the weighted average degree of relation with the three main monarchs, and whether the state had at least one Protestant monarch, respectively. These positive correlations between the variables support the choice of these variables in the equation (4) but these correlations do not mean that there should certainly be a causation between these variables because the other factors, which were selected as control variables, could affect the relationship between these variables.

In order to examine the variables more deeply, I created Tables 1 and 2 which represent the descriptive statistics for monarch and merged state datasets, respectively. Table 1 indicates

that nearly 25% of the monarchs in the dataset were Protestant. Also, more than half of the monarchs were able to see the Reformation. This indicates that the Reformation spread more drastically rather than the Protestant variable shows. The statistics also show that nearly 30% of the rulers were related to the main three monarchs. This result supports the choice of these selected monarchs with an indication that they were related with a considerable amount of the rulers of the Empire. On the other hand, the degree of relation with the three main monarchs indicates that the average monarch in the dataset was a 3rd degree relative to one of the main monarchs. On its own, this result would have indicated that most of the rulers of the dataset were distant relatives of the main rulers. However, with a standard deviation of 24, most of the monarchs are on a spectrum of 0 to 35. This shows that the degree of relationship between the main monarchs and other rulers was significantly diverse. The diverse relationship between the monarchs could mean that my results for this variable on the religion of an individual monarch can strengthen my aim to find significant effects because the data would not be centered on a certain place on the spectrum of the Degree of Relation variable.

Table 2 shows that more than half of the states in the Empire converted to Protestantism and slightly more states had at least one Protestant ruler. Additionally, the mean of the weighted average of the degree of relation for the states with the main three monarchs was close to 9 and had a standard deviation of 19.6. This means that the statistics of the Degree of Relation variable did not change significantly despite the changes made to the variable.
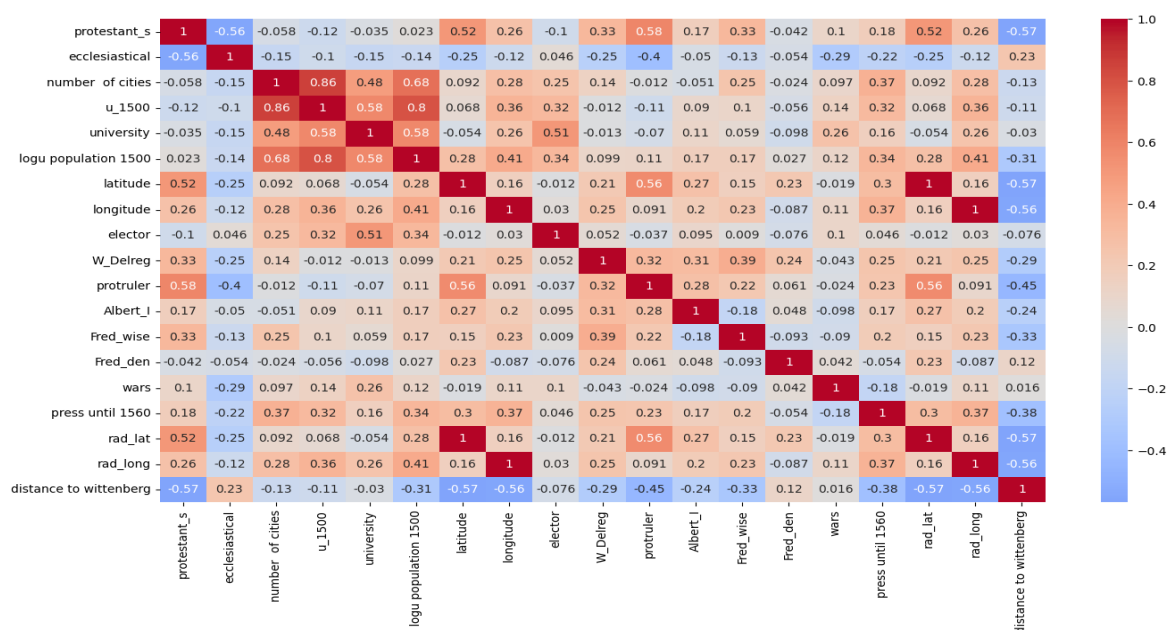
Figure 1: Heat Map with Pairwise Correlations for States

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Table 1: Descriptive Statistics for Monarch Dataset

Variables	Mean	Std. Dev.	Min	Max	t-stat
Protestant Monarch	0.244292	0.430158	0	1	11.885532
Not Being Born as Protestant	0.947489	0.223311	0	1	88.797522
Related to Albert I	0.146119	0.353629	0	1	8.647586
Related to Frederick the Wise of Saxony	0.105023	0.306933	0	1	7.161048
Related to Frederick I of Denmark	0.0502283	0.218665	0	1	4.807346
Degree of Relation	11.2785	24.3019	0	100	9.712925
Related to Three Monarchs	0.294521	0.456348	0	1	13.506920
Lived Beyond Reformation	0.5593613	0.497032	0	1	23.552939

