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ABSTRACT

Social Organization and the Roots of Supernatural Beliefs*

Religion and beliefs in the supernatural are present in all societies. Yet, studies about the economic roots of small-scale supernatural belief systems remain quite limited. In this work, we test the anthropological hypothesis that historical dependence on pastoralism favored the adoption of customs that contributed to the reduction in witchcraft beliefs. Pastoral societies were characterized by the use of social strategies as a way of mitigating the risks inherent in pastoral production, making the practice of accusations of witchcraft a barrier to maintaining their existing social ties. Consistent with this hypothesis, we document that people descending from historically more pastoral societies have a lower level of contemporary belief in witches. The results using an instrumental variable based on the ecological determinants of pastoralism corroborates our main analysis. We further show that the main mechanism behind our result seems to be pastoralist groups' freedom of movement and an increase in social ties, proxied by the level of trust in relatives, neighbors, courts, and local councils. We also show that the reduced belief in witches increases references to witchcraft in pastoral societies' oral traditions, narratives, stories, jokes, and proverbs, possibly because the lack of fear makes pastoralists more willing to speak, sing and joke about the supernatural. Finally, we test for the importance of cultural persistence by examining people who live today in locations with low levels of suitability for pastoralism but belong to ethnic groups that have historically lived in areas with high levels of suitability and show that the reduction in belief in witches persists.

JEL Classification: O10, Z10, Z13, Z19

Keywords: culture, pastoralism, persistence, superstition, witchcraft

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1 Introduction

Religions, beliefs and traditions have shaped the course of human societies for centuries. Not surprisingly, a considerable body of research shows that religious beliefs and practices have played an important role in determining outcomes as diverse as happiness, educational attainment, health status, innovation, and, more broadly, the formation of societies.[1] While most of this body of research draws on the impacts and origins of major religious systems such as Islam and Christianity, beliefs in the supernatural can take much broader forms (Murdock, 1945).[2] The emergence of these small-scale, personalized forms of belief systems dates long before doctrinal religions and to date affect millions of people around the globe. In spite of this, we have scant knowledge about how and why these belief systems emerged.

The present study adds to this nascent literature in economics by studying the origins of witchcraft beliefs, understood as the superstition that certain people have supernatural powers to control people or events. In doing so, we test an influential thesis advanced by anthropologist Paul T. W. Baxter that historical dependence on pastoralism disfavored the adoption of witchcraft beliefs.[3] Baxter (1972) suggests two mechanisms to justify the apparent reduction in adherence to these beliefs. First, pastoralist groups are known for the characteristic of leaving their villages for some periods to take the cattle to pasture. This freedom of movement produces an important mechanism that prevents negative relationships from evolving to the point of generating a social rupture that could lead to accusations of witchcraft among the members of the group. Second, the high levels of cooperation present in the pastoralist environment makes witchcraft accusations more complex: if someone wants to claim that someone else is using witchcraft to grow his herd, he will be attacking not only the accused person but the entire network of connections. This culture may have evolved over time and persist to the present day, manifesting in a lower prevalence of witchcraft beliefs among individuals from areas historically exposed to pastoralism.

Surprisingly, the evidence of a causal link between pastoralism practices and witchcraft

[1] See, for instance, the seminal work of McCleary and Barro (2003, 2006) and, more recently, Campante and Yanagizawa-Drott (2015) on the relationship between religion and economic development. See Becker and Woessmann (2008, 2010); Chaudhary and Rubin (2011); Valencia Caicedo (2019) on the link between religious practices and education. For analysis on religion and health, see Becker and Woessmann (2018). Finally, the link between religion and innovation has been investigated by Bénabou et al. (2015a) and Bénabou et al. (2015b).

[2] Few exceptions include work on superstitions, such as the existence of magic protections (LeMay-Boucher et al., 2013), the presence of the evil eye (Gershman, 2015), bulletproofing spells (Nunn and Sanchez de la Sierra, 2017), and, important to our study, the belief in witchcraft (Gershman, 2016, 2020).

[3] This phenomenon of non-adherence of pastoralist tribes to the practice of witchcraft accusations was not perceived only by Baxter (1972), but also by several anthropologists in field research. For example, Edgerton (1971) analyzing four east African societies and, more recently, Jacobsen (1998) analyzing the pastoralist group Beja.

beliefs remains very scant. Rigby (1981), for instance, writes: "I think Baxter's comparisons of the two types of social formation and those aspects of their ideologies related to witchcraft beliefs and practices are valid. The causal connection, however, remains unexplored." This is the objective of this paper. To achieve this goal, we match ethnographic data with contemporary measures about individual beliefs in witches. Data on the presence of pastoralism comes from the ethnographic atlas (Murdock et al., 1967), an anthropological database covering 1200 ethnic groups around the world. These data contains detailed information on the main characteristics of the ethnic groups before colonial contact and industrialization. Following Becker (Forthcoming), we combine information about the type of animal domesticated by the ethnic group (those that involve taking the herds out to pasture, such as sheep, cattle, horses, reindeer, alpacas, or camels) with animal husbandry dependency to create an ethnic level measure of historical dependence on pastoralism. The contemporary data on witchcraft belief is taken from surveys conducted between December 2008 and April 2009, by the Pew Forum on Religion and Public Life in nineteen countries of Sub-Saharan Africa.[4]

We begin by estimating ordinary least square regressions (OLS) that compare individuals who live in the same country or region today but come from ethnic groups with different historical reliance on pastoralism. We document that individuals belonging to ethnic groups with higher dependence on pastoralism present lower chances of having witch beliefs. A one standard deviation increase in historical dependence on pastoralism is associated with a decrease in the probability of having belief in witches of 5.7 percentage points (10% of the sample mean in the estimate with full set of controls). We show that the estimates are fairly robust to controlling for country or region fixed effects, individual covariates, historical controls, and a set of contemporary regional characteristics. We then build a measure of land suitability for pastoralism relative to agriculture to instrument for the historical dependence on pastoralism, based on data from Beck and Sieber (2010).[5] We consider that dependence on pastoralism is largely determined by environmental conditions, such as climate and soil type, and thus exogenous to the presence of witchcraft beliefs. Consistent with Becker (Forthcoming)'s observation that measurement error in our historical dependence on pastoralism variable is likely to cause a downward bias in the OLS estimates, our instrumental-variable estimation results in larger estimates compared to the OLS counterpart.

Baxter (1972) proposes two main mechanisms to explain the lowering of belief levels in

[4]The countries included in the survey are Botswana, Cameroon, Chad, Democratic Republic of the Congo (DRC), Djibouti, Ethiopia, Ghana, Guinea-Bissau, Kenya, Liberia, Mali, Mozambique, Nigeria, Rwanda, Senegal, South Africa, Tanzania, Uganda, and Zambia. Rwanda and South Africa were removed from the analysis, as they lack information about the individuals' ethnicity.

[5]Beck and Sieber (2010) used a maximum entropy model (Phillips et al., 2006; Phillips and Dudík, 2008) to estimate the probability with which a type of land use occurs in each grid cells. We explain this in more detail below.

witchcraft in pastoral societies. The first concerns the greater flexibility of movement. Individuals in more flexible societies bear a smaller cost of moving when involved in hostile or conflicting relationships. Using Pew survey data, we show that witchcraft beliefs are present in societies that domesticate 'non-herding' species such as pigs, dogs, fowls, bees, guinea pigs, or other smaller species that do not require taking the cattle out to pasture. This distinction is also observed if we compare fully nomadic to non-nomadic pastoralist societies. Fully nomadic pastoralist societies are less likely to present witch beliefs when compared to Non-fully nomadic societies. This is in line with the argument highlighted in Baxter (1972) that, even among pastoralist societies, as society becomes less settled the presence of witchcraft beliefs decreases even more.

The second proposed mechanism concerns the levels of cooperative behavior present in societies. To test this hypothesis, we use the concept of trust, defined as "the belief a partner would cooperate in a transaction with or without formal commitments" as proxy for cooperation (Okoye, 2021).[6] We create four variables using data from the afrobarometer to measure levels of trust in family, neighbors, courts of law and the local government council. Consistent with the cooperative hypothesis, we find that the historical dependence on Pastoralism is associated with an increase in these trust measures.

An interesting aspect highlighted in Lienhardt (1951) and Baxter (1972) concerns the presence of witchcraft in the partoralists' traditional folklore. According to them, although pastoral societies exhibit low dissemination of the belief in witches, references to witchcraft in songs, jokes and stories was recurrent. This idea is briefly encapsulated in Jacqueline Simpson's Presidential Address given at the 1994 Folklore Society where she writes: "[t]o crack jokes about witchcraft, one might assume, only becomes possible when the fear of it has faded." We investigate this hypothesis using the extremely rich dataset structured by Michalopoulos and Xue (2021), who digitized the catalog of oral traditions developed by anthropologist and folklorist Yuri Berezkin (Berezkin, 2015). These data capture the presence of concepts or keywords in the oral traditions of about 1,000 societies around the world. Our results show an increase in the references to witchcraft in pastoral societies' oral traditions, narratives, stories, jokes and proverbs. This is striking and possibly reflects that a lack of fear makes pastoralists more willing to speak, sing and joke about the supernatural.

We perform a large set of robustness analysis to assert whether the effects we find derive from the historical transmission of pastoralist internal norms and not from alternative expla-

[6]This definition is in line with several other works in the literature, such as Coleman (1994), Algan and Cahuc (2014), and, especially, Sapienza et al. (2013) that from experimental evidence shows that the answer to questions about trust is correlated with beliefs about the "trustworthiness" of others. This, according to Gambetta et al. (2000), means that "the probability that he will perform an action that is beneficial or at least not detrimental to us is high enough for us to consider engaging in some form of cooperation with him."

nations. First, we might be concerned about whether our estimates are driven by a particular country or ethnicity, calling into question the generalizability of our findings. To tackle this issue, we rerun our baseline specification but excluding from our sample each country and ethnicity one at a time and show that our estimates barely change on each of these exercises. Also, it could that pastoralist groups live today in more developed areas or with better institutions and this could on its own reduce the incidence of witchcraft beliefs. To attest that our effect really come from differences in internal norms and not from (other) external factors, we examine people who live today in areas with low levels of suitability for pastoralism but are members of ethnic groups that have historically developed in areas with high suitability for pastoralism. Our results remain consistent even when we focus our analysis on this very select group. Finally, use a variety of data, subject to several caveats, to show that the effects we estimates are present in virtually all continents of the world.

This paper contributes to several branches of economic literature. More generally, our study relates to the seminal works of Greif (1994); Iannaccone (1998); Barro and McCleary (2003), who study the origins and consequences of religions and other cultural practices. Recent articles have expanded the scope and deepened our knowledge about the effects of religions on outcomes such as economic development, cooperation and pro-social behavior, conflict, interactions between religions and government, and the risk taking behavior of religious practitioners (Platteau, 2008; Becker and Woessmann, 2009; Campante and Yanagizawa-Drott, 2015; Norenzayan et al., 2016; Skali, 2017; Auriol and Platteau, 2017; Okoye, 2021; Bryan et al., 2021; Auriol et al., 2021). Most of this literature however has focused on major religions, such as Christianity and Islam or on the presence of moralizing gods, while our knowledge about smaller belief systems such as ancestors or witchcraft remains scant. Our paper contributes to this literature as it studies how social organization shaped the spread of one of these smaller-scale belief systems.

Our paper also speaks to studies that seek to rationalize the acceptance and persistence of different superstitions. For instance, Gershman (2015) studies the relation between the levels of envy in society to the origins of evil eye beliefs; LeMay-Boucher et al. (2013) studies the determinants of spending on magic protection in Benin; Leeson (2013) discusses the use of Vermin Trials by the Catholic Church to increase tithe revenues; Leeson (2014) argues that monks used maledictions to protect their property against predators where government unavailable to them; Leeson et al. (2014) that develops a theory of rational human sacrifice; and Nunn and Sanchez de la Sierra (2017) rationalize the persistence of the belief in bullet-proofing spells in the Congo. Our findings contribute to this line of research by providing additional evidence for the existence of rational decisions behind the historical mechanisms that determine the persistence of certain types of supernatural beliefs.

