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Witchcraft, Weather and Economic Growth in Renaissance Europe

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Between the thirteenth and nineteenth centuries, as many as one million individuals in Europe were executed for the crime of witchcraft. The majority of the trials and executions took place during the sixteenth and seventeenth centuries. During this period, the speed and volume of executions were astonishing: in one German town, as many as 400 people were killed in a single day (Midelfort, 1972). The trials were ubiquitous: conducted by both ecclesiastical and secular courts; by both Catholics and Protestants. The victims were primarily women, primarily poor and disproportionately widows. The persecutions took place throughout Europe, starting and ending earlier in southwest Europe than in the northern and eastern areas, and spread even across the Atlantic Ocean to Salem, Massachusetts. Although witchcraft trials in Europe and America largely ended by the late eighteenth century, witchcraft accusations and killings still take place in many countries today, particularly in the developing world. For example, witchcraft is often blamed for AIDS deaths in sub-Saharan Africa (Ashforth, 2001), and Miguel (2003) shows that negative economic shocks are associated with increases in witch killing in modern Tanzania. Belief in the witch, and fear of her, is enduring.

While much work has been done on the motivations behind the European trials, the large-scale causes remain unknown. The existing work has primarily been concerned with the factors that played into trials on a small scale—why a certain individual was targeted or why a certain type of individual was targeted in a given area. This work has indicated that there was a diverse set of issues that played into trials on an individual level. More broadly, however, there are few causal explanations for why witchcraft trials happened at all and on such a large scale in so many

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areas at the times that they did. The earliest trials, going back to the thirteenth century, were the work of church institutions, particularly the Catholic Inquisition, but the mass of trials later in the period saw very little formal church involvement of this type. Various hypotheses have been offered: for example, a need by the male medical profession to rid the world of midwives and female folk healers (Ehrenreich and English, 1973); a perceived need for moral boundaries by the Catholic church (Ben-Yehuda, 1980); or an increase in syphilis and subsequent increase in the mentally ill, who were then targeted as witches (Ross, 1995).

This paper explores the possibility that the witchcraft trials are a large-scale example of violence and scapegoating prompted by a deterioration in economic conditions. In this case, the downturn was brought on by a decrease in temperature and resulting food shortages. The most active period of the witchcraft trials coincides with a period of lower than average temperature known to climatologists as the "little ice age." The colder temperatures increased the frequency of crop failure, and colder seas prevented cod and other fish from migrating as far north, eliminating this vital food source for some northern areas of Europe (Fagan, 2000). Several kinds of data show more than a coincidental relationship between witch trials, weather and economic growth. In a time period when the reasons for changes in weather were largely a mystery, people would have searched for a scapegoat in the face of deadly changes in weather patterns. "Witches" became target for blame because there was an existing cultural framework that both allowed their persecution and suggested that they could control the weather.

Background on Witchcraft and the Little Ice Age

The belief in the existence of witches goes back at least as far as the Old Testament of the Bible, which forbids the practice of witchcraft. For example, the book of Exodus (22:18) says: "Thou shalt not suffer a witch to live." Pre-Christian cultures in Greece, Rome and Iceland, among other places, believed in the power of witches (Ankarloo and Clark, 1999; Davidson, 1973). The history of systematic witch hunting, however, is primarily associated with the Christian church. Russell (1972) and the volume edited by Kors and Peters (2001) both offer good general histories of witchcraft in the medieval period.

In the early medieval period, the Catholic Church asserted that it was not possible for mortals to do things that were attributed to witches. For this reason, the early church leaders dismissed the view that witches could influence the weather. For example, in the ninth century, an important cleric, Agobard, Archbishop of Leon, dismissed the idea that witches could produce weather in his letter, "Against the foolish opinion of the masses about hail and thunder" ("*Contra insulsum vulgi opinionem de grandine et tonitruis*") (Agobard of Leon, 9th century). Early church documents went as far as to suggest that belief in witchcraft was heresy (Kors and Peters, 2001).

Starting in the mid-thirteenth century, however, it became widely accepted that witches existed, were capable of causing physical harm to others and could control natural forces. The first trials for witchcraft emerged from the actions of the Catholic Inquisition, an official church-sponsored investigatory organization designed to stamp out heretical behavior. During this early period, accusations of witchcraft and sorcery were primarily an offshoot of the accusations of heresy that the Inquisition was originally charged to tackle. Some have argued that the move toward persecuting witchcraft in addition to heresy was, in part, a response to the waning power of the Inquisition once other heretic groups like the Cathars (who held the gnostic belief that matter was evil and salvation came through spiritual renunciation of matter) and the Waldensians (who preached in public without approval of the clergy and translated some of the Bible into vernacular language) had been largely eliminated (Russell, 1972). During this period, witchcraft accusations were often closer to heresy—accusations of prostration to the devil, for example—than to criminal behavior.