Note:Some of the variables are excluded from this table such as the dummies linking each state with the respective ruler and family relation dummies. The family relation dummies were Self, Child/Grandson, Brother/Sister, Father/Mother, Niece/Nephew, Uncle/Aunt, Spouse, Grandfather/Grandmother, Cousin, 3rd Degree or more and No_Relation. These variables were excluded because the state dummies were solely used to merge the datasets, and the family relation dummies were used to create the variable referred as the Degree of Relation.

Table 2: Descriptive Statistics for State Dataset

Variables	Mean	Std. Dev.	Min	Max	t-stat
Protestant State	0.586667	0.495748	0	1	10.248525
Ecclesiastical	0.36	0.483232	0	1	6.451744
Number of Cities	1.46667	2.12662	0	11	5.972714
University	0.146667	0.356156	0	1	3.566336
Logged Population at 1500	1.24427	1.20852	0	4.12713	8.916412
Elector	0.0933333	0.292858	0	1	2.760009
At least One Protestant Ruler	0.626667	0.486947	0	1	11.145146
Weighted Degree of Relation	8.78667	19.6193	0	85	3.878576
Participated to the Religous Wars	0.413333	0.495748	0	1	7.220551
Printing Press until 1560	0.36	0.483232	0	1	6.451744
Distance to Wittenberg	320.115	162.055	0.119993	702.43	17.107039

Note:Some of the variables are excluded from this table such as Latitude, Longitude and dummies for being related to main three monarchs. These variables were excluded because Latitude and Longitude variables are only used for the calculation for the distance to Wittenberg and dummies for being related to the three main monarchs were not used in the regression analysis.

4. Results

4.1) Social Network Analysis Results

Figures 2 and 3 show the Catholic and Protestant States who are related or not related with the three monarchs, respectively. Orange nodes show the Catholics who are related with the three monarchs and green nodes show those who are not. Red nodes are for the related Protestants and blue ones are for non-related ones. The nodes are randomly assigned because I did not arrange them to position with respect to their weighted degrees of relations. They were constructed to position in a circular way but with random assignment. This was only done for the visualization. In total, there were 75 states and 44 of those states were Protestant in the year 1600. 13 of these states were related by family ties with the main three monarchs and only 1 of them was Catholic.

The choice of Protestantism by nearly all of the states shows that there could be an effect of family ties with these main three rulers. Also, more than a quarter of the Protestant states were related with these monarchs which can be an indicator for the claim made by Fleming (1973), which was that there were political goals of creating family ties with other royal houses through marriage. Additionally, Cantoni's (2012) claim of a virtual absence of intermarriages across Catholics and Protestants can be linked with this, assuming that there were mostly intermarriages inside these religions.

Figures 4,5 and 6 show the family trees of the main three monarchs which are Albert I, Frederick I of Denmark, and Frederick the Wise of Saxony. These family trees exclude the 3rd-degree relations. Family tree of Albert I shows that most of his relatives who are born after him became protestants except for his nieces and nephews from two of his Catholic sisters. Some of his siblings had also converted to Protestantism but his cousins stayed as Catholics. All of the children of Frederick I of Denmark became Protestants, but his cousins and his brother stayed Catholic and also his nephew Christian II which was the catholic belligerent of the Count's Feud, and the Protestant one was Christian III, the son of Frederick who won the Feud which was a succession war and the event which bring Reformation officially to Denmark. Finally, the family tree of Frederick the Wise indicates that even though his other siblings stayed as Catholics, his brother John did not, and his descendants

were Protestants as well. His cousin Henry had also converted to the cause of Luther, whose son took up the title of elector after John's son John Frederick. All of these interpretations support the connection between the spread of Reformation and family ties, specifically on the aspect of succession of the reigned territory and titles.