With greater proximity, our paper is also connected to studies assessing the main causes and consequences of witch hunts. Oster (2004) and Miguel (2005) point to climatic motivations for the occurrence of witch murders; Leeson and Russ (2018) connects the age of witch trials to a competition between Catholic and Protestant churches for religious market share; Gershman (2016) documents important correlations of witch beliefs with the erosion of social capital in societies. In particular, our work relates to Gershman (2020), who investigates the impact of slavery on the presence of belief in witches to the extent that, unlike previous studies that sought to assess the causes of hunting, it tries to understand the possible economic origins of the persistence of this belief.[7] Our work complements this literature as it adds an important dimension to our understanding of the contemporary presence and diffusion of this supernatural belief and assess new mechanisms of transmission.

Finally, this paper contributes to the recent and still scarce empirical literature on the long-term effects of the practice of pastoralism. First, Michalopoulos et al. (2019) finds that individuals from ethnicities that derived a larger share of subsistence from pastoralism in the precolonial era are today less educated and wealthy today. McGuirk and Nunn (2020) discusses how recent climate change is altering the cooperative behavior between pastoralist groups and sedentary agriculturalists. Cao et al. (2021) discuss how pastoralist groups are related to the presence of the culture of honor in which individuals are strongly concerned with maintaining their reputations in society. And finally, Becker (Forthcoming) shows that women who belong to more pastoralist societies are much more likely to have undergone the most invasive form of female genital cutting, to adhere to more restrictive norms about promiscuity and to be subject to reductions in their freedom of mobility. Our work speaks to these articles as it studies the consequences of pastoralism, a practice still carried out by 268 million people worldwide but relatively understudied, on a new important cultural outcome with implications to economic development.

The rest of the paper is organized as follows. Section 2 provides background information on pastoralism and present our main hypothesis. Section 3 describes the historical and contemporary data and preliminary evidence. Section 4 presents the empirical strategy and section 5 describes our main results and additional robustness checks. In section 6, we discuss the main mechanisms behind the estimated effect. Section 7 discusses possible channels of causality. Section 8 present estimates using data for other continents, since we focus most of our analysis on the African continent. Finally, section 9 concludes.

[7]For a review of the emerging economic literature on witchcraft beliefs, see Gershman (2021).

2 Pastoralism and Witchcraft

2.1 The Ecology of Pastoralism

Pastoralism is a form of animal husbandry that is present in areas with diverse ecologies around the world and has been an important mode of subsistence for centuries, being particularly present in preindustrial periods. It is currently being practiced by approximately 268 million people, representing 10 to 44% of the gross domestic product (GDP) of African countries, and 43% of Africa's landmass supports pastoral activities (Osman et al., 2018). The practice of husbandry is used by pastoralists in the most diverse types of herding animals, ranging from small animals, such as goats, to cattle, horses and camels. Pastoralist tribes are also characterized by a frequent absence of men from their household. Due to their flock's grazing needs, members of the tribe often spend days or weeks away from the settlement. Although these groups are expected to be nomadic or semi-nomad, several tribes have very sedentary habits and may also mix pastoralism with some agricultural practices on a smaller scale.

2.2 From Pastoralism to Witch Beliefs: The Baxter's Hypothesis

A phenomenon perceived by several anthropologists concerns the non-adherence of pastoralist tribes to the practice of witchcraft accusations.[8] Important to our paper is the seminal work of Baxter (1972), who studied nine pastoralist societies in sub-Saharan Africa.[9] According to his study, the relative non-adherence of witchcraft beliefs in these societies reflects two important social features: first, pastoral societies are characterized by a periodic need for movement; second, these societies are much more cooperative when compared to other societies (for instance, agricultural societies). This has also been claimed by Burns (2018) in his recent book:

> "This pattern [of pastoralists ... rarely accusing each other of using bewitchment] does seem to hold true for nomads across the globe, perhaps because their mobile lifestyle and relatively small social units tend to reduce the potential for the personal conflicts that generate suspicions of witchcraft."

The Mobility Mechanism. Baxter (1972) highlights that often individuals in more agricultural societies, when having problems with other members of the group, are prevented from moving due to their investment in the soil or by their property investment.[10] In pastoral

[8] For instance, Edgerton (1971), analyzing four groups two of farmers and pastoralists, or Jacobsen (1998), who documented this same pattern while living with the pastoralist group *Beja*.

[9] Namely, the pastoral groups *Nandi*, *Mandari*, *Dinka*, *Nuer*, *Turkana*, *Karinmojong*, *Samburu*, *Somali* and *Boran*.

[10] Baxter is not the first to raise such fact. Max Gluckman in his 1964 and 1965 Marett lectures discusses

societies, on the contrary, this problem is greatly alleviated. Pastoralists must move to take their livestock to pasture, and this is done in groups, generating a sense of "[r]emaining together implies mutual satisfaction, not just mutual tolerance." This is likely one of the main explanations for why the levels of belief and accusations of witchcraft are lower for pastoralist groups. Relationships are unlikely to erode to the point where it's necessary to use a tool as extreme as accusing your neighbor of witchcraft. As the author highlights:

> "Those who have reason to dislike or envy each other do not have to live and work together nursing their ill-will into hate or fear, but may legitimately separate, easily justifying their removal in terms of good stock management."

Also in line with this mechanism, Baxter (1972) argues that as society's dependence on pastoralism increases, its adherence to witchcraft beliefs decreases. In his analysis, although the nine pastoralist groups studied present very low levels of the belief, the author points that those with the greatest traces were the *Mandari* and *Nandi* tribes, ethnic groups that carried out pastoralism together with agricultural practices and were more settled. This passage makes this point clear:

> "...a stranger might be excused for thinking there was no witchcraft in *Nandi*, but it is clear that the prominence of beliefs and the incidence of accusations is more marked among these two peoples than it is in the other selected peoples. Both *Mandari* and *Nandi*, though valuing pastoral activities highly, fall in the economic category "pastoral with agriculture."

The Cooperation Mechanism. Baxter (1972) argues that due to the great uncertainties inherent in pastoral practice, cooperation arises first from a need to spread their risks and second to create social links. In these societies, it is very common for individuals to distribute their stock among the flock of different members to reduce the risk of loss, due to different food needs from the stock, or in an intentional attempt to establish a relationship with another herder. A consequence of this is that members of the group become connected and an accusation of witchcraft in this scenario is considered an attack not only on the accused, but on their entire network of connections, which can cause problems for the accuser. Baxter (1972) points that "in the field, I was constantly stumbling across strands of ownership connecting

how the presence of witchcraft accusations is "the outcome of profound moral crises in relationships within the group," and links this to mobility patterns by raising the following questions: *Why cannot those who wish to do [move] so simply move away?* and *Why does the individual remain in an environment with such a profound moral crisis?* (Gluckman, 2014).

men to herds and to individual beasts cared for by others." This organizational scenario may have favored the path towards the creation of more cooperative societies.

The evidence that pastoralist groups exhibit remarkable cooperative behavior was also noted by many other anthropologists. For instance, Jacobsen (1998) highlights that within their tribes, also called "diwáb",[11] "if some members ... be struck by catastrophe of any kind, the other members are expected to share their expenses. When marriages, mourning rites and burials are performed, the people in the same diwáb will support each other." Galvin (2009), reviewing recent anthropology literature on pastoralist groups, stresses that "it is still common among many African pastoralists, such as the *Maasai*, to distribute portions of their herds to friends and relatives who might have better access to good grazing or simply to assist poor friends or family."

As also discussed by Bourdieu (1986), Galvin (2008), and Galvin (2009), the cooperative environment of pastoralist societies comes from the "horizontal linkages such as kin and close associates among local resource users" that "allow them to interact and work cooperatively to achieve a common end" (Galvin, 2008). As already discussed by Okoye (2021), the concept of cooperation is closely related to the definition of trust as "the belief a partner would cooperate in a transaction with or without formal commitments", and can provide a great clue for understanding the presence of witch beliefs in contemporary society.

2.3 Folklore, Witchcraft, and Pastoralism: Weaker Beliefs, but strong Folktales

Another important and interesting aspect highlighted by Baxter (1972) is that although pastoral societies exhibit low dissemination of the belief in witches, tales, songs or jokes related to witches are present in these societies. Lienhardt (1951), while studying the *Dinka*, points that although actual accusations of witchcraft were rarely witnessed, the presence of dance songs, jokes and stories was recurrent. Also, he writes that "even though every child knows something about witches, it is nevertheless a concept in some ways marginal." In this matter, Baxter (1972) writes that:

> "[d]espite (or perhaps because of) the paucity of accusations, the *Dinka* talk, sing and even joke about witches, although these embody all those false-faced characteristics which Dinka profess to hate"

These oral traditions, passed through the generations by word of mouth, may reflect different forces at play in a society. For the specific case of witchcraft, places with widespread presence of the belief may encounter important social restrictions to talk about the subject, as emphasized by Waters (2014):

[11] That generally range in size from 50 to 200 families. (Jacobsen, 1998)

> "The inhabitants of the Normandy Bocage were by no means unique in their aversion to talking about contemporary witchcraft. On the contrary, the notion appears to be quite widespread, and has been documented by scholars of geographically disparate cultures. Ann Ross, in her 1976 study of the folklore of the Scottish highlands, reiterated many times that witchcraft 'is a subject that people are often unwilling to speak about, but there is no doubt that belief in powers to work good and evil is still fairly widespread'. Further afield, on the border between Mexico and the United States, the Pueblo also believe that talking about witches will tempt their malice. One anthropologist noted in 1976 how that belief ensured his fieldwork was all the more difficult: 'Information on Pueblo witchcraft is more uncertain and in smaller supply than is the case for most other aspects of the culture. This is easily understood when it is realised that the Indians are loath to discuss the subject in detail for fear that supernatural powers may somehow retaliate'. Scholars of Japanese, north Indian, east African and Nepalese cultures have also recorded that their informants harbour the same belief about the supernatural significance of speech, and the dangers that follow from openly discussing contemporary witchcraft. Nancy Levine, for instance, noted that the Nyinba people of Tibetan Nepal were 'reluctant to discuss witchcraft (ngan), because, they said, the witches might retaliate against them for doing so'. Likewise a recent study of Indian sorcery has described how 'the fear that the witch might afflict a person for levelling an accusation against her ... undoubtedly prevent[s] many people from voicing their superstitions'."

In contrast, societies that present low adherence to the practice of witchcraft may speak more frequently about it, making witches an important component in their traditional folklore. This is clearly stated in the concluding remarks of the 1994 Presidential address given to the Folklore Society by Simpson (1995):

> "To crack jokes about witchcraft, one might assume, only becomes possible when the real fear of it has faded."

In what follows, we test not only the hypothesis that the historical dependence on pastoralism favored the adoption of customs and norms, which in turn contributed to a reduction in the incidence of the belief in witches, but also provide evidence on the two main mechanisms by which this occurs and investigate how these are reflected in pastoral societies' oral traditions, narratives, stories, jokes and proverbs using the data recently structured by Michalopoulos and Xue (2021).

3 Data

3.1 Data on Pastoralism in Preindustrial Societies

Data on the presence of pastoralism comes from the Ethnographic Atlas (Murdock et al., 1967), an anthropological data-base covering 1200 ethnic groups around the world. The Atlas contains detailed data on the main characteristics of the ethnic groups prior to colonial contact and industrialization. Following Becker (Forthcoming), we combine information about the type of animal domesticated by the ethnic group with animal husbandry dependency to create an ethnic level measure of historical dependence on pastoralism.

We use two variables available in the ethnographic atlas to create this measure, namely, the degree to which a society depended on animal husbandry, which varies from 0 to 100%, and the major type of animal used in this society. We assign an index equal to 1 if the animal used is from the herd of sheep, cattle, horses, reindeer, alpacas, or camels and zero otherwise (if they do not use animals or if they are predominantly pigs, dogs, or poultry, that do not require taking out to pasture). The historical dependence on pastoralism measure is then obtained by the interaction between the dependence on animal husbandry and this index, such that

$$\text{Pastoralism}_e = \text{Animal Husbandry}_e \times \mathbb{1}\text{Herd Animal}_e \tag{1}$$

Note that although this measure of dependence on pastoralism varies at the ethnic level, we use contemporary data to measure individual's beliefs in witchcraft. Since populations from ancestral ethnic groups have moved across regions, this means that we are able to use substantially more variation than just that generated by ethnic group's historical location. As we will show, our results hold if we add country or region fixed effects, such that we compare individual's living in the same country or region today but belonging to ethnic groups with different measures of reliance on pastoralism.