There appeared to be a lull in the witchcraft trials between the end of the fifteenth century and the middle of the sixteenth, after a significant period of witch hunting in the early fifteenth century. This lull was followed by the largest period of witch persecutions, lasting from the mid-sixteenth century to the end of the eighteenth, which is the period discussed in this paper. It is during this period that the majority of the executions took place, and the trials spread throughout Europe and Scandinavia. The victims were disproportionately women, especially those poor or widowed. Largely in contrast to earlier periods, the later trials were conducted by both Catholics and Protestants, in both ecclesiastical and secular courts.

The principal text outlining the proper treatment of witches in this latter period was the *Malleus Malleficarum*, published in 1484 (Summers, 1971). This book was instrumental in codifying the existing beliefs about witches, their powers and their actions. It gave specific guidelines about how suspected witches should be "questioned" until they confessed to their crimes. In addition, it calls our attention to the extant beliefs about witchcraft, weather making and crop destruction at this time. In the Papal Bull that opens the *Malleus*, Pope Innocent VIII recognizes the power of witches in the destruction of crops, writing: "It has indeed lately come to Our ears . . . many persons of both sexes . . . have blasted the produce of the earth, the grapes of the vine, the fruits of the trees, . . . vineyards, orchards, meadows, pasture-land, corn, wheat, and all other cereals. . . ." In addition, the *Malleus* contains a chapter detailing the powers of witches with regard to the weather, titled "How they Raise and Stir up Hailstorms and Tempests, and Cause Lightning to Blast both Men and Beasts." This chapter ends with a line that leaves no room for doubt about the perceived power of witches: "Therefore it is reasonable to conclude that, just as easily as they raise hailstorms, so can they cause lightning and storms at sea; and so no doubt at all remains on these points."

It has long remained a mystery why the witchcraft trials re-emerged in the mid-sixteenth century, and why they did so with such force. The textual evidence shows us why it would be *possible* in this time to believe that witches controlled the weather. Moreover, the evidence on climate change suggests that important and noticeable weather changes during this period would have severely affected food production.

Temperatures began to drop around the beginning of the fourteenth century (after a 400-year "medieval warm period"), and the world was warming again by the early 1800s. The coldest segments of this "little ice age" period were in the 1590s and between 1680 and 1730 (Fagan, 2000). The temperature over the period was about two degrees Fahrenheit lower than it had been in previous centuries. This decrease was large enough to leave Iceland completely surrounded by ice and to freeze the Thames in England and the canals in Holland routinely—both otherwise unheard-of events.

The cause of the generally colder weather is not known. Climatic historians have demonstrated that during the latter part of the little ice age (1645–1715), known as the "Maunder Minimum,"[1] there were very few sunspots, although it is not immediately clear why this would lead to lower temperature. The colder weather was exacerbated by a number of volcanic eruptions (including Huaynaputina in southern Peru in 1600, the volcano now known as Mount Parker in the Philippines in 1641 and smaller volcanic episodes in 1666–1669, 1675 and 1698–1699), which cooled much of the world for years at a time (Fagan, 2000).

In general, there is overlap in the time period of the colder weather and the witchcraft trials. Over this period trials are generally rising and then falling, while the temperature is falling and then rising. In addition to this general overlap, one of the sharpest drops in temperature in the little ice age roughly coincides with the reinvigoration of witchcraft trials around 1560, after a 70-year lull. It is possible that this drop in temperature was a catalyzing factor in the regrowth of the trials. Some anecdotal evidence also suggests that witchcraft accusations in Europe may have been connected with periods of particularly extreme weather. Behringer (1995, 1999) notes the overlap between the period of the little ice age and the witchcraft trials and provides several examples of large storms or other weather anomalies that were cited in specific trials. For example, Behringer (1999) shows historical evidence that the particularly cold May in the year 1626 was associated with a renewed call among peasants for persecution of witches and sorcerers in the Franconian town Zeil.

The remainder of this paper explores systematic evidence on the issue of whether poor weather and economic downturns were causally related to the witch trials.