Figure 2: Related and Non-Related Catholic States

Green: Non-related Catholic States

Orange: Related Catholics States

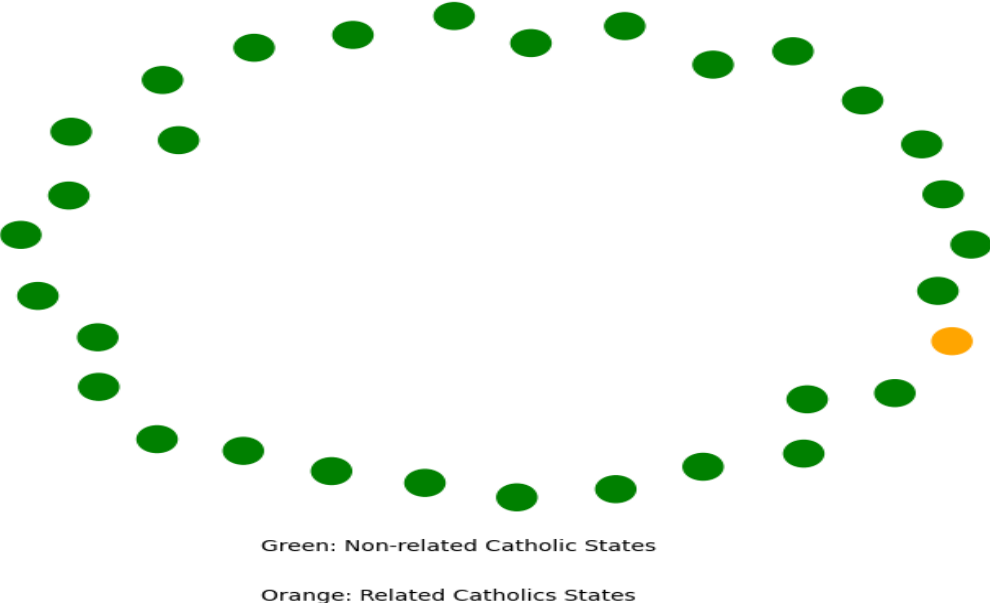Figure 3: Related and