3.2 Data on Witchcraft Beliefs

Our main source of data on the presence of witchcraft beliefs comes from the *Pew Forum on Religion and Public Life*, a survey conducted between December of 2008 and April 2009 in Sub-Saharan Africa.[12] The survey covered a total of nineteen countries, including: Botswana, Cameroon, Chad, Democratic Republic of the Congo (DRC), Djibouti, Ethiopia, Ghana, Guinea-Bissau, Kenya, Liberia, Mali, Mozambique, Nigeria, Rwanda, Senegal, South Africa, Tanzania, Uganda, and Zambia. Rwanda and South Africa were excluded from the analysis,

[12]These data are available on https://www.pewforum.org/interactives/africa/.

as they lack information about the individuals' ethnicity.

Our measure of witch beliefs is based on two (yes/no) questions. In the first question, the respondent was asked whether he/she believed in "witchcraft", while the second question inquired about the belief in the "evil eye", or that "certain people can cast curses or spells that cause bad things to happen to someone." For our main analysis, we consider that a person believes in witches if he or she answered yes to any of the two questions. However, as highlighted by Gershman (2020) when discussing the differences between both questions, "the first question leaves the notion of witchcraft vague and open to interpretation, while the latter spells out the basic concept of causing harm via supernatural means." Given this vague definition and the possibility of capturing beliefs in the evil eye, a distinct phenomenon defined as the "supernatural destructive power of envious glances," we also show that our results marginally change when using only the first question.

4 Empirical Framework

We estimate the relation between individual-level belief in witchcraft and the ethnicity-level measure of historical dependence on pastoralism using the following regression model:

$$Witch_{i,e,r,c} = \alpha_c + \beta \text{Pastoralism}_e + X'_{i,e,r,c}\Omega + \epsilon_{i,e,r,c} \tag{2}$$

where the outcome variable $Witch_{i,e,r,c}$ equals 1 if individual i belonging to ethnic group e and residing in region r of country c believes in witchcraft and 0 otherwise. Pastoralism_e is our measure of historical dependence on pastoralism calculated for each ethnic group e, and α_c is a country-of-residence fixed effect. We estimate this model via OLS and cluster the standard errors at the ethnic level, as our partoralism measure varies across ethnic groups.

In addition to this basic set of variables, we also include additional controls, represented by $X_{i,e,r,c}$. These include individual-level covariates obtained from the Pew Survey questionnaire, such as age, age squared, a gender dummy, an urban location indicator dummy, and variables related to religion and education. The Pew Survey allows us to identify four religious groups: Christian, Muslim, traditional/animist religion, and unaffiliated. For education, three categories are available: completed primary or less, some secondary or completed secondary, and post-secondary and higher. We add fixed effects for each religion and education category.

We also include controls at the ethnic group level using the information provided in the Ethnographic Atlas. We account for the centralization of political institutions of the ethnic groups by introducing jurisdictional hierarchies fixed effects. This variable captures the number of jurisdictional hierarchies beyond the local community and is provided in four categories: societies without centralized political organizations; societies with petty chiefdoms;

societies with larger chiefdoms; societies with the presence of states. This is an important measure of precolonial political centralization and has been shown to correlate with contemporary economic development (Gennaioli and Rainer, 2007; Michalopoulos and Papaioannou, 2013). To address differences in settlement patterns we control for the type of settlement. The Atlas divides ethnic groups in 8 categories, ranging from totally nomadic (migratory) to complex settlements.[13] This acts as a proxy for initial population density/social development (Nunn and Wantchekon, 2011). Another important dimension that might correlated with the presence of the belief is the existence of polygyny practices in the society. As highlighted by anthropologists Evans-Pritchard (1937) and Baxter (1972), discussions among women in the household can generate conflicts that may later evolve into accusations of witchcraft and, therefore, relate to the level of the belief. In fact, Baxter (1972) points that one of the few times he learned about witchcraft accusations among the *Dinka* happened in a discussion between co-wives, where the female co-residents were both the accusers and the accused. We account for this by including a polygyny indicator extracted from Murdock et al. (1967).[14]

We also worry about the influence of important historical events in shaping the practice of witchcraft in the societies. Gershman (2020), for instance, provides evidence that ethnic groups which were more exposed to the Atlantic slave trade in the past are more likely to believe in witchcraft today. In that time, accusations of witchcraft were often used as justification for handing over neighbors or family members to slave traders. We approach this in two ways. First, from the Ethnographic Atlas, we constructed a variable that equals 1 if the ethnic group has or had slavery practices at some point in its history. Second, from the slavery data provided by Nunn and Wantchekon (2011), we add to our specification controls for the number of slaves exported from each ethnic group in the Transatlantic Slave Trade and in the Indian Ocean Slave Trade. Another similar concern relates to the European interventions in the African continent during the colonial period. We include controls for three of the main interventions that took place during this period. First, using data from the Century Company (1911), we constructed an indicator for the presence of colonial railways in the area historically inhabited by the ethnic groups. Second, using the same data, we build an indicator of whether the ethnic group's area was reached by any European explorer during the colonial period. Third, using information on the presence of Christian missions during the colonial period, we constructed a measure of the number of missions per square kilometer in the ethnic group area of habitation (Roome, 1925).[15]

[13]Categories are Nomadic or fully migratory; Seminomadic; Semisedentary; Compact but impermanent settlements; Neighborhoods of dispersed family homesteads; Separated hamlets, forming a single community; Compact and relatively permanent settlements; and Complex settlements.

[14]For more details on data sources and the construction of all variables used in our analysis, see the Appendix section A.1.

[15]A point that one may still wonder is whether the number of missionary stations interacts with our main

Another concern relates to the appearance of diseases in the societies and how that could have influenced the use of witchcraft as a possible explanation for this misfortune (Muela et al., 1998). For instance, it could be that pastoralist groups live in areas more or less prone to disease vectors and this could affect how we interpret our estimates. Also, it is argued that areas with a relatively high incidence of malaria were particularly affected by the slave trade (Esposito et al., 2018; Gershman, 2016). To address both concerns, we include a malaria stability index to proxy for the presence of diseases. This variable is constructed as the mean of the malaria index among the cells within the area of each ethnic group. (Kiszewski et al., 2004)[16]

We also include a plow use indicator built from the Ethnographic Atlas to account for the presence of male dominance in the society. Since women have been disproportionately accused of witchcraft, more male dominant societies could have more frequently resorted to the use of witchcraft. As highlighted by Alesina et al. (2013), the use of plow closely relates to the presence of male dominance in the society.

Finally, in addition to individual- and ethnic group-level variables, we also include several controls at the regional level. First, we include nighttime per capita (Michalopoulos and Papaioannou, 2013) and control for land suitability for Agriculture in the region, to proxy for local development. We also include the levels of Ethnolinguistic Fractionation, as this relates to the presence of ethnic polarization and conflicts, which could affect the spread of accusations of witchcraft in society (Montalvo and Reynal-Querol, 2005). As discussed in Oster (2004); Miguel (2005), the presence of accusations of witchcraft in a society is closely related to periods of climatic anomalies. For this reason, we include a Rainfall anomaly variable to capture significant climatic changes in the two years prior to the application of the survey. Finally, we also include the regional average of the Index of terrain ruggedness, as constructed by Nunn and Puga (2012), since ruggedness of the terrain relates to the level of exposure to slave trade.

5 Results

The goal of this section is to present our main results. First, we present the baseline estimates of the relationship between historical dependence on pastoralism and the level of contemporary belief in witchcraft. Second, we propose an instrumental variable approach that leverages changes in land suitability for pastoralism relative to agriculture as an exogenous source of

treatment variable, contributing to the spread of beliefs in witchcraft. However, we did not find differential effects in the interaction of the variables.

[16]Our results also barely change if we include the suitability index for Tse-Tse flies constructed by Alsan (2015) as a proxy for the disease environment.

variation in the dependence on pastoralism across ethnic groups. Third, we provide a variety of robustness checks to assess the validity of the main results. Finally, we investigate how the belief in witches reflects in societies oral traditions, narratives, stories, jokes or proverbs, as measured by the data recently structured by Michalopoulos and Xue (2021).

5.1 Baseline Estimates

Table 1 presents our baseline results. We find that individuals belonging to ethnic groups with higher historical dependence on pastoralism are less prone to having witch beliefs today. Our baseline specification, presented in column 5, shows that a one-standard deviation increase in historical dependence on pastoralism decreases the probability of having belief in witches in 5.7 percentage points. Relative to the sample mean, this implies a 10% reduction in the presence of the belief in witchcraft.

The other columns investigate the robustness of the results to alternative specifications. Column 1 presents the results of a model estimated with no control variables. In column 2 we add country fixed effects, and in column 3 and 4 we include, respectively, the whole set of ethnic- and individual-level controls. In column 5, our main specification, we add the set of regional-level variables. This specification yields a more precise estimate compared to that estimated with no controls, but smaller in magnitude coefficient relative to the specification that includes only individual and ethnic variables. The final column replaces the country fixed effects for region fixed effects as an alternative to including our set of regional controls. This specification leverages variation in ancestral dependence on pastoralism for individuals living in relatively narrowed defined regions. Our main coefficient of interest slightly decreases, but remains statistically significant and of large economic size. [17]

Table A.3 in the Appendix presents results of our baseline specification but estimated using a probit model instead of OLS, due to the binary nature of the dependent variable. Estimates are slightly larger than those presented in Table 1 and imply a 17% decrease in contemporary levels of witchcraft beliefs as a result of a one-standard deviation increase in our measure of historical dependence on pastoralism.

[17] Although controlled in the main specification, someone might be concerned about how the introduction of some alternative channels, such as, male dominance presence (Plow indicator), the jurisdictional hierarchy levels, or Atlantic slave trade influence, in the regression affect our results. In appendix table A.8, we present how our results react to the introduction of these controls, and in fact, this barely change our estimates.

Table 1: Historical Dependence on Pastoralism and Contemporary Witch beliefs

	Contemporary Witch Beliefs					
	(1)	(2)	(3)	(4)	(5)	(6)
Pastoralism	-0.0293*	-0.0396***	-0.0646***	-0.0591***	-0.0577***	-0.0446***
	[0.0150]	[0.0126]	[0.0175]	[0.0157]	[0.0160]	[0.0122]
N	18,201	18,201	17,136	16,673	16,673	16,671
R-squared	0.0033	0.1530	0.1585	0.1806	0.1826	0.2374
Country Fixed Effects	No	Yes	Yes	Yes	Yes	No
Region Fixed Effects	No	No	No	No	No	Yes
Historical controls	No	No	Yes	Yes	Yes	Yes
Individual controls	No	No	Yes	Yes	Yes	Yes
Regional controls	No	No	No	No	Yes	No

Notes. OLS estimates in all columns. Standard errors shown in parentheses are clustered at ethnic level. The set of individual controls includes age, age squared, male indicator, urban location indicator, and fixed effects for religion and education. Historical controls are settlement patterns and political centralization fixed effects, a polygyny indicator, historical slavery indicator, atlantic and indic slavetrade incidence, indicators for colonial railways and European explorer routes, the density of Christian missions, malaria suitability index, and traditional plow use. Regional-level controls include nighttime lights per capita, mean land suitability for agriculture, recent precipitation anomaly, ruggedness and Ethnic fractionalization. (***$p \leq 0.01$, **$p \leq 0.05$, *$p \leq 0.1$).

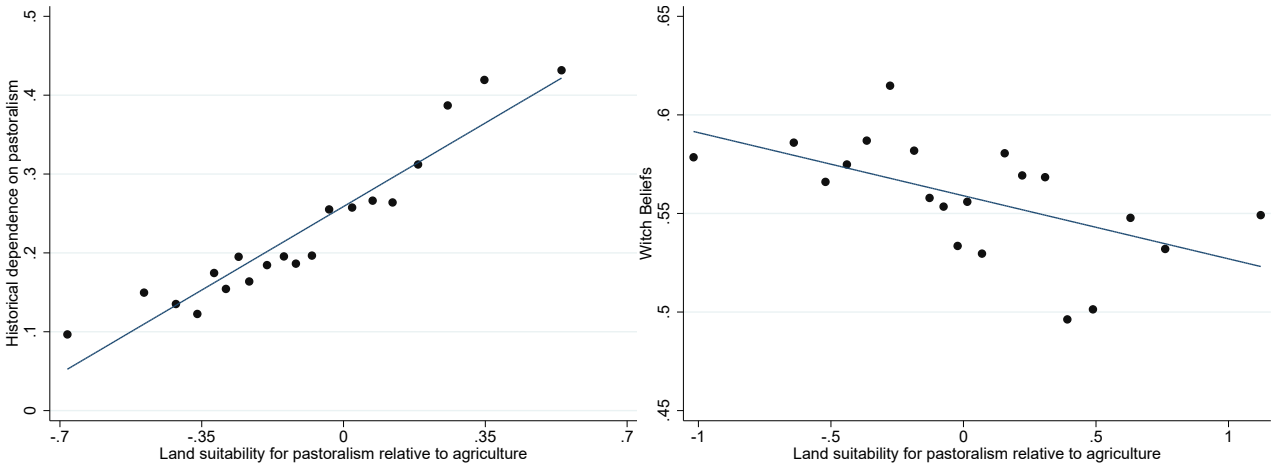
5.2 Instrumental Variable Approach

The negative association between historical dependence on pastoralism and witchcraft beliefs that we document in the previous section is consistent with the hypothesis posed by Baxter (1972) that social practices associated with pastoral societies minimized the incidence of accusations of witchcraft. However, this analysis rests heavily on the assumption that historical dependence on pastoralism is exogenously determined, so that OLS estimates have a causal interpretation. In this section, we propose an instrumental variable approach that leverages changes in land suitability for Pastoralism relative to agriculture as an exogenous source of variation in the dependence on pastoralism across ethnic groups.