Multicountry Analysis

One way to test the relationship between weather and witch trials is to look at the correlations across a number of regions. I collected data on witchcraft trials,

[1] Edward Walter Maunder (1851–1928) was a British astronomer who is best remembered today for his studies of cyclical patterns of sunspots, but who was also active as a skeptic in the debate over whether observed markings on Mars were canals.

weather and growth in a number of regions of Europe between 1520 and 1770. Figure 1 presents the primary relationship detailed in this paper. This graph shows standardized temperature (averaged over all regions) and standardized trials (again, averaged over all regions) graphed against time. The graph clearly shows that temperature and trials moved in opposite directions in this period. The most extreme example of this is in the period after 1720, but the relationship is also clear in the earlier time periods. A (quadratic) time trend has also been removed from these data, which is one way of attempting to ensure that the relationship between weather and witchcraft is not just a coincidental relationship between two time trends.

The data and calculations underlying Figure 1 deserve some additional explanation. Details of the data collection for trials and weather, and the sources for each part of the data used, are in the Appendix. The data on the number of trials were complied from a variety of secondary sources dealing with 11 regions of Europe: Bishopric of Basel (in the northern part of modern Switzerland), Essex (in the modern United Kingdom), Estonia, Finland, Franche-Compte (now in eastern France), Geneva, Home Circuit (England), Hungary, Neuchatel (now near the western border of Switzerland), Parlement of Paris and Scotland. I tabulated the trials by decade (in cases where the number of trials was available by year, they were summed over the decade). Recording at the decadal level was done primarily to match the trial data with temperature data, which were generally available only decadally. In addition, the number of trials was standardized relative to the regional means. This adjusts for differences in the absolute number of trials across countries and makes the coefficients in the regressions (presented later) easier to interpret. Thus, in each area the mean is zero and the standard deviation is one.

Data on weather were also collected from secondary sources. It is available for fewer regions, and as a result, more than one witch trial region was matched with each set of temperature data. For some areas, data are available directly on temperature. For others, data exist on "winter severity," which should be a good proxy for temperature (colder winters are more severe). To combine the two measures (which is done to ensure the closest geographic temperature-trial matching), all data are standardized relative to the country mean. I create two measures, one in which each trial region is matched with the closest weather region, in which weather can be measured either through temperature or winter severity, and a second measure in which only a subset of trial regions are matched to winter severity measures, as a robustness check. The details of this matching appear in the Appendix.

The relationship in Figure 1 is analyzed statistically in Table 1. Columns 1 and 2 of the table provide a direct test of the relationship between weather and trials: the standardized trial index is regressed against the standardized weather index, with quadratic controls for date also included. Column 1 includes all observations and uses the combined temperature/winter severity index to measure weather; column 2 includes only the subset of countries for which winter severity is available and therefore uses winter severity to measure weather. The results suggest that a

Figure 1
Temperature and Trials over Time 1520–1770

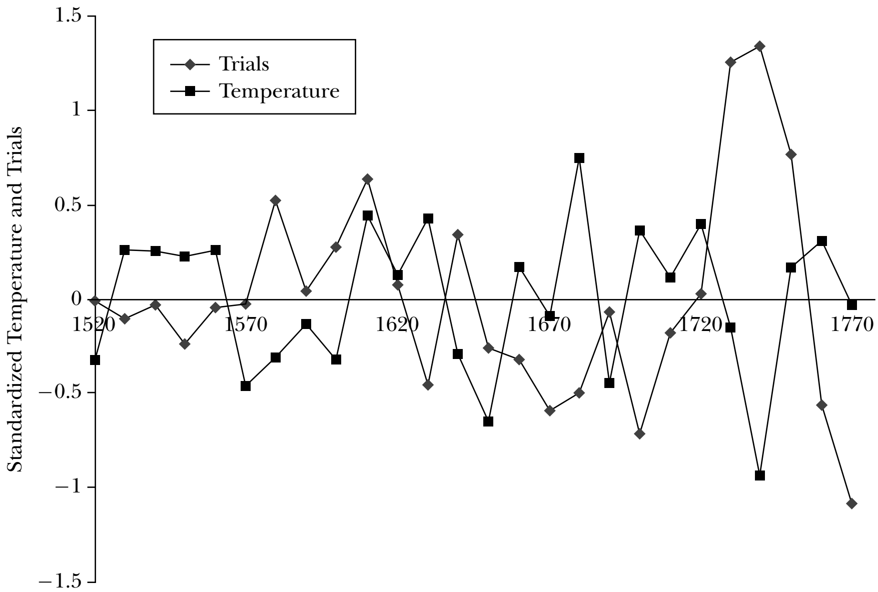


Table 1
Witchcraft Trials and Temperature
(dependent variable: witchcraft trials standardized by region)