Non-Related Protestant States

Blue: Non-related Protestant States
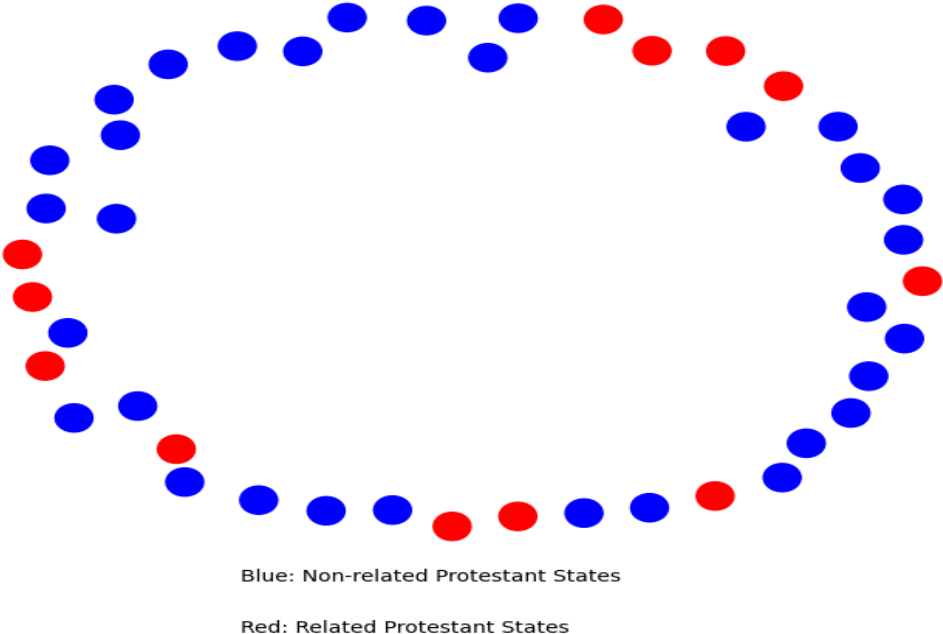
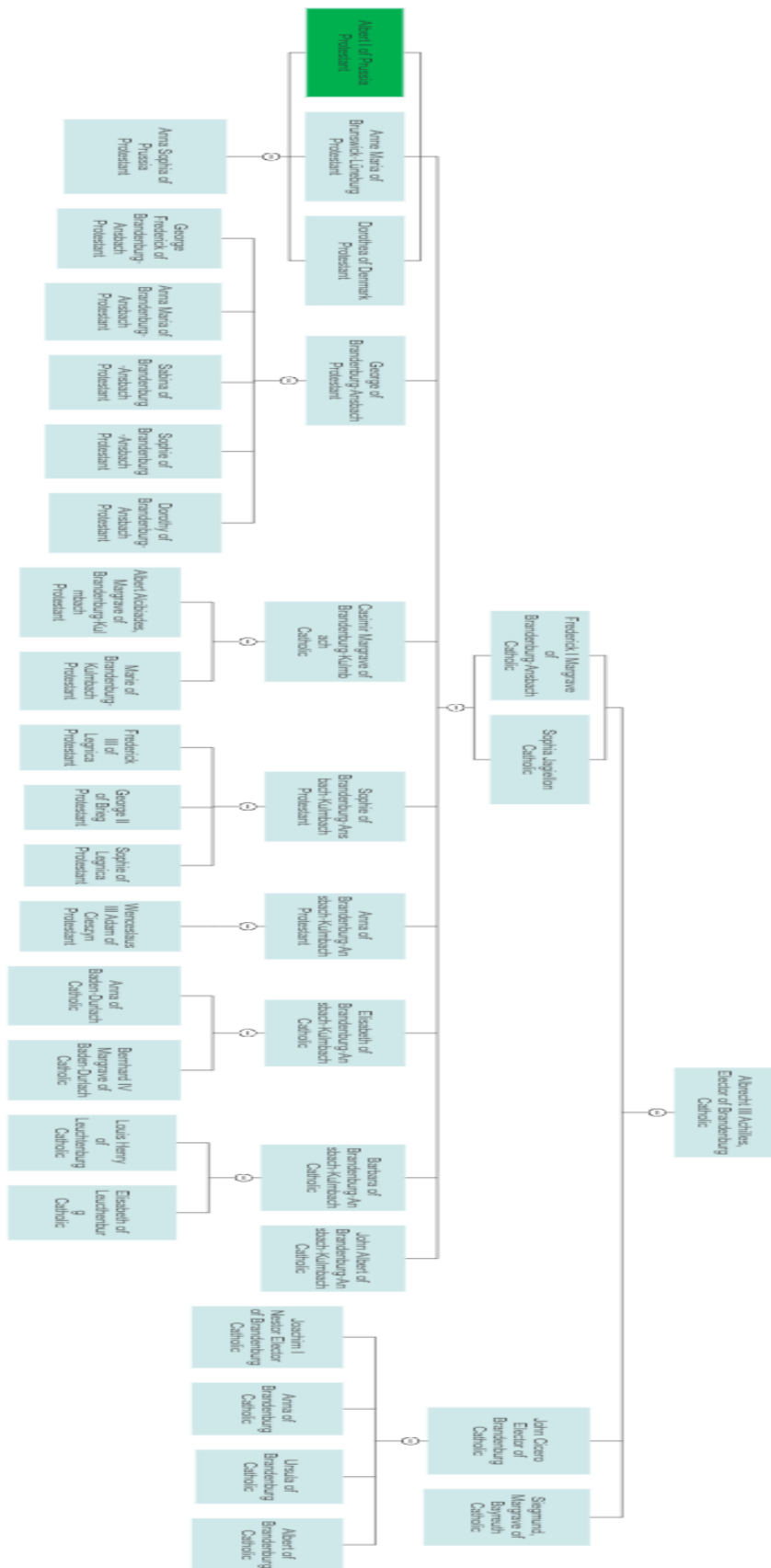Red: Related Protestant States