In line with Becker (Forthcoming), the idea behind this instrument is that certain ecological conditions favor the presence of pastoralism, as herding animals need access to pastures and these grow in specific types of soils. For instance, gleyosols (wetland soils) or leptosols provide

ideal conditions for grazing, but due to their calcareous characteristic are bad for agricultural use. Based on this rationale, we calculate grid cell level suitability for pastoralism relative to agriculture using data provided by Beck and Sieber (2010).[18] This measure is calculated as follows: first, we identify for each five-by-five kilometer grid cell its maximum value of land use suitability for sedentary and for nomadic pastoralism; second, we subtract from this number the grid cell's suitability for agriculture, leading to a measure of land suitability for pastoralism relative to agriculture; third, we calculate for each ethnic group the average of this relative suitability measure for grids contained in a 25-kilometer radius around the group's historical centroid.

Figure 1: Association between Historical Dependence on Pastoralism, Land Suitabiliy to Pastoralism, and Witchcraft beliefs



(a) Historical dependence on pastoralism and land suitability for pastoralism

(b) Witchcraft beliefs and land suitability for pastoralism

Notes. These figures plot the association between historical dependence on pastoralism and land suitability for pastoralism (panel a) and the association between land suitability for pastoralism and witchcraft beliefs, conditional on baseline controls.

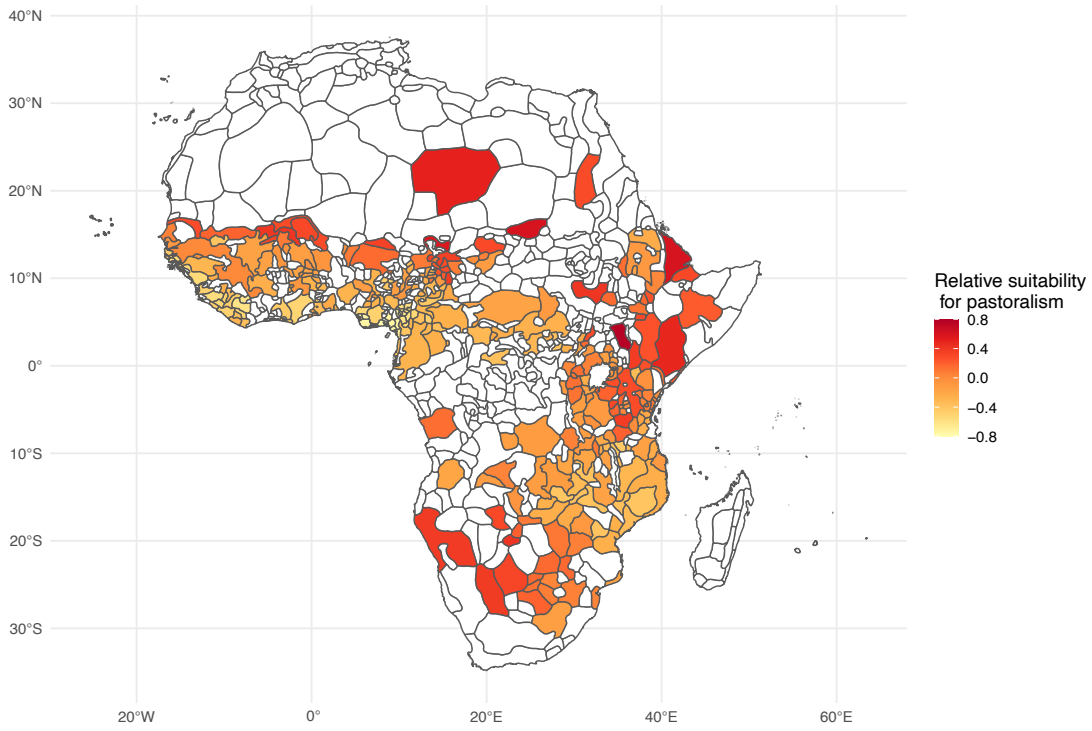
Figure 1 depicts the relationship between this measure of land suitability for pastoralism relative to agriculture and our measure of historical dependence on pastoralism on the left, and the relationship between the land suitability measure and witchcraft beliefs on the right. Both figures show interesting associations. Historical dependence on pastoralism is strongly related to the land suitability for pastoralism measure, suggesting that ecological conditions causes substantial variation in pastoralism. Second, a clear negative pattern emerges between

[18]Using climate and soil information, Beck and Sieber (2010) calculates the probability that a type of land use occurs in small grid cells for Africa, Europe, Asia and Australia. They provide environmental conditions that are favorable for four basic land use types (hunting-gathering, agriculture, sedentary animal husbandry, and nomadic pastoralism).

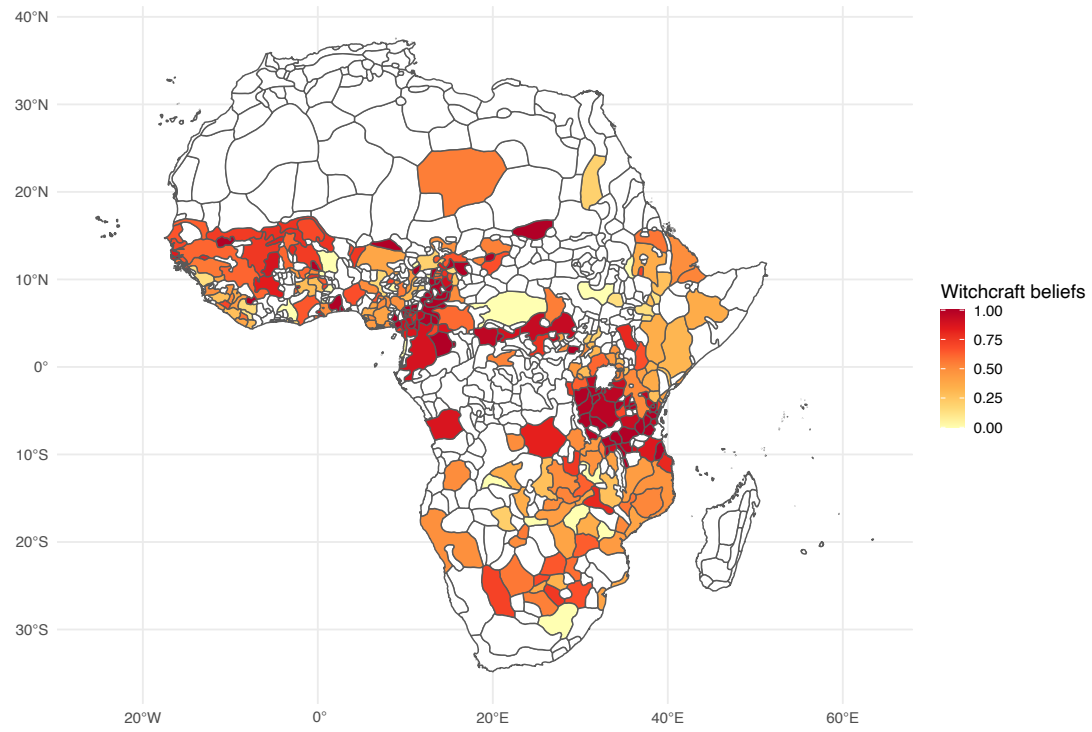
historical dependence on pastoralism and the presence of witchcraft beliefs.

Figure 2 presents the spatial distribution of our measure of relative land suitability for pastoralism (panel a) and our measure of witchcraft beliefs (panel b) for all ethnic groups present in the Murdock Map (Murdock, 1959). Darker red areas represent regions that are more suitable to pastoralism in panel a, while darker areas in panel b are those that have been deeply intertwined with witchcraft beliefs. One can visually see a negative relation between the measure of relative suitability for pastoralism, presented in Panel (a), and the distribution of witch beliefs (panel (b)).

Figure 2: Pastoralism and Witchcraft beliefs across ethnic groups of Sub-Saharan Africa



(a) Relative Suitability for Pastoralism



(b) Witchcraft Beliefs

Notes. Figures displays the ethnic-level Relative Suitability for Pastoralism and Witchcraft Beliefs. Darker shades of Red represents a larger share.

We report IV estimates in Table 2. Columns (1) and (2) report second-stage estimates, while column (3) reports results for the first-stage regression. All specifications include the full set of controls reported in our baseline specification (column (5) of Table 1). As usual, the main assumption for the validity of this approach is that land suitability for pastoralism does not relate to contemporary beliefs in witchcraft through any mechanism different from the presence of pastoralism. The first-stage results show that our measure of land suitability for pastoralism is positively correlated with historical dependence on pastoralism. This estimate is highly significant at conventional levels of significance and the F-Stat is above 14. The second-stage estimate report a negative and significant effect of pastoralism on witch beliefs. These reinforce our interpretation regarding the causal effect of pastoralism on the practice of witchcraft. In fact, as emphasized by Becker (Forthcoming), measurement errors in the dependence on pastoralism variable is likely inducing downward bias to the OLS estimates, justifying the differences in magnitudes that we observe between our OLS and IV estimates.

Table 2: Historical Pastoralism and Contemporary Witch beliefs: IV Estimates

	Contemporary Witch Beliefs		Pastoralism
	OLS	IV	First Stage
	(1)	(2)	(3)
Pastoralism	-0.0577***	-0.1857***	
	[0.0159]	[0.0703]	
Suitability for Pastoralism [Std.]			0.5658***
			[0.1505]
Number of Observations	16,673	16,673	16,673
R-squared	0.1826	0.1747	0.8823
Kleibergen-Paap Wald F-stat			14.0784
Country Fixed Effects	Yes	Yes	Yes
Baseline Controls	Yes	Yes	Yes

Notes. IV estimates in all columns. Standard errors shown in parentheses are clustered at ethnic level. For details on the baseline controls see table 1. (***$p \leq 0.01$, **$p \leq 0.05$, *$p \leq 0.1$)

5.3 Robustness

We perform a number of robustness checks to assess the validity of the main results, all of which are presented in the Online Appendix to save space. First, to check whether estimates are driven by a particular country or ethnicity, we rerun our baseline specification repeatedly, but each time excluding a specific group of observations. The results, presented in Appendix Figures A.1 and A.2, show that treatment effects are remarkably stable to exclusions of different countries and ethnicities, respectively, suggesting that the our main findings are not being distorted by any specific country or ethnic group. Second, to ensure that the results cannot be easily reproducible at random, we perform a permutation test by randomly assigning each ethnicity a false historical dependence on pastoralism, and then re-estimating the model using the implied placebo treatment measure. This procedure is repeated 1000 times and the empirical distribution of placebo coefficients is presented in Appendix Figure A.3. The true coefficients fall far below in the distribution of placebo coefficients, suggesting that our results are very unlikely to be obtained due to the randomness of the data. Another possible concern relates to how the witchcraft beliefs variable is constructed. As discussed in the data section, this variable is based on two (Yes/No) questions (Gershman, 2016): the first is somehow specific about witchcraft, while the second resembles the "evil eye," a distinct phenomena. To verify the robustness of the results, we re-estimate the model using only the information provided in the first question. The results, shown in Appendix Table A.4, remain consistent in significance and magnitude.