	(1)	*(2)*	*(3)*	*(4)*
Standardized combined index	-0.212^{c} (2.59)		-0.206^{b} (2.32)	
Standardized winter severity only		-0.179^{b} (1.96)		-0.292^{c} (2.84)
Date	0.096 (1.96)	0.233^{c} (3.43)		
Date-squared	−0.003 (1.43)	-0.011^{c}(3.45)		
Constant	-0.645^{b} (2.39)	-1.037^{c} (3.16)	−0.019 (0.26)	−0.059 (0.71)
Decade fixed effects (1520–1770):	NO	NO	YES	YES
Observations	170	128	170	128
R-squared	0.10	0.15	0.24	0.28

Note: Absolute value of t-statistics in parentheses.
[a] significant at 10 percent; [b] significant at 5 percent; [c] significant at 1 percent.

one standard deviation decrease in temperature leads to about a 0.20 standard deviation increase in witch trials. The small R-squared on columns 1 and 2 indicates that only about 8–12 percent of the variation in trials is explained by the variation in temperature and simple date controls. This level of explanatory power is not surprising given that the data are likely to be quite noisy and a number of other factors certainly contributed to the witch trial phenomenon.

Two main econometric concerns arise with columns 1 and 2. First, there is the possibility that the regressions are simply picking up opposite directional trends in the data that are not sufficiently controlled for by date variables. Second, there is the possibility of omitted variable bias because of lack of controls for important historical events in this period: for example, the Thirty Years War, really a series of wars fought across Europe from 1618–1648, mainly pitting the Hapsburg dynasty of Austria against, at various times, France, Sweden, Denmark and Holland; outbreaks of bubonic plague, which happened about once every twenty years in heavily populated areas during this period; and others. Columns 3 and 4 address these issues by including decadal dummies. The dummies allow for overall changes in trials over time. Thus, the results hinge on cross-sectional differences during each decade rather than time-series trends. Moreover, any large events that affected the whole of Europe in this time period will be implicitly controlled for by these dummy variables. The results in columns 3 and 4 show only a small decrease in the magnitude of the relationship once the decadal dummies are included, and the statistical significance is unaffected.[2]

I tested the robustness of these results in a number of ways. For example, one possible concern about this analysis is that the results may be driven by a strong relationship in one or two countries. But when the regression is run repeatedly, each time excluding one area, the magnitude of the results does not change appreciably. Also, most of the regions are missing observations either at the beginning of the 1520 to 1770 period, or at the end, or both. But when the regressions were run using a subset of dates for which all countries were observed, the results remained essentially the same. Overall, these results suggest that decreases in temperature led to more witchcraft trials.

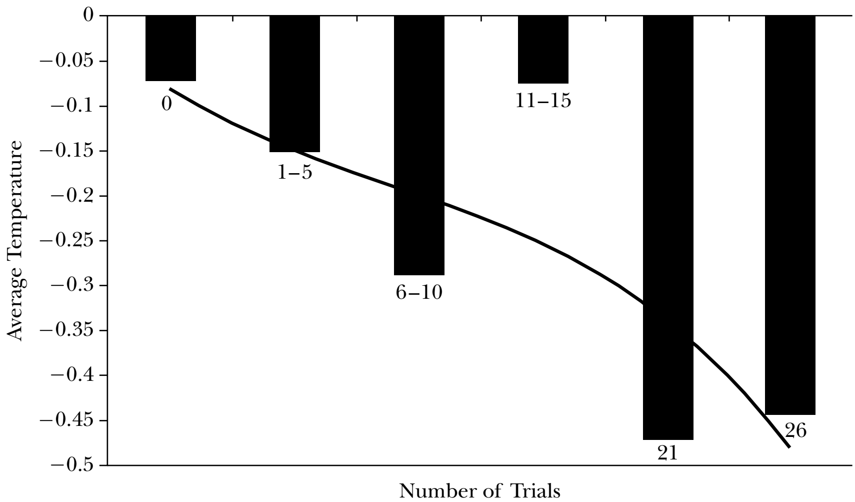
Geneva Yearly Analysis

Temperature data are generally available only at the decadal level. However, for the Geneva region, both trial data and temperature data were available on a yearly basis. Since food shortages are likely produced by circumstances in previous years, the analysis is carried out by presenting the relationship between the number of trials and the average temperature for the previous three years.