Figure 4: Family Tree of Albert I

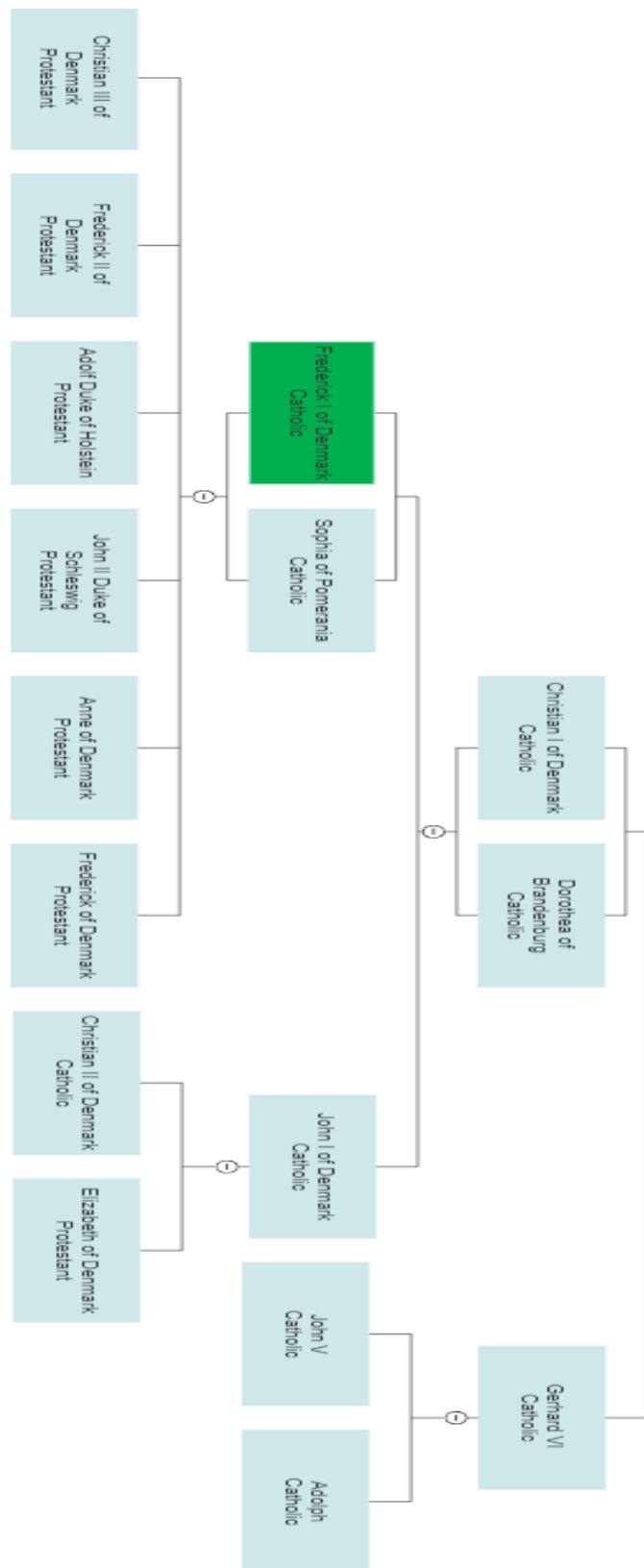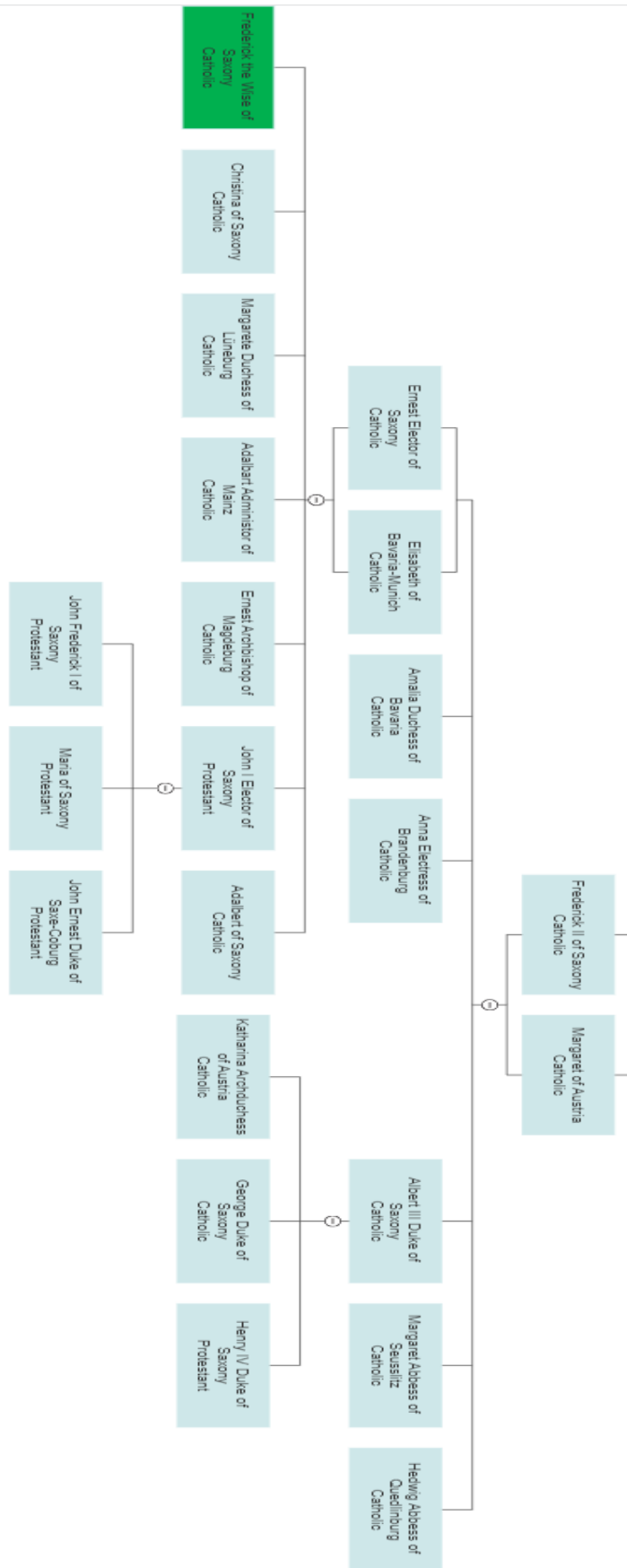Figure 5: Family Tree of Frederick of Denmark