In all of our regressions so far, we clustered standard errors at the ethnic level to account for possible correlation across ethnicity. A possible limitation of these standard errors is that they do not account for possible spatial correlation in the residuals, which could affect inference if pastoralism exposure is correlated over space across regions. As a simple robustness check, Appendix Table A.5 shows two-way clustered standard errors at the ethnic and region to adjust flexibly for both Ethnic and spatial correlation in error terms. While these standard errors are slightly larger, the conclusions remain unchanged. Another possible concern one might have is that our effects are arising from some sort of differentiated spatial diffusion of beliefs in pastoralist areas. To deal with this possibility, in Appendix Table A.6 we add controls that could somehow relate to the spread of the belief in witchcraft. The table presents estimates for the distance to 600 AD Trade Routes, distance to 1800 AD Trade Routes, distance to Ottoman Empire, distance to Addis Ababa, contact with European explorer routes, contact of ethnicity with colonial railways, ethnic density of missionary stations among ethnic group, and, finally, distance to the coast. We observe that our main coefficient of interest marginally changes when we add these controls. The only variable showing meaningful effects is distance to the coast, which is consistent with the aforementioned effects of the Atlantic slave trade.

Finally, in Appendix Table A.7, we assess the potential bias due to unobserved factors using the methodology developed Oster (2019). This analysis is based on the notion that movements in the coefficient of interest, when including and not including controls for which one is concerned about omitted variables, is informative about the bias caused by unobservables. Columns (1) to (5) present estimates of δ, the coefficient of proportionality, which is a measure of the degree of selection on unobservables relative to observables that would be required for the treatment to be completely explained by unobserved variables not included in the model. For instance, estimates in column (1) show that to attribute the entire OLS estimate to selection bias, selection on unobservables would have to be more than three times greater than selection on observables. From columns (1) to (5) we vary value of R_{max}, which is the R-squared of a regression that would include all relevant observed and unobserved variables. We follow Oster (2019) and set R_{max} as proportions of the R-squared of the baseline estimates $\bar{R}$. Even in the more extreme case of R_{max} being 30% larger than our baseline R-squared (column (5)), selection on unobservables would have to equal selection on observables to completely wash away the effect of historical dependence on pastoralism on contemporary witchcraft beliefs that we estimate.

5.4 Folklore, Witchcraft, and Pastoralism

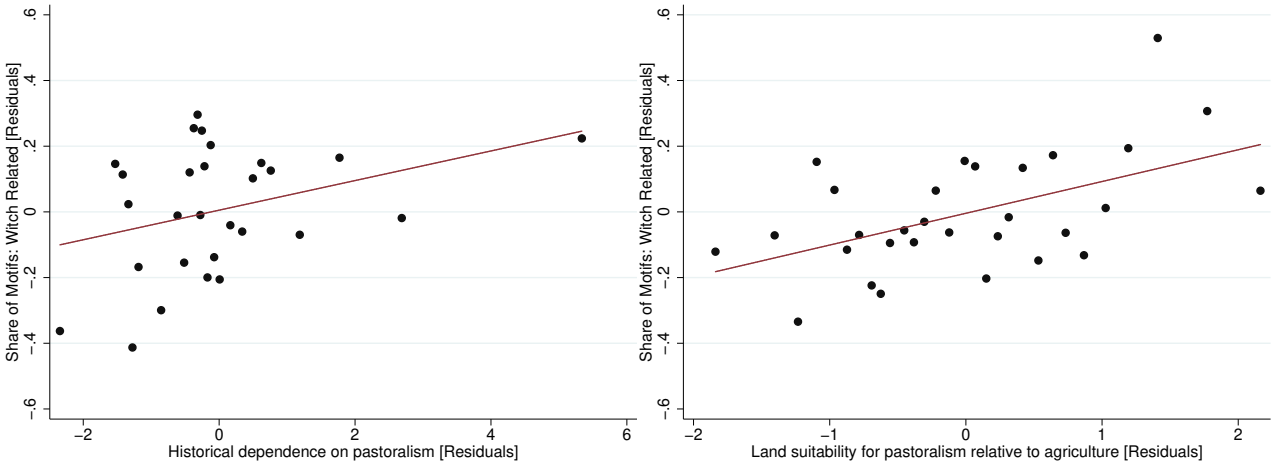
In this section we investigate the presence of tales, songs or jokes related to witches in pastoral societies, as suggested by Baxter (1972), Lienhardt (1951) and many others. We use the extremely rich dataset structured by Michalopoulos and Xue (2021), who digitized the catalog of oral traditions developed by anthropologist and folklorist Yuri Berezkin. Berezkin (2015) generated a catalog that documents the presence of 2,564 different motifs in the local folklore of approximately 1,000 societies around the world. A motif is defined as images or episodes present in the set of narratives recorded in an ethnolinguistic community, and encompass stories, jokes and proverbs. Michalopoulos and Xue (2021) performed a text mining process, creating several variables corresponding to the relative presence of different types of characteristics in the oral traditions of these societies. They also linked these data with the Murdock Ethnographic atlas, allowing us to better understand how the presence of pastoralism relates to this cultural trait.[19]

In Figure 3 we present the association between witch related motifs and historical dependence on pastoralism in panel A, and with the measure of land suitability for pastoralism in panel B. Following Michalopoulos and Xue (2021), estimates are the residuals of a regression accounting for the natural log of the year of first publication and the natural log of the num-

[19]These data has been recently used by Becker (Forthcoming) and Cao et al. (2021), to analyze persistence in oral traditions.

ber of publishers of the sources in a society's oral traditions, and continent fixed effects. We document that the number of motifs related to witchcraft is positively associated with our measures of pastoralism. In line with Baxter (1972), this evidence, analyzed together with the reduction in the level of belief, suggests that the dissemination of jokes, dance songs, and folkloric stories related to witchcraft is somehow negatively related to current beliefs and fear levels of these societies in witchcraft, as highlighted by Waters (2014).

Figure 3: Share of witch related motifs in a society's folklore and dependence on pastoralism



(a) Witch related motifs and Historical dependence on pastoralism

(b) Witch related motifs and land suitability for pastoralism

Notes. These figures plot the association between Witch related motifs and historical dependence on pastoralism (panel a) and the association between Witch related motifs and land suitability for pastoralism. Estimates are residualized off continent fixed effects, the natural log of the year of first publication, and the natural log of the number of publishers of the sources in a society's oral traditions, in line with Michalopoulos and Xue (2021) .

6 Mechanisms

The results presented so far are quite consistent with the phenomenon acknowledged by several anthropologists that pastoral tribes adhered to practices that disfavored the adoption of witchcraft. In this section, we investigate the two main mechanisms highlighted by Baxter (1972) to explain why this belief never fully flourished in these societies: freedom of movement and cooperation.

6.1 The Mobility Mechanism

As discussed in section 2, the practice of pastoralism is characterized by the domestication of herd animals that need to be taken to pasture. This habit of leaving their villages for long

periods of time prevents the escalation of conflicts, one of the triggers for the invocation of the supernatural. To investigate this specific mechanism, we proceed in two ways. First, we look at societies that domesticate non-herding animals, such as pigs, dogs, fowls, bees, guinea pigs, or other smaller species. Contrary to societies dealing with herd animals, societies domesticating non-herding species are more settled, increasing the chances of negative relationships generating social rupture. To conduct this exercise, we construct ethnic-level measures of historical dependence on non-herding animal husbandry. We do this using information on the main domesticated animal in each ethnic group, for which we can map if this animal is a non-herding species. We then interact this binary variable with the dependence on animal husbandry, available in the ethnographic atlas, to create the measure of historical non-herding animal husbandry dependence.

Our second exercise involves comparing nomadic to non-nomadic pastoral societies. As highlighted by Baxter (1972), although accusations of witchcraft are rare in pastoralist environments, he argues that they are not equally rare even among pastoral groups. As society becomes more settled, the presence of witchcraft beliefs emerge. Following , we consider nomadic pastoralist groups those that are classified as *Nomadic* and *Seminomadic*, and as non-nomadic the remaining categories provided in the Ethnographic Atlas.

Estimates of these effects are presented in Table 3. Column (1) presents our baseline estimates, column (2) investigate if the belief in witchcraft is present in societies that depend historically on non-herding animal husbandry, and in column (3) we look into how these effects vary between fully nomadic and non-nomadic pastoral societies. Coefficient estimates presented in column (2) for the dependence on non-herding species is statistically insignificant and small in magnitude. This is in line with the idea that the negative relation between the practice of pastoralism and the belief in witches is not widespread among all groups that domesticate animals and, more importantly, it suggest that the act of leaving home for the pastures seems to be a determining factor.

Column (3) shows estimates of the effects of nomadic and non-nomadic pastoral groups. We find that individuals belonging to both types of ethnic groups are less likely to present witchcraft beliefs, although the effects seem much stronger among those that belong to nomadic pastoral groups. The estimate effect for nomadic societies is in the order of 8.3%, while for non-nomadic societies the reduction is only 3.1%.

Table 3: Mechanisms: Freedom of movement, Animal husbandry with non-herding, and Nomadic status

	Contemporary Witch Beliefs		
	(1)	(2)	(3)
Pastoralism	-0.0577***	-0.0571***	
	[0.0160]	[0.0161]	
Dependence on Animal Husbandry		0.0025	
(Without herding)		[0.0018]	
Nomadic Pastoralism			-0.0836***
			[0.0311]
Non-nomadic Pastoralism			-0.0317***
			[0.0112]
N	16,673	16,673	16,673
R-squared	0.1826	0.1826	0.1826
Country Fixed Effects	Yes	Yes	Yes
Baseline Controls	Yes	Yes	Yes

Notes. OLS estimates in all columns. Standard errors shown in parentheses are clustered at ethnic level. For details on the baseline controls see table 1. (***$p \leq 0.01$, **$p \leq 0.05$, *$p \leq 0.1$)

6.2 The Cooperation Mechanism

The other important mechanism suggested by Baxter (1972) to justify reductions in the adherence to witchcraft beliefs in pastoral societies concerns its high levels of cooperation. To test this hypothesis, we measure the level of trust, defined here as "the belief a partner would cooperate in a transaction with or without formal commitments" (Okoye, 2021),[20] and use data from the Afrobarometer (rounds 3, 4 and 5), ranging from 2005-2013. As usual in the literature, we create four variables, measured on the ordinal 0–3 scale, to capture trust in family, neighbors, courts of law and the local government council.

[20]For more details on the relationship between trust and cooperation, see also, Coleman (1994); Gambetta et al. (2000); Sapienza et al. (2013); Algan and Cahuc (2014)

Table 4 present coefficient estimates for the four trust measures we consider. We uncover statistically significant effects for all variables. The estimates imply that a one standard deviation increase in the historical dependence on pastoralism increases by .0385 the measure of trust in relatives, by .0585 the trust in neighbors, by .0281 the trust in courts of law, and by 0.0434 the trust in local council. The magnitudes of these effects are quite similar to those obtained by Nunn and Wantchekon (2011) and Gershman (2020).

Table 4: Mechanisms: Pastoralism and Trust

	Trust in:			
	Relatives	Neighbors	Courts	Local Council
	(1)	(2)	(3)	(4)
Pastoralism	0.0385**	0.0585***	0.0281*	0.0434***
	[0.0171]	[0.0199]	[0.0144]	[0.0137]
N	40,159	27,902	38,559	38,534
R-squared	0.1248	0.1773	0.0969	0.1327
Country and Wave Fixed Effects	Yes	Yes	Yes	Yes
Baseline Controls	Yes	Yes	Yes	Yes

Notes. OLS estimates in all columns. Standard errors shown in parentheses are clustered at ethnic level. For details on the baseline controls see table 1. (***$p \leq 0.01$, **$p \leq 0.05$, *$p \leq 0.1$)

In his article, Baxter (1972) suggests that the increase in cooperation could be explained by a need of pastoral societies to mitigate risks. However, his hypothesis for the presence of such behavior is not exhaustive and spreading risks need not be the only reason for the presence of such characteristic. In particular, one possible explanation for the more cooperative and trustworthy environment of these societies that is worth highlighting is the presence of the culture of honor. As discussed by Cao et al. (2021), individuals in pastoralist societies have a great need to preserve their reputation, often responding violently to acts considered wrong or unfair. This could also contribute to generating a more cooperative environment insofar the fear of retaliation could discourage harmful attitudes in the relationship with other members of society.

7 Channels of Transmission

The evidence presented so far is consistent with Baxter (1972) experiences with pastoralist societies and strengthens his theory that there is an internal mechanism of cultural norms transmission affecting the persistence of this type of belief in these societies. However, one could argue that individuals from these ethnic groups may have lower levels of the belief in witchcraft today not because dependence on pastoralism affects the internal norms of individuals, but because of other unobserved components affecting these individuals today. If pastoralist's currently live in environments with better institutions and legal structures, for instance, this could cause individuals to present lower levels of witchcraft beliefs and and higher levels of trust.[21] In this section we present three exercises to assess the plausibility that the effects we uncover are coming from customs transmission.