Figure 2 shows the negative relationship between number of trials and temperature. Years with specific numbers of trials are grouped (1–5, 6–10 and so on)

[2] For some regions, data on the number of executions for witchcraft are available alongside data on the number of trials. When this regression is run using deaths rather than trials, we see coefficients of similar magnitude, although only very marginal statistical significance, likely due to the smaller number of observations.

Figure 2
Average Temperature by Number of Trials



because there are generally only one or two years with any given number of trials. When the relationship in this graph is tested statistically by running a regression of number of trials on the average temperature for the last three years, the relationship is negative and marginally statistically significant at the 8 percent level. The coefficient implies that a 1 standard deviation increase in temperature leads to about a 0.39 standard deviation decrease in trials.

Of course, it would be unwise to put too much weight on evidence from a single area. However, taken together with the earlier results, the annual time series from Geneva provides additional evidence that adverse weather conditions in this period should be part of an explanation of the witchcraft trial phenomenon.

Witchcraft and Economic Growth

In the primarily agricultural economies of the medieval period, economic growth will be heavily influenced by crop yield and, hence, by weather. In this section, we take this approach one step further and attempt to test more directly the relationship between economic growth and the witchcraft trials. However, a test of this hypothesis immediately runs into the difficulty that sufficient data on economic growth are unavailable for the period between 1520 and 1770, so it becomes necessary to turn to proxies.

I use two measures to proxy for economic growth. The first is the number of cities in the country with a population of more than 10,000. These data comes from de Vries (1984) and were also used by De Long and Shleifer (1993) as a measure of growth. The second proxy for growth is country population density from McEvedy and Jones (1978). These data have been used by Acemoglu, Johnson and Robinson (2002), and they argue that only during prosperous periods could countries support dense populations, implying that population growth parallels economic growth. In addition, population growth is likely to be closely related to food production, so it may capture the effects of lower food production on witchcraft trials more directly than weather. It should be noted that, although population density is available for all regions in the analysis, the urbanization data are not available for Hungary or Estonia. In addition, the growth data are country specific, so to the extent that there is more than one location in each country, all locations within the same country have the same growth data.

Both the number of cities and population density data are available at 50-year intervals (starting in 1500). Percentage population growth over each 50-year period is standardized relative to the country mean (note that within an area of fixed size, growth in population and growth in population density are identical). The number of cities over 10,000 is also standardized relative to the country mean. In addition, the witch trial data are aggregated to 50-year intervals, to match the population data.

Figure 3 demonstrates the negative relationship between trials and growth graphically, using the population density measure. The average number of trials for each growth quantile is graphed against the level of population growth. Areas with slower-than-average population growth had more witch trials; areas with faster-than-average population growth had fewer witch trials. The relationship between growth and trials is statistically significant and negative in these data, despite the relatively small number of observations. Table 2 shows this relationship, with and without controls for year; again, because both trials and growth are standardized relative to area it is not necessary to control for region dummies. Columns 1 and 2 show the relationship for urbanization and columns 3 and 4 for population density. The coefficients suggest a relationship between trials and growth that is similar in magnitude to the relationship between trials and weather, or slightly higher. Without controls for date, the coefficient on urbanization is −0.57 and on population growth is −0.34, both significant at the 5 percent level. Including dummy variables for 50-year period, the coefficient on urbanization drops to −0.52 and is still significant at the 5 percent level, while the coefficient on population density is −0.25 and is significant at only the 10 percent level.

Given the small sample size, the results are fairly robust. The negative relationship between growth and trials holds for all countries in the sample except for Hungary (which has only data on population growth, not urbanization data). During this time period, Hungary had 200 years of stagnant population, due primarily to invasion and massacre by the Ottoman Turks. When Hungary is excluded from the sample, the coefficients on population density in columns 3 and 4 are larger and significant at 1 percent and 5 percent, respectively.