Figure 6: Family Tree of Frederick the Wise of Saxony

4.2) Exploring the Individual Religious Choice

In order to explore more deeply into the relationship between religious choice and being related to the main three rulers, I have conducted additional analysis. Table 3 shows the effects of being related to the main three monarchs. The variable interaction is the combined effect of being related to one of the main monarchs, being alive beyond the start of the Reformation, and being an individual who was not born as a Protestant. There are two reasons behind for using this interaction for the main effect on religious choice. The first reason for doing this interaction is to eliminate the negative effects of individual monarchs who cannot be Protestant because they did not live to see it. The second reason is to focus on converting to the Protestant fate. Being born as a Protestant can lead to overestimation in estimating adopting the Protestant fate. The results suggest that being related to Albert I, not being born as a Protestant, and being alive after the start of the Reformation increases an individual monarch's chance of being a Protestant by 20.9 percentage points. The chance is 37.3 percentage points for being a relative of Frederick the Wise of Saxony with the same interacting effects and 4.2 percentage points for Frederick I of Denmark. The only result which is statistically significant at the %5 level was for Frederick the Wise.

Table 4 shows that the degree of family ties has a statistically significant effect on the choice of being a protestant for an individual ruler. When family ties change from no relation to 3rd-degree relations or from 3rd-degree to being a cousin, the chance of an individual monarch being a Protestant increases by 4 percentage points because a single jump is with 10 units, not with 1 unit. If it was 1 unit, then the jump would be 0.4 percentage points. The maximum change, keeping in mind that there are 11 tiers of family ties in the dataset and a maximum of 10 jumps is possible, would be 40 percentage points which is considerably high.

The religious choice tables indicate that even though results for Albert I and Frederick I of Denmark are not significant at %5 level, being related to the three main monarchs, while being alive beyond the start of the Reformation and not being born as a Protestant, increases the chance of adopting the Protestant fate. The results are much higher if an individual is related to Frederick the Wise, while there is a considerable effect for being related to Albert I. The effect of Frederick I of Denmark is much lower than the other two monarchs. Also, jumps in the degree of family relation with these monarchs have a significant effect on religious choice.

Table 3: The Effects of Being Related to the Three Main Monarchs on Religious Choice

	Dependent variable: Protestant Monarch		
	(1)	(2)	(3)
Related to Albert I	0.030		
	(0.100)		
Lived Beyond Reformation	0.297***	0.342***	0.304***
	(0.037)	(0.036)	(0.037)
Related to Frederick I of Denmark		0.013	
		(0.122)	
Related to Frederick the Wise of Saxony			-0.063
			(0.082)
Interaction	0.209*	0.042	0.373***
	(0.116)	(0.162)	(0.111)
Constant	0.644***	0.612***	0.664***
	(0.100)	(0.088)	(0.085)
Not Being Born as Protestant	-0.624***	-0.592***	-0.637***
	(0.094)	(0.083)	(0.079)
Observations	438	438	438
R²	0.329	0.304	0.331
Adjusted R²	0.323	0.298	0.325
Residual Std. Error	0.354 (df=433)	0.361 (df=433)	0.354 (df=433)
F Statistic	53.081*** (df=4; 433)	47.268*** (df=4; 433)	53.507*** (df=4; 433)
Note:			*p<0.1; **p<0.05; ***p<0.01

Table 4: The Effects of Degree of Relation with the Three Main Monarchs on Religious Choice

	Dependent variable: Protestant Monarch
	(1)
Degree of Relation	0.004***
	(0.001)
Constant	0.194***
	(0.022)
Observations	438
R²	0.063
Adjusted R²	0.060
Residual Std. Error	0.417 (df=436)
F Statistic	29.128*** (df=1; 436)
Note:	*p<0.1; **p<0.05; ***p<0.01

4.3) Effects of Degree of Family Ties on Religious Choice

Table 5 includes a variable called Interaction. This variable shows the effects for the degree of relation of an individual monarch, who lived beyond 1517. When the Interaction variable increases by 1 unit, the likelihood of adopting the Reformation increases by 0.5 percentage points. This means that when the status jumps from a 3rd degree relative to a cousin, the chance of being an individual monarch being a Protestant increases by 5 percentage points. In this sense, the maximum jump possible is 10 because there are 11 subgroups for family relations and the highest possible chance of increase would be 50 percentage points. This result, which is statistically significant at the 1% confidence level, suggests that the degree of relation of individual monarchs who were able to see beyond the Reformation is a highly important and effective explanation for the choice of adopting the Protestantism. In addition to the interaction term, being alive after the start of the Reformation increases the chance of being a Protestant by 33 percentage points with the result being statistically significant. This was expected because the spread of Reformation was successful and this result support that success. On the other hand, without any interaction, an increase in the degree of relation with the main monarchs does not affect the chance of being a Protestant. This makes sense because some of the monarchs of the dataset had died before the start of the Reformation and probably the effect of them cancelled the ones who lived beyond 1517.