First, it could be that individuals coming from pastoralist groups now live surrounded by individuals with low rates of witch beliefs, influencing pastoralists to also have low contemporary beliefs. To deal with this possible effect, we perform an analysis analogous to that of Nunn and Wantchekon (2011) and add to our baseline specification the average dependence on pastoralism of individuals of other ethnicities living in the same location as the respondent. We create this measure first by averaging the dependence on pastoralism for individuals located today in the same country as the respondent and second by doing the same algebra but for individuals who live today in the same region. Results are presented in Panel A of Table 5. Columns 1 and 2 present the estimates using the measure constructed within countries and columns 3 and 4 using the measure constructed within regions. We find that the inclusion of these additional controls changes very little our baseline estimates. This indicates that the effect we uncovered cannot be explained by differences in exposure of pastoralists to other ethnic groups living near today, suggesting an internal channel.

In our second test we compare the effects of a location-based treatment measure with that of our baseline ethnic measure, also in line with Nunn and Wantchekon (2011). To perform this analysis, we create a new measure of exposure to pastoralism but for the region the respondent lives in today. This measure is a combination of our baseline ethnic measure of dependence and this new location average of dependence. That is, for individuals who live in a region that has an intersection with the historical area of their ethnic group, we assign the value of this new variable to be identical to our baseline measure; however, if the respondent lives in an area with no intersection with the historical area of their ethnic group, the new variable equals the average exposure of all ethnic groups that have some intersection with the region where the individual currently lives.

[21] In fact, it is possible to show that individuals belonging to more treated ethnic groups have a lower level of education, live in less urban areas and report that they believe their leaders are more corrupt.

The introduction of the ethnic-based and the location-based measures at the same time in the regression allows us to have an idea about the effects transmitted via internal norms versus those operating via external factors. Since individuals who live today in the same location as their historical group are assigned the exact same value for both variables, the entire source of variation in our baseline pastoralism variable comes from migrants in the sample. That is, the estimates based on individuals who no longer live in the same region as their ethnic group are strong indicative of an internal channel of cultural transmission.

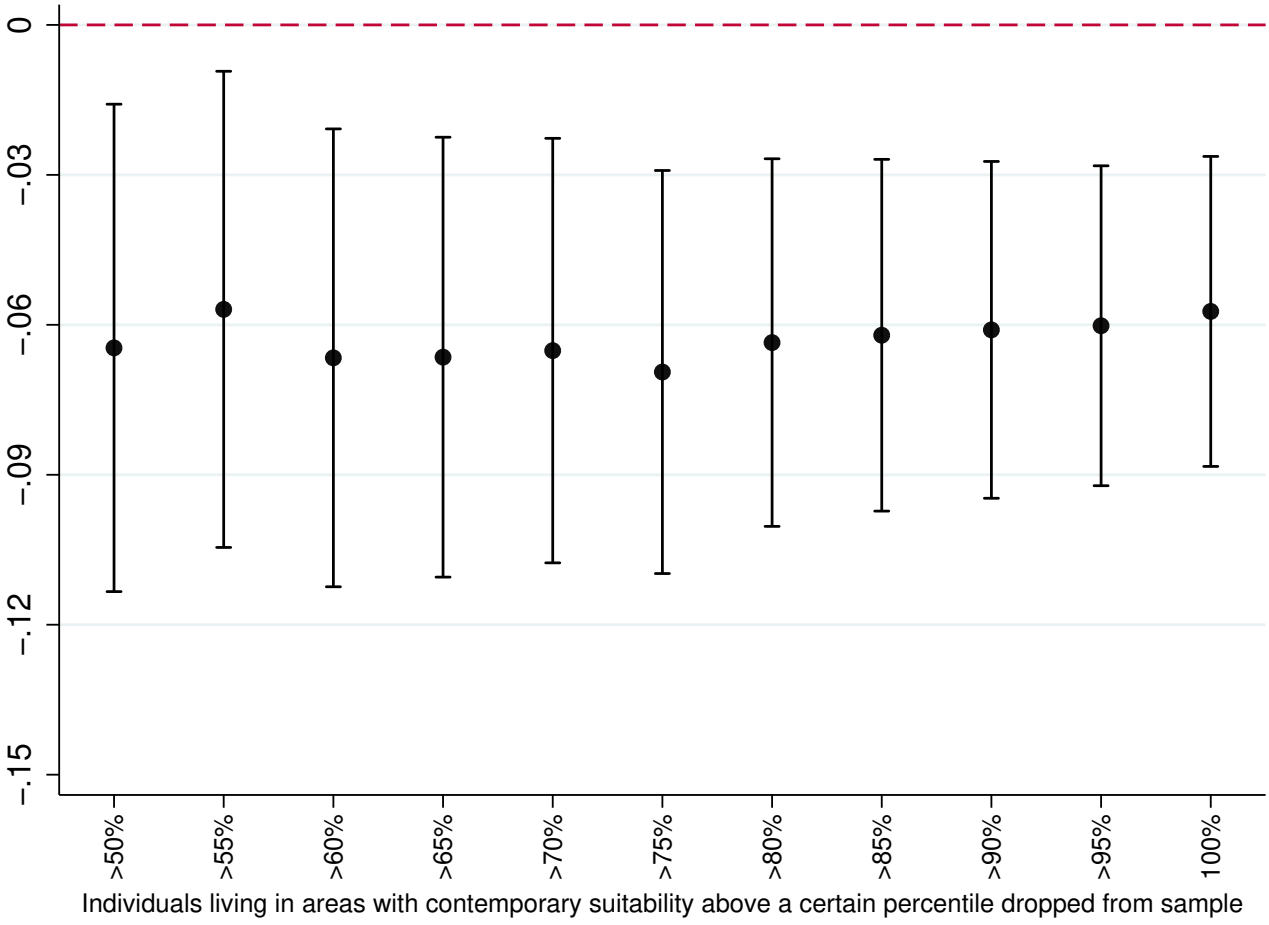
Table 5: Identifying Internal versus External Channels of Transmission

	Contemporary Witch Beliefs			
	Within Country		Within Region	
	(1)	(2)	(3)	(4)
PANEL A.				
Pastoralism (Baseline measure)	-0.0485***	-0.0487***	-0.0580***	-0.0564***
	[0.0153]	[0.0156]	[0.0155]	[0.0156]
Average Pastoralism measure among	0.0835	0.0725	0.0134	0.0186
other ethnicities in the same location	[0.0513]	[0.0511]	[0.0175]	[0.0185]
N	16,673	16,673	16,570	16,570
R-squared	0.1811	0.1829	0.1810	0.1831
	Contemporary Witch Beliefs			
	(5)	(6)	(7)	(8)
PANEL B.				
Pastoralism (Baseline measure)	-0.0371**	-0.0378**	-0.0468***	-0.0469***
	[0.0172]	[0.0168]	[0.0157]	[0.0164]
Location-based Pastoralism measure	-0.0344**	-0.0313**		
	[0.0158]	[0.0158]		
Location-based Suitability			-0.0501***	-0.0464***
for Pastoralism measure			[0.0143]	[0.0172]
N	16,673	16,673	16,673	16,673
R-squared	0.1812	0.1830	0.1828	0.1841
Country Fixed Effects	Yes	Yes	Yes	Yes
Baseline Historical and Individual controls	Yes	Yes	Yes	Yes
Regional controls	No	Yes	No	Yes

Notes. OLS estimates in all columns. Standard errors shown in parentheses are clustered at ethnic level. For details on the baseline controls see table 1. (***$p \leq 0.01$, **$p \leq 0.05$, *$p \leq 0.1$)

Columns (1) and (2) of Panel B of Table 5 presents the estimates. We observe that our parameter of interest is still statistically significant and of large economic significance, albeit being slightly smaller than the baseline estimates. This goes in favor of an internal channel of transmission, although it also suggests that factors external to the individuals play a role in explaining beliefs, since the coefficient of the location-based measure is significant.[22] In a second approach, similar in nature to this first test, we add a measure of land suitability for the individual's residence region calculated from Beck and Sieber (2010)'s data. Estimates presented in columns (3) and (4) of Panel B of the same table remains fairly unchanged, reinforcing our hypothesis of the existence of an internal mechanism.

Figure 4: Testing for Channels of Causality: Effects of the Historical Pastoralism on Internal Norms versus External Factors



Notes. Individuals living in areas with contemporary suitability for pastoralism above a certain percentile dropped from the sample.

[22] Our sample has only 26% of migrants and we show that migration is not correlated with our treatment measures, even though migrants live more in urban environments, have a greater ethnic fractionalization and have a lower rate of co-ethnicity in their region, similarly to the evidence found by Nunn and Wantchekon (2011). In the table A.9 in the Appendix we detail differences between movers and stayers.

Finally, in a third approach, we examine people who live today in locations with low levels of land suitability for pastoralism but belong to ethnic groups that presents historically high levels of dependence on pastoralism. We find that even among these individuals the reduction in witchcraft beliefs persists. These are depicted in Figure 4, which presents the estimates of our baseline specification but dropping from the sample individuals living in areas with contemporary suitability above a certain percentile. The estimates remain significant and of similar economic meaning even after a substantial reduction in the sample size.

8 Worldwide Estimates

So far, we focused our attentions on the African continent. However, it is likely that the relationship between witchcraft and pastoralism also occurs in other contexts. In this section, we test our hypothesis using several other data sets covering all continents.

We start by using the Standard Cross-Cultural Sample, which includes 186 pre-industrial societies around the world and provides information on the incidence of *Witchcraft or Sorcery Beliefs* (to 46 societies) and *Loyalty to Ethnic Group* (to 86 societies). We take the variable *Loyalty to Ethnic Group* as a proxy for the trust measures presented in the previous sections, approximating for the levels of cooperation within the ethnic group. To estimate the desired effects, we follow the same logic as above and create an exposure variable to pastoralism identical to the one used in the main estimation. Results are presented in columns (1)-(4) of Table 6. Specifications include a huge set of controls: at the geographic level, we controlled for the log of the rainfall level, the suitability of the area for malaria, and the slope of the terrain; at the ethnic level, we controlled for settlement patterns of societies, population density, the number of jurisdictional hierarchies, an indicator of polygyny in society, the historical presence of slavery, and a plow use indicator. In all columns the errors are clustered at the level of the ethnolinguistic group of the society and all specifications include fixed effects for the regions present in the SCCS.[23] We document significant effects of pastoralism on witchcraft and on the proxy for trust. Points estimates suggest a reduction of -14% in the beliefs in witches in pastoral societies. Note that these are estimated using an extremely small sample of societies.

Another database containing information on witchcraft is the Pew Research Center's Religion & Public Life survey. These data is composed of approximately 25,000 Muslim individuals living in countries in North Africa and Asia.[24] The data, however, has no information on the ethnicity of the individuals, only their place of residence.[25] Our approach, therefore, is to esti-

[23]For details on the construction of controls, see Appendix data section A.1

[24]The countries included in this new database are: Afghanistan, Albania, Algeria, Azerbaijan, Bangladesh, Bosnia and Herzegovina, Egypt, Indonesia, Iran, Iraq, Jordan, Kazakhstan, Kosovo, Kyrgyzstan, Lebanon, Malaysia, Morocco, Niger, Pakistan, Palestinian territories, Tajikistan, Tunisia, Turkey, and Uzbekistan.

[25]The Pew also has information on witchcraft beliefs for Latin America. However, the data does not have

mate the reduced-form relationship between witchcraft and the land suitability for pastoralism mean, as provided in Beck and Sieber (2010). The empirical model includes both geographic and individual-level controls, in addition to country fixed effects. At the geographic level, we also add controls for nighttime lights per capita, land suitability for agriculture, region elevation and distance to the coast. At the individual level, we include age, age squared, gender indicator, and urban indicator controls.[26] As usual, standard errors are clustered at the region level. Columns (5) and (6) report our estimates. We find significant effects of the exposure to pastoralism on the presence of beliefs in witchcraft. Parameter estimates are similar in magnitude to those of our baseline estimation using data for Africa. In Appendix Figure A.5 we graphically present the results for the two datasets we use, the SCCS and the Pew.