Figure 3
Population Growth and Trials

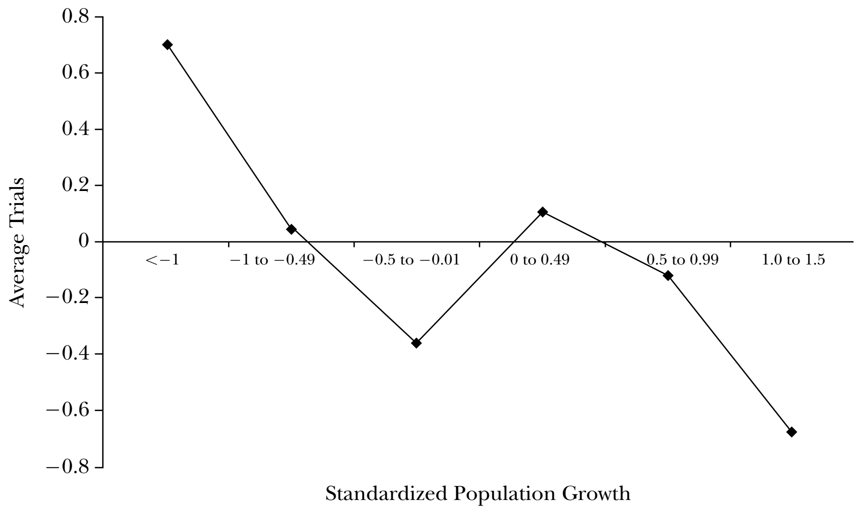


Table 2
Witchcraft Trials and Economic Growth
(dependent variable: witchcraft trials standardized by region)

	(1)	(2)	(3)	(4)
Standardized number of cities over 10,000	−0.577[c] (2.98)	−0.527[b] (2.18)		
Standardized population growth			−0.342[b] (2.26)	−0.252[a] (1.80)
Constant	−0.087 (0.62)	−0.079 (0.65)	−0.070 (0.53)	−0.051 (0.45)
Fifty-year fixed effects (1500–1750)	NO	YES	NO	YES
Observations	31	31	42	42
R-squared	0.23	0.52	0.11	0.35

Note: Absolute value of t statistics in parentheses.
[a] significant at 10 percent; [b] significant at 5 percent; [c] significant at 1 percent.

It is more difficult to draw strong conclusions about the relationship between trials and economic or population growth than about that between trials and weather. There are many fewer observations, and the links between economic growth and either population growth or urbanization are obviously complex. On the other hand, the fact that we see even marginal statistical significance with so few observations is suggestive, particularly coupled with the argument that there is an immediate causal connection between weather, food production and economic growth in this type of society.

Discussion and Conclusion

There is a small literature on how economic conditions may be associated with violent scapegoating. Such papers are conceptually related to work on witchcraft because they, too, deal with situations in which the victims are not personally responsible for causing an injury.

For example, in a pioneering study, Hovland and Sears (1940) explore whether economic downturns were associated with a higher frequency of lynchings in the American south. They find significant correlations between various measures of economic well being—the value of land, or cotton, or straight economic well-being (the Ayres index)—and increases in the number of black and total lynchings. Hepworth and West (1988) investigate whether the results were driven by varying time trends in the data, by using more advanced time series techniques to avoid this problem, and they confirm the negative correlations between the parameters, although the magnitude is somewhat smaller than suggested in the original work. Specifically, they find a -0.21 correlation between farm value and number of black lynchings. However, Green, Glaser and Rich (1998) have extended the time series in that paper through the Great Depression and argued that the result does not hold when that is done. Despite this, the earlier work is suggestive, and it is possible that the Depression is more of an anomaly than the earlier time period.

In a series of papers on the causes of civil war, Collier and Hoeffler (2000, 2002) have demonstrated that poor economic conditions are generally associated with an increased chance of civil conflict. There are several possible explanations for the phenomenon. The most consistent with the work presented here is that citizens blame other ethnic groups for deterioration in economic conditions. (Moreover, "other ethnic groups" in this case may well mean the government, given that political coalitions often form along ethnic lines.) However, Collier and Hoeffler argue that there are other major contributing factors that are not as consistent with a scapegoating hypothesis—for example, rebels have fewer outside labor market opportunities when the economy is slumping.

A final paper to mention in this discussion is the analysis by Miguel (2003) of the relationship between witch killings and weather patterns in modern Tanzania. Unlike in medieval Europe, where witch killings were quite common and not within family, a Tanzanian village sees one witch killing approximately every five years, and the victims are generally the oldest woman in the household, killed by her own family members. Miguel finds that in years when there is extreme rainfall (either too little or too much) the number of witch murders is significantly increased: moving from normal to severe rainfall in either direction increases the number of witch killings by 0.085. Miguel argues that in Tanzania, the killings may reflect an elimination of the least productive household member in the face of food shortages. Although this argument is somewhat different than the scapegoating argument presented here, they are by no means mutually exclusive. If medieval communities felt responsible for feeding the poor older women in the village, then they may have had particular impulse to increase accusations of witchcraft during difficult times.