Table 5 showed the relationship between family ties with the three main rulers and individual religious choices. In addition to that, Table 6 shows the same relationship but instead of individual choice, it uses state choice for religion as the dependent variable. The table represents 3 different versions of equation (4) with each of the columns is a different version. The Weighted Degree of Relation variable was explained in the data section but in short words, it is the weighted averages of the degree of relation per state with the main three monarchs. The variable interaction is the interaction term for the Weighted Degree of Relation and At least One Protestant variable. It determines the combined effect of the Weighted average of the degree of relation and having at least one Protestant monarch on the state's choice of religion.

The results from equation (1) of Table 6 show that the Interaction of Weighted Degree of Relation and At least One Protestant decreases the chance for a state to convert to the Protestantism. In other words, when a state with at least one ruler who was Protestant and had

one unit increase on the weighted average degree of relation with the main three monarchs, then the chance of the state converting to Protestantism decreases by 4.8 percentage points. The highest effect possible, with 10 jumps, is a 48 percentage point decrease. On the other hand, if the variables were not interacted, they increase the chance of conversion to Protestantism with a 5.2 percentage points increase for one unit increase on the weighted average degree of relation with the main monarchs and 57.5 percentage points if a state had at least one Protestant ruler. This means being even slightly related to the main three monarchs has considerable effects on becoming a Protestant because of the 5.2 percentage point increase. Only the result for the At least One Protestant Ruler variable is statistically significant at any level. This indicates that there is no strong evidence for an interaction effect. Even though there are no significant effects, a decrease was not expected and it is considerably high.

Table 5: The Effects of Degree of Relation for Individual Conversion to Protestantism

	Dependent variable: Protestant Monarch
	(1)
Lived Beyond Reformation	0.330***
	(0.039)
Degree of Relation	-0.000
	(0.001)
Interaction	0.005***
	(0.002)
Constant	0.023
	(0.028)
Observations	438
R^2	0.259
Adjusted R^2	0.254
Residual Std. Error	0.371 (df=434)
F Statistic	50.640*** (df=3; 434)
Note:	*p<0.1; **p<0.05; ***p<0.01

4.4) Robustness Tests

In order to see whether the results were consistent across different factors, I conducted two estimations which are equations (2) and (3) in Table 6. Including only participation in the religious wars did not create great changes in the results and the significance of the results. This indicates that results were robust with the inclusion of the Religious Wars in the equation. In addition to this, participating to the Religious Wars increases the chance of a state being Protestant at 1600 by 13.4 percentage points. It was expected to be a result such as this because the participants of the Religious Wars were Protestants, Catholics who were against the Protestant states or Catholics who were trying to suppress Protestant rebellions.

Equation (3) of the Table 6 had more drastic effects on the main results rather than just including Religious Wars in the estimations. The inclusion of all control variables decreased

Table 6: The Effects of Degree of Relation to State Conversion to Protestantism

	Dependent variable: Protestant State		
	(1)	(2)	(3)
Interaction	-0.048	-0.054	-0.040
	(0.036)	(0.036)	(0.032)
Weighted Degree of Relation	0.052	0.058	0.042
	(0.036)	(0.036)	(0.032)
Constant	0.182**	0.121	1.042***
	(0.079)	(0.089)	(0.174)
Distance to Wittenberg			-0.001***
			(0.000)
Ecclesiastical			-0.342***
			(0.098)
Elector			-0.179
			(0.157)
Logged Population at 1500			-0.079
			(0.052)
Number of Cities			-0.011
			(0.026)
Printing Press until 1560			-0.087
			(0.097)
At least One Protestant Ruler	0.575***	0.580***	0.307***
	(0.104)	(0.103)	(0.103)
University			0.154
			(0.157)
Participated to the Religious Wars		0.134	0.024
		(0.093)	(0.088)
Observations	75	75	75
R^2	0.379	0.396	0.626
Adjusted R^2	0.352	0.362	0.561
Residual Std. Error	0.399 (df=71)	0.396 (df=70)	0.328 (df=63)
F Statistic	14.428*** (df=3; 71)	11.495*** (df=4; 70)	9.600*** (df=11; 63)
Note:			*p<0.1; **p<0.05; ***p<0.01

the effect of having at least one Protestant ruler from a 57.5 percentage point increase of equation (1) to a 30.7 percentage point increase. The other main variables did not change drastically and there was no change in the significance levels. This shows that the At least One Protestant Ruler variable could be influenced by different factors which can include the control variables of the equation (3).