Finally, to verify whether the effects on cooperation also generalize to a broader context, we use data from the *World Value Survey* for more than 20 thousand individuals from 37 countries spread across all continents. In this database we obtain 3 variables of interest, the levels of trust in family, trust in neighbors, and trust in others you know. As these data has information on the ethnicity of individuals compatible with the Ethnographic Atlas, it is possible to build a treatment measure identical to the one created for the baseline assessments. Similarly to what is done above, specifications include a variety of controls at the individual and ethnic levels. At the individual level, we control for age, age squared, gender indicator, education fixed effects, and religion fixed effects. The ethnicity-level controls are the same as the baseline estimation, all specifications include a country-fixed effect and standard errors are clustered at the ethnicity level. The estimates are presented in Table 6. We find all estimates to be statistically significant. The effects of increasing a one standard deviation in the treatment variable on Trust in family, neighbors, and people you know are, respectively, 0.15, 0.14, and 0.20. Appendix Figure A.6 presents the graphs for all these outcomes.

Taken together, the evidences presented in this section provide compelling support for the anthropological hypothesis that historical dependence on pastoralism favored the adoption of customs that contributed to a reduction in the spread of the belief in witches, and that this effect is present in virtually all the continents of the world.

information on ethnic groups. Also, Beck and Sieber (2010) data are not variable for the Americas.

[26] An important individual control that is not used in our baseline estimation regards the educational levels. Our specification does not include this control as this question is not available for all countries. Our results, however, changes very little with the inclusion of this control. Also, in the main estimation, Russia and Thailand are left out as the majority of the population is not Islamic, and thus the data is not representative.

Table 6: Witchcraft, Trust and the Historical Pastoralism: World Databases

	SCCS				Pew - Asia and North Africa	
	Witchcraft or Sorcerer Beliefs	Witchcraft or Sorcerer Beliefs	Loyalty to Ethnic Group	Loyalty to Ethnic Group	Witch Beliefs	Witch Beliefs
	(1)	(2)	(3)	(4)	(5)	(6)
Pastoralism	-0.1566**	-0.1460*	0.2165**	0.1832*		
	[0.0699]	[0.0806]	[0.0967]	[0.1065]		
Suitability for Pastoralism					-0.0473*	-0.0437*
					[0.0264]	[0.0260]
N	46	46	86	86	23,241	23,058
R-squared	0.3310	0.9160	0.1618	0.2988	0.1331	0.1346
Region or Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Geographic controls	Yes	Yes	Yes	Yes	Yes	Yes
Historical controls	No	Yes	No	Yes	–	–
Individual controls	–	–	–	–	No	Yes
	World Value Survey					
	Trust in Family	Trust in Family	Trust in Neighbors	Trust in Neighbors	Trust People You Know	Trust People You Know
	(7)	(8)	(9)	(10)	(11)	(12)
Pastoralism	0.1707***	0.1550***	0.2276***	0.1410*	0.2366***	0.2005***
	[0.0405]	[0.0384]	[0.0845]	[0.0845]	[0.0686]	[0.0755]
N	21,561	20,679	21,569	20,687	21,558	20,677
R-squared	0.0856	0.0918	0.0640	0.0780	0.0467	0.0506
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Historical controls	Yes	Yes	Yes	Yes	Yes	Yes
Individual controls	No	Yes	No	Yes	No	Yes

Notes. OLS estimates in all columns. For details on the controls see section 8. (***$p \leq 0.01$, **$p \leq 0.05$, *$p \leq 0.1$)

9 Conclusion

It has long been hypothesized that the dependence on pastoralism relative to the dependence on agriculture was an important determinant of the persistence of witchcraft beliefs in societies. In this paper, we formally test this hypothesis by combining ethnographic data on historical dependence on pastoralism with contemporary data to measuring the presence of witchcraft beliefs. Consistent with the existing hypothesis, we present evidence that people descending from historically more pastoral societies have a lower level of contemporary belief in witches. The results using an instrumental variable based on the ecological determinants of pastoralism corroborate our main analysis and indicate an 18% reduction in the incidence of contemporary witchcraft beliefs. The main mechanisms behind this result appear to be pastoralist groups' freedom of movement and cooperative behavior. We also show that the reduced belief in witches is reflected in pastoral societies' oral traditions, narratives, stories, jokes and proverbs, possibly because the lack of fear makes pastoralists more willing to speak, sing and joke about the supernatural. Finally, to test for the importance of cultural persistence by examining people who live in locations with low levels of suitability for pastoralism today but belong to ethnic groups that have historically lived in areas with high levels of suitability and find that, even among these individuals, the reduction in witches beliefs persists.

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Online Appendix to "Social Organization and the Roots of Supernatural Beliefs"

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A Appendix

A.1 Data Sources and Variable Definitions

A.1.A Pew survey Data and Ethnographic Variables

Witchcraft Beliefs: Our measure of witch beliefs is built based on two (yes or no) questions. In the first, the respondent is asked whether believes in "witchcraft", while the second question inquires about the belief in the "evil eye", or that "certain people can cast curses or spells that cause bad things to happen to someone". we consider that a person believes in witches, dummy variable equal to 1, if the respondent answers yes to any of the two questions, and 0, otherwise. *Source*: Pew Forum survey.

Dependence on pastoralism: Based on two variables from ethnographic atlas. The first one indicates a ethnicity's dependence on animal husbandry between 0 and 100 in 10 intervals. This variable was re-scaled to the midpoint of the intervals between 0 and 1. The second one indicates the predominant domestic animals in that ethnicity. Using information from v40, we generated an indicator that takes value 1 if the predominant animal is a herding animal (sheep or goats, equine animals such as horses or donkeys, deer/reindeer, camels or camelids such as alpacas or llamas, bovine animals such as cattle, water buffalos or yaks). To generate our measure for a society's dependence on pastoralism, we multiplied this indicator with the rescaled variable measuring dependence on animal husbandry. *Source*: Murdock et al. (1967) (variables v4 and v40)

Dependence on animal husbandry without herding: Based on two variables from ethnographic atlas. The first one indicates a ethnicity's dependence on animal husbandry. The second one indicates the predominant domestic animals in that ethnicity. Using information from v40, we generated an indicator that takes value 1 if the predominant animal is a non-herding animal (poultry, bees, pigs, dogs, fowls, guinea pigs). To generate the measure for a society's dependence on animal husbandry without herding, we multiplied this indicator with the rescaled variable measuring general dependence on animal husbandry. *Source*: Murdock et al. (1967) (variables v4 and v40)

Nomadic and Non-Nomadic Pastoralism: *Source*: Using the variable v30 of the Ethnographic Atlas, we consider that a society is Nomadic if the group has a Settlement Pattern that is Fully nomadic or Semi-nomadic, and the society is considered Non-Nomadic otherwise. From this, the Nomadic and Non-Nomadic Pastoralism variables are created from the interaction of the Dependence on Pastoralism variable described above, with two indicators created from the Nomadic Status. *Source*: Murdock et al. (1967) (variables v4,

v30 and v40)

Land Suitability to pastoralism relative to agriculture: We calculate grid cell level suitability for pastoralism relative to agriculture, as the difference between suitability measures for pastoralism and for agriculture. In figure 2 it is possible to see the suitability map divided between the different ethnic regions determined by Murdock (1959). We calculate suitability in a 25-kilometer radius around the historical centroid of this regions. *Source*: Beck and Sieber (2010) and Murdock (1959)

Age: Individual's Age in completed years. *Source*: Pew Forum survey.

Male Indicator: Individual gender indicator receives the value 1 if male. *Source*: Pew Forum Survey

Education: Level of educational attainment, three categories: completed primary or less; some secondary; or completed secondary, post-secondary and higher. *Source*: Pew Forum survey.

Urban Indicator: Dummy variable indicating whether an individual resides in an urban location. *Source*: Pew Forum survey.

Plow Use Indicator: Indicator variable that takes value 1 if a society traditionally used the plow in agriculture. Source: Murdock et al. (1967) (variable v39.)

Polygyny: Dummy variable indicating whether an ethnic group practiced polygyny *Source: Murdock et al. (1967)* (variable v8)

Transatlantic Slave Trade: Number of slaves taken from the respondent's ethnic group in the transatlantic slave trade, divided by the area of land historically inhabited by the group. *Source*: Nunn and Wantchekon (2011)

Indian Ocean Slave Trade: Number of slaves taken from the respondent's ethnic group in the Indian Ocean slave trade, divided by the area of land historically inhabited by the group. *Source*: Nunn and Wantchekon (2011)

Historical presence of slavery: Indicator variable that takes value 1 if v70 ("Type of Slavery") equals "incipient or nonhereditary", "reported but type not identified", or "hereditary and socially significant", and v71 ("Former Presence of Slavery") is different of "Formerly Present but not currently existing", and 0 otherwise. *Source*: Murdock et al. (1967) (variables v70 and v71)

Settlement patterns: Precolonial settlement patterns, Variable with 8 groups ranging from fully nomadic to complex settlements. *Source*:Murdock et al. (1967) (variable v30).

Jurisdictional hierarchies: The number of jurisdictional hierarchies beyond the local community. *Source*: Murdock et al. (1967) (variable v33).

Missions/area: The number of religious missions per square kilometer in an ethnic

group's homeland during the colonial period. *Source*:Roome (1925) and Murdock (1959).

Colonial railways: Indicator variable that takes value 1, if a part of the railway network built by the Europeans was on the homeland of the ethnic group, and 0, otherwise. Recorded in 1911 by the Century Company. Source: http://scholar.harvard.edu/nunn/pages/data-0.

European explorers: Indicator variable that takes value 1, if an European explorer route, as recorded in 1911 by the Century Company, crossed the homeland of the ethnic group, and 0, otherwise. Source: http://scholar.harvard.edu/nunn/pages/data-0.

Ruggedness index Index of terrain ruggedness as constructed by Nunn and Puga (2012). The variable used in the analysis is the average value of the index across cells in each region. *Source*: Nunn and Puga (2012)

Malaria stability index: Index of Malaria stability as constructed by Kiszewski et al. (2004). The variable used in the analysis is the average value of the index across cells in each geographic region and takes values from 0 to 39. *Source*: Kiszewski et al. (2004)

Nighttime lights per capita: The average nighttime luminosity from the Defense Meteorological Satellite Program's Operational Linescan System (DMSP-OLS). The measure ranges from 0 to 63 and is aggregated for 2008 and 2009 at the regional level average. This average is then divided by the region's population size. *Source*: Gershman (2020) based on Henderson et al. (2012)

Land suitability for agriculture: Average region value of the Land suitability for agriculture (maximizing technology mix) as constructed by Gershman (2020). 8-step variable ranging from 1 (very high suitability) to 8 (not suitable). *Source*: Gershman (2020)

Rainfall anomaly: Average monthly precipitation during the period 2006-2008 (two years before the survey wave) relative to the long-run average (1951-2000), censored at 100%. The final measure is the average of pixels in each region. Source: Gershman (2020) based on Schneider et al. (n.d.)

Ethnolinguistic fractionalization: Standard ELF indices constructed at different levels of linguistic aggregation based on regional-level data on ethnolinguistic composition. For Nigeria, the indices were recalculated using the data from the 2013 Demographic and Health Survey at the level of geopolitical zones. *Source*: Gershman (2020) based on Gershman and Rivera (2018) and Gershman and Rivera (2020).

Distance to 600 AD Trade Routes: Great-circle distance from the nearest trade route 600 AD to the centroid of an ethnic group in thousand kilometers. *Source*: Michalopoulos et al. (2018) based on Brice and Kennedy (2001)

Distance to 1800 AD Trade Routes: Great-circle distance from the nearest trade route 1800 AD to the centroid of an ethnic group in thousand kilometers. *Source*: Michalopou-

los et al. (2018) based on Brice and Kennedy (2001) and O'Brien (1999).