Historians often base their arguments in the very specific context of relationships in a certain place and time, an approach that can often be extraordinarily fruitful. In this spirit, studies of witchcraft trials often rely on explanations revolving around psychological factors in the population. This paper argues for mindfulness about potential economic macrofoundations of historical events. The witchcraft trials suggest that even when considering events and circumstances thought to be psychological or cultural, key underlying motivations can be closely related to economic circumstances.

Appendix
Data on Witch Trials and Weather

The data on number of trials was collected from a number of different sources, which are enumerated in the table below.

Country	*Trials or deaths*	*Years*	*Source*
Bishopric of Basel	Trials only	1560–1680	Monter (1992)
Essex	Trials only	1560–1680	Macfarlane (1979)
Estonia	Both	1520–1730	Madar (1990)
Finland	Both	1520–1700	Heikkinen and Kervinen (1990)
Franche-Compte	Both	1590–1670	Monter (1976)
Geneva (decadal and yearly)	Both	1520–1690	Monter (1976)
Home Circuit	Trials only	1560–1710	Sharpe (1996)
Hungary	Both	1520–1770	Klaniczay (1990)
Neuchatel	Trials only	1560–1680	Monter (1976)
Parlement of Paris	Both	1560–1640	Soman (1978)
Scotland	Trials only	1510–1720	Black (1992)

This paper uses two climate measures: a mixed index of temperature and winter severity, and an index including only winter severity. For the multicountry index I used several measures of climate from different sources. I did not have individual climate from each country used, so for some countries the weather from the closest country for which there were data was used. The table below shows the data that were used for the combined index and the winter severity index for each of the 11 areas.

Country	*Combined index (source)*	*Winter severity index (source)*
Bishopric of Basel	Swiss Temp. Index (Lamb, 1982)	German Winter (Lamb, 1982)
Essex	England Winter Severity (Lamb, 1982)	England Winter (Lamb, 1982)
Estonia	Russian Winter (Lamb, 1982)	Russian Winter (Lamb, 1982)
Finland	Russian Winter (Lamb, 1982)	Russian Winter (Lamb, 1982)
Franche-Compte	Swiss Temp. Index (Lamb, 1982)	Not Used

Country	*Combined index (source)*	*Winter severity index (source)*
Geneva	Swiss Temp. Index (Lamb, 1982)	German Winter (Lamb, 1982)
Home Circuit	England Winter (Lamb, 1982)	England Winter (Lamb, 1982)
Hungary	Hungarian Temp. Index (R'acz, 1994)	Not Used
Neuchatel	Swiss Temp. Index (Lamb, 1982)	German Winter (Lamb, 1982)
Parlement of Paris	Swiss Temp. Index (Lamb, 1982)	Not Used
Scotland	England Winter (Lamb, 1982)	England Winter (Lamb, 1982)

The source for yearly temperature data for Geneva is Pfister (1993).

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References

Acemoglu, Daron, Simon Johnson and James Robinson. 2002. "Reversal of Fortune: Geography and Institutions in the Making of the Modern World Income Distribution." *Quarterly Journal of Economics.* 117:4, pp. 1231–294.

Agobard of Leon. 9th Century. "*Contra insulsam vulgi opinionem de grandine et tonitruis.*" Available at ⟨http://www.fordham.edu/halsall/source/Agobard-OnHailandThunder.html⟩.

Ankarloo, Bengt and Stuart Clark, eds. 1999. *Ancient Greece and Rome, Witchcraft and Magic in Europe.* Philadelphia: University of Pennsylvania Press.

Ashforth, Alan. 2001. "AIDS, Witchcraft, and the Problem of Power in Post-Apartheid South Africa." Institute for Advanced Study, Occasional Papers of the School of Social Science No. 10.

Behringer, Wolfgang. 1995. "Weather, Hunger and Fear." *German History.* 13:1, pp. 1–27.

Behringer, Wolfgang. 1999. "Climatic Change and Witch-Hunting." *Climatic Change.* 43:1, pp. 335–51.

Ben-Yehuda, Nachman. 1980. "The European Witch Craze of the 14th to 17th Centuries: A Sociologist's Perspective." *American Journal of Sociology.* 86:1, pp. 1–31.

Black, George. 1992. "A Calendar of Cases of Witchcraft in Scotland, 1510–1727," in *Witchcraft in Scotland.* Brian Levack, ed. New York: Garland Publishing, pp. 133–232.

Collier, Paul and Anke Hoeffler. 2000. "Greed and Grievance in Civil War." Centre for the Study of African Economies Working Paper WPS0018.

Collier, Paul and Anke Hoeffler. 2002. "On the Incidence of Civil War in Africa." *Journal of Conflict Resolution.* 46:1, pp. 13–28.