5. Conclusion

The Lutheran Reformation drastically changed the politics and religious foundations of the Holy Roman Empire and Europe itself. The reformation spread across the continent and shape other countries such as England. The effects of family ties, specifically being related to the monarchs Albert I of Prussia, Frederick the Wise of Saxony, and Frederick I of Denmark, affecting the spread of the Reformation in terms of individual choice and state-wise choice in the Empire was in question at this paper. Also, the degree of relationships with these monarchs was considered as a possible factor in the spread of Lutheran ideas.

The findings of this paper give some insight into these questions. An individual who was related to the main monarchs while lived beyond the start of the Reformation and was not born as a protestant had a significant chance to become a Protestant except the monarch was Frederick I of Denmark but the result including him was not statistically significant at any level. In addition to this, I find that the degree of relation with the main three monarchs, on its own, is an important factor for individual religious choice with results being statistically significant. Also, my results suggest that the degree of relation of individual princes with the main monarchs who were able to see beyond the Reformation is a highly important and effective explanation for the choice of adopting the Protestantism.

On the other hand, some of the results for states were not expected. My findings show that even though by its own, weighted average of the degree of relation with the main monarchs, increases the chance of adopting the Protestant fate, when interacting this with having at least one protestant ruler, it has negative effects. In overall, even though the results were insignificant for the state religious choice, on its own, the weighted degree of relation with the three main monarchs had a positive and considerable impact on the choice of Protestantism. This would mean that being even slightly related to one of the main three monarchs would increase the chances of adopting the Protestant fate.

Even though I had some limitations, such as limited literature and data in the field of family ties and the Reformation, I found results that support, with and without statistical significance, the hypothesis of being related to the three monarchs increases the chance of adopting Protestantism in individual and state-wise terms, especially when the degree of relation with these three rulers increases. The family trees and figures 2 and 3 also support the effects of family ties with Albert I, Frederick I, and Frederick the Wise on the choice of Protestantism.

6. Appendix

Appendix A

Table A1: Variable Descriptions

Variables	Descriptions
Protestant Monarch	Binary variable,1 if an individual monarch was Protestant
Protestant State	Binary variable,1 if an individual state was Protestant
Not Being Born as Protestant	Binary variable,1 if an individual monarch was not born as a Protestant
Related to Albert I	Binary variable,1 if an individual monarch had family ties with Albert I of Prussia
Related to Frederick the Wise of Saxony	Binary variable,1 if an individual monarch had family ties with Frederick the Wise of Saxony
Related to Frederick I of Denmark	Binary variable,1 if an individual monarch had family ties with Frederick I of Denmark
Related to Three Monarchs	Binary variable,1 if an individual monarch had family ties with any of the main three monarchs
Degree of Relation	The degree of relationship with the main three monarchs which is subjected to 11 subgroups of family relation dummy variables.
Lived Beyond Reformation	Binary variable,1 if an individual monarch lived beyond 1517
Number of Cities	The number of cities within each individual state
University	Binary variable, 1 if the state had an active university
Ecclesiastical	Binary variable, 1 if the state had an ecclesiastical territory
Logged Population at 1500	Logged population of a state
Elector	Binary variable, 1 if the state was an Electorate of the Holy Roman Empire
At least One Protestant Ruler	Binary variable, 1 if the state had at least one Protestant ruler
Weighted Degree of Relation	Weighted average of the Degree of Relation varaible for every single state
Participated to the Religious Wars	Binary variable, 1 if the state participated to the Religious Wars
Printing Press until 1560	Binary variable, 1 if the state had any printing press until 1560
Distance to Wittenberg	Distance to Wittenberg for every single state according to the latitude and longitude values obtained from the original state dataset

Note: The data, including information about monarchs and state participation to the religious wars was created by me which was based on sources such as Wikipedia, Britannica and the websites of the houses who still lives on. The state data was obtained from Cantoni (2012) which originates from and Bairoch, Batou, and Chèvre (1988). The varaibles which are Distance to Wittenberg and Weighted Degree of Relation were based on own calculations

Appendix B

Table B1: Spectrum of Degree of Relation

Family Relation	Value
Self	100
Child/Grandson	90
Brother/Sister	80
Father/Mother	70
Niece/Nephew	60
Uncle/Aunt	50
Spouse	40
Grandfather/Grandmother	30
Cousin	20
Third Degree Relative	10
No Relation	0

Note: All of the variables in the Family Relation column were originally dummy variables which determined the relationship of individual rulers with the three main monarchs. These dummies were assigned to specific numerical values which is given in the Value column.

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