Davidson, H. R. Ellis. 1973. "Hostile Magic in the Icelandic Sagas," in *The Witch Figure.* Venetia Newall, ed. London: Routledge, pp. 20–41.

De Long, J. Bradford and Andrei Shleifer. 1993. "Princes and Merchants: European City Growth before the Industrial Revolution." *Journal of Law and Economics.* 36:2, pp. 671–702.

De Vries, Jan. 1984. *European Urbanization 1500–1800.* Cambridge: Harvard University Press.

Ehrenreich, Barbara and Deirdre English. 1973. *Witches, Midwives and Nurses: A History of Women Healers.* New York: Feminist Press.

Fagan, Brian. 2000. *The Little Ice Age.* New York, N.Y.: Basic Books.

Green, Donald, Jack Glaser and A. Rich. 1998. "From Lynching to Gay-Bashing: The Elusive Connection between Economic Conditions and Hate Crime." *Journal of Personality and Social Psychology.* 75:1, pp. 82–92.

Heikkinen, Antero and Timo Kervinen. 1990. "Finland: The Male Domination," in *Early Modern European Witchcraft.* Bengt Ankarloo and

Gustav Henningsen, eds. Oxford: Oxford University Press, pp. 319–38.

Hepworth, Joseph and Stephen West. 1988. "Lynchings and the Economy: A Time-Series Reanalysis of Hovland and Sears (1940)." *Journal of Personality and Social Psychology*. 55:2, pp. 239–47.

Hovland, C. and R. Sears. 1940. "Minor Studies of Aggression: Correlation of Lynchings with Economic Indices." *Journal of Psychology*. 9, pp. 301–10.

Klaniczay, Gabor. 1990. "Hungary: The Accusations and the Universe of Popular Magic," in *Early Modern European Witchcraft*. Bengt Ankarloo and Gustav Henningsen, eds. Oxford: Oxford University Press, pp. 223–26.

Kors, Alan and Edward Peters, eds. 2001. *Witchcraft in Europe, 400-1700*. Philadelphia: University of Pennsylvania Press.

Lamb, H. H. 1982. *Climate, History and the Modern World*. London: Routledge.

Macfarlane, Alan. 1979. *Witchcraft in Tudor and Stuart England*. New York, N.Y.: Harper and Row.

Madar, Maia. 1990. "Estonia I: Werewolves and Poisoners," in *Early Modern European Witchcraft*. Bengt Ankarloo and Gustav Henningsen, eds. Oxford: Oxford University Press, Part III.

McEvedy, Colin and Richard Jones. 1978. *Atlas of World Population History*. New York: Facts on File.

Midelfort, Erik. 1972. *Witch Hunting in Southwestern Germany, 1562–1684*. Stanford, Calif.: Stanford University Press.

Miguel, Edward. 2003. "Poverty and Witch Killing." BREAD Working Paper No. 41.

Monter, E. William. 1976. *Witchcraft in France and Switzerland*. Ithica, N.Y.: Cornell University Press.

Monter, E. William. 1992. "Patterns of Witchcraft in the Jura," in *Witch Hunting in Continental Europe: Local and Regional Studies*. New York, N.Y.: Garland Publications, pp. 181–206.

Pfister, Christian. 1993. "Historical Weather Indices from Switzerland. IGBP PAGES/World Data Center-A for Paleoclimatology Data Contribution Series, No. 93-027." Technical Report, NOAA/NGDC Paleoclimatology Program, Boulder, Colorado.

R′acz, Lajos. 1994. "The Climate of Hungary during the Late Maunder Minimum (1675–1715)," in *Climatic Trends and Anomalies in Europe 1675-1715*. Burkhard Frenzel, ed. New York: Gustav Fischer Verlug, pp. 95–107.

Ross, Eric. 1995. "Syphilis, Misogyny and Witchcraft in 16th-Century Europe." *Current Anthropology*. 36:2, pp. 333–37.

Russell, Jeffrey Burton. 1972. *Witchcraft in the Middle Ages*. Ithica: Cornell University Press.

Sharpe, James. 1996. *Instruments of Darkness: Witchcraft in England 1550–1750*. New York: Penguin.

Soman, Alfred. 1978. "The Parlement of Paris and the Great Witch Hunt (1565-1640)." *Sixteenth Century Journal*. 9:2, pp. 30–44.

Summers, Montague. 1971. *The Malleus Maleficarum of Heinrich Kramer and James Sprenger*. New York: Dover.

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