Distance to Ottoman Empire: Great-circle distance from the Ottoman Empire border to the centroid of an ethnic group in thousand kilometers. *Source*: Own calculations shapefile available at https://www.britannica.com/place/Ottoman-Empire

Distance to Addis Ababa: Great-circle distance from Addis Ababa to the centroid of an ethnic group in thousand kilometers. *Source*: Own calculations

Distance to Islamic Empire: Great-circle distance from the Islamic Empire border (Late Abbasid Caliphate c.A.D.900) to the centroid of an ethnic group in thousand kilometers. *Source*: Brice and Kennedy (2001)

Distance to the Coast: Great-circle distance from the nearest coastline to the centroid of an ethnic group or region in thousand kilometers. *Source*: Own calculations

A.1.B Afrobarometer Survey Data and Variables

Trust questions: Four variables with questions about the levels of Trust in Family, Neighbors, Courts of Law and the Local Government Council. The answers are coded in 4 steps ranging from 0 (not at all) to 3 (a lot). *Source*: Afrobarometer Survey

Age: Individual's age in completed years. *Source*: Afrobarometer Survey

Male Indicator: Individual gender indicator receives the value 1 if male. *Source*: Afrobarometer Survey

Urban Indicator: Dummy variable indicating whether an individual resides in an urban location. *Source*: Afrobarometer Survey

Religion: Five denominations: Christian, Muslim, traditional religion, unaffiliated, other. *Source*: Afrobarometer Survey

Education: Respondent's highest level of education, ten steps, ranging from "No formal schooling" to "Post-graduate". *Source*: Afrobarometer Survey

A.1.C Pew Survey (Asia and North Africa) Data and Variables

Witchcraft Beliefs: Same as previous definition. *Source*: Pew Forum survey.

Age: Individual's age in completed years. *Source*: Pew Forum Survey

Male Indicator: Individual gender indicator receives the value 1 if male. *Source*: Pew Forum Survey

Urban Indicator: Dummy variable indicating whether an individual resides in an urban location. *Source*: Pew Forum survey.

Elevation: Average elevation in meters within the unit of analysis, i.e. region or ethnic group. *Source*: Gershman (2020)

A.1.D Standard Cross-Cultural Sample Data and Variables

Witchcraft or Sorcerer Beliefs: Indicator Variable that takes the value of 1 if the Witch or Sorcerer beliefs is present in the ethnic group and 0 otherwise. *Source*: SCCS (variable v883)

Loyalty to Ethnic Group: Describes the extent to which members of society feel loyal to their ethnic group. Ordinal variable ranging from 1 to 3. *Source*: SCCS (variable v1771)

Settlement patterns: Precolonial settlement patterns, in 8-steps ranging from fully nomadic to complex settlements. *Source*: SCCS (variable v234).

Jurisdictional hierarchies: The number of jurisdictional hierarchies beyond the local community. Variable with 4-steps ranging from no levels to three levels. *Source*: SCCS (variable v237).

Polygyny Indicator: Dummy variable indicating whether an ethnic group practices polygyny. *Source*: SCCS (variable v210)

Historical presence of slavery: Indicator variable that takes value 1 if v274 ("Type of Slavery") equals "incipient or nonhereditary", "reported but type not identified", or "hereditary and socially significant", and v275 ("Former Presence of Slavery") is different of "Formerly Present but not currently existing", and 0 otherwise. *Source*: SCCS (variable v274 v275)

Plow Use Indicator: Indicator variable that takes value 1 if a society traditionally used the plow in agriculture. *Source*: SCCS (variable v243)

Population Density: This variable represents the mean population density in the ethnic area, presenting 5-step. (less than 1 person/sq. mile; 1-5 persons/sq. mile; 5.1-25 persons/sq. mile; 26-100 persons/sq. mile; more than 100 persons/sq. mile) *Source*: SCCS (variable v156)

Land Slope: 5-step variable on the Land Slope of the ethnic group area. Ranges from "level to gently undulating" (0 to 8% slope) to "steeply dissected by mountains. *Source*: SCCS (variable v922)

Rainfall: Log of Mean Yearly Annual Rainfall. Ordinal variable with 185 unique values. *Source*: SCCS (variable v1913)

Malaria Suitability Indicator: Indicator variable that takes value 0 if Malaria is "Absent or not recorded" in the ethnic group and 1 otherwise. *Source*: SCCS (variable

v1255)

Region: Data on geographic regions directly from SCCS with: 1 = Africa: 2 = Circum-Mediterranean; 3 = East Eurasia; 4 = Insular Pacific; 5 = North America; and 6 = South America. *Source*: SCCS (variable v200)

A.1.E World Value Survey Data and Variables

Trust Questions: Three variables with the questions about the levels of Trust in Family, Neighbors and People you know. The answers are coded in 4 steps ranging from "Do not trust at all" to "Trust completely". *Source*: World Value Survey

Age: Individual's Age in completed years. *Source*: World Value Survey

Male Indicator: Individual gender indicator receives the value 1 if male. *Source*: World Value Survey

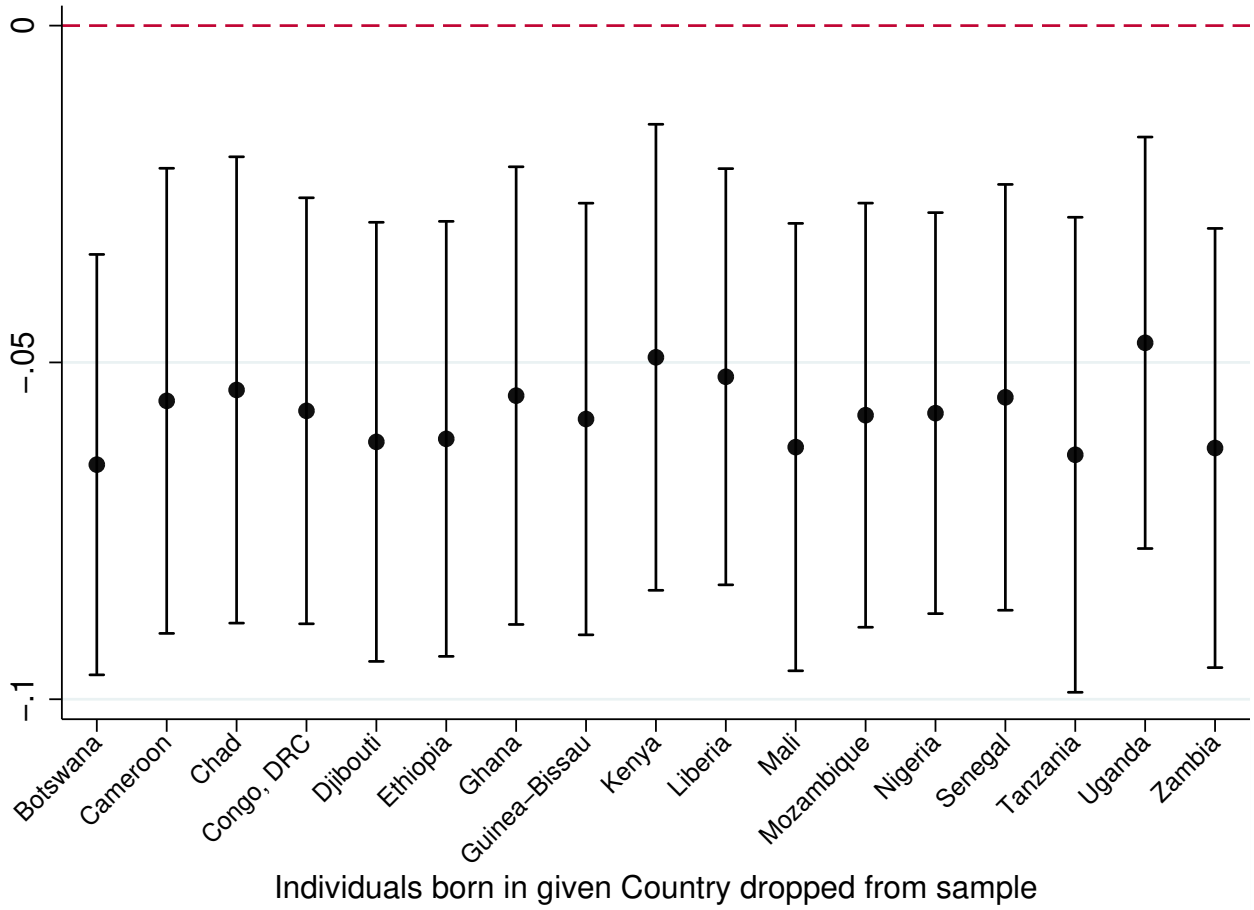
Education Individual's education, divided in 8 groups, ranging from "Inadequately completed elementary education" to "University with degree/Higher education" *Source*: World Value Survey

Religion: Categorical variable of religion with 11 denominations (None, Other, Other Christian, Buddhist, Protestant, Catholic, Hindu, Jew, Muslim, Orthodox, and Sunni). *Source*: World Value Survey

A.2 Figures

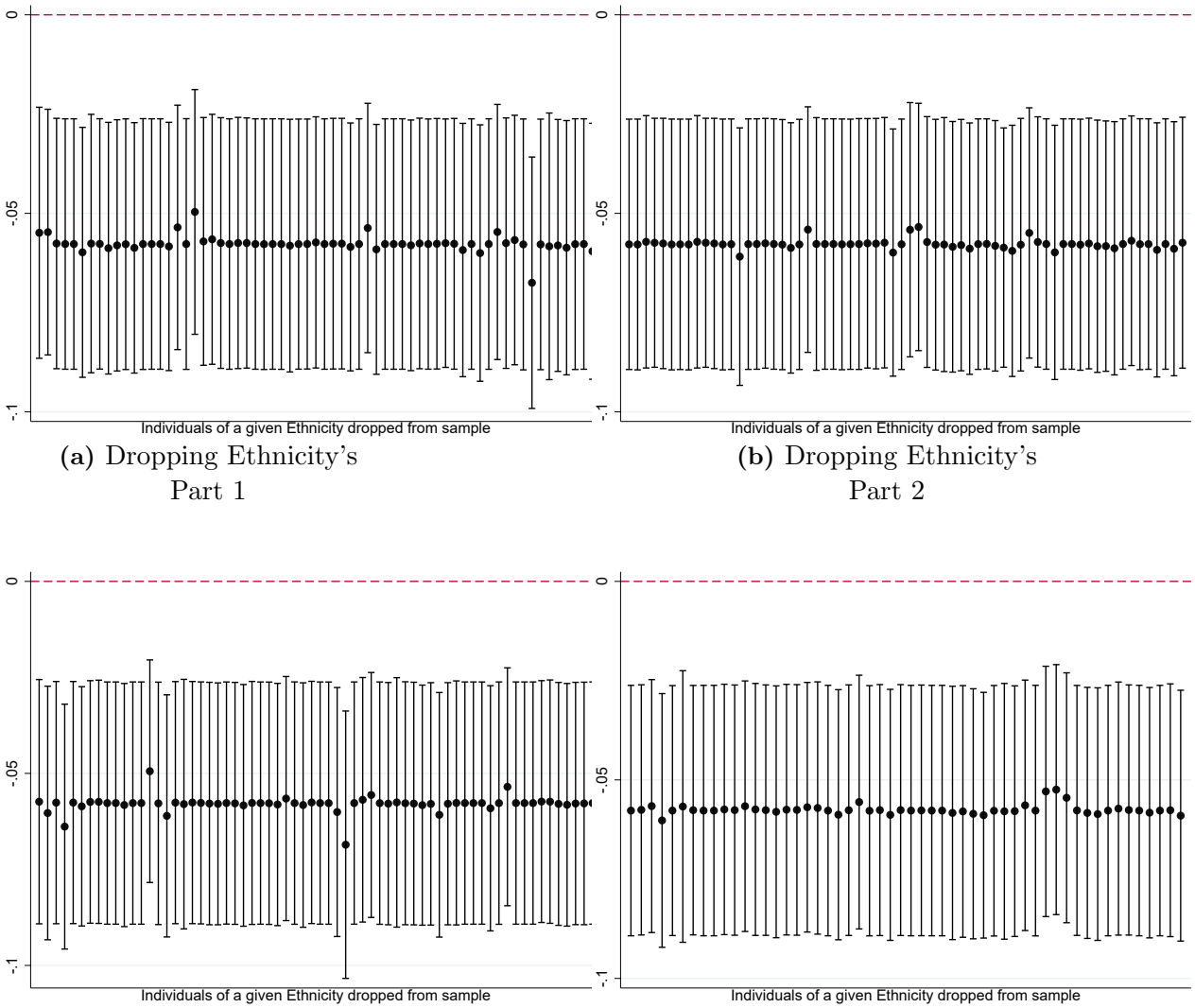
A.2.A Robustness to Sample Restrictions

Figure A.1: Robustness to Sample Restrictions - Country



Notes. This figure plots estimates based on the specification 2. See Table 1 for details on the controls. Point estimates for the effect of in Witch Beliefs, denoted by markers, and corresponding 95-percent confidence intervals represented by lines, as different subsets of Observations are excluded from the sample.

Figure A.2: Robustness to Sample Restrictions - Ethnicity



(a) Dropping Ethnicity's Part 1

(b) Dropping Ethnicity's Part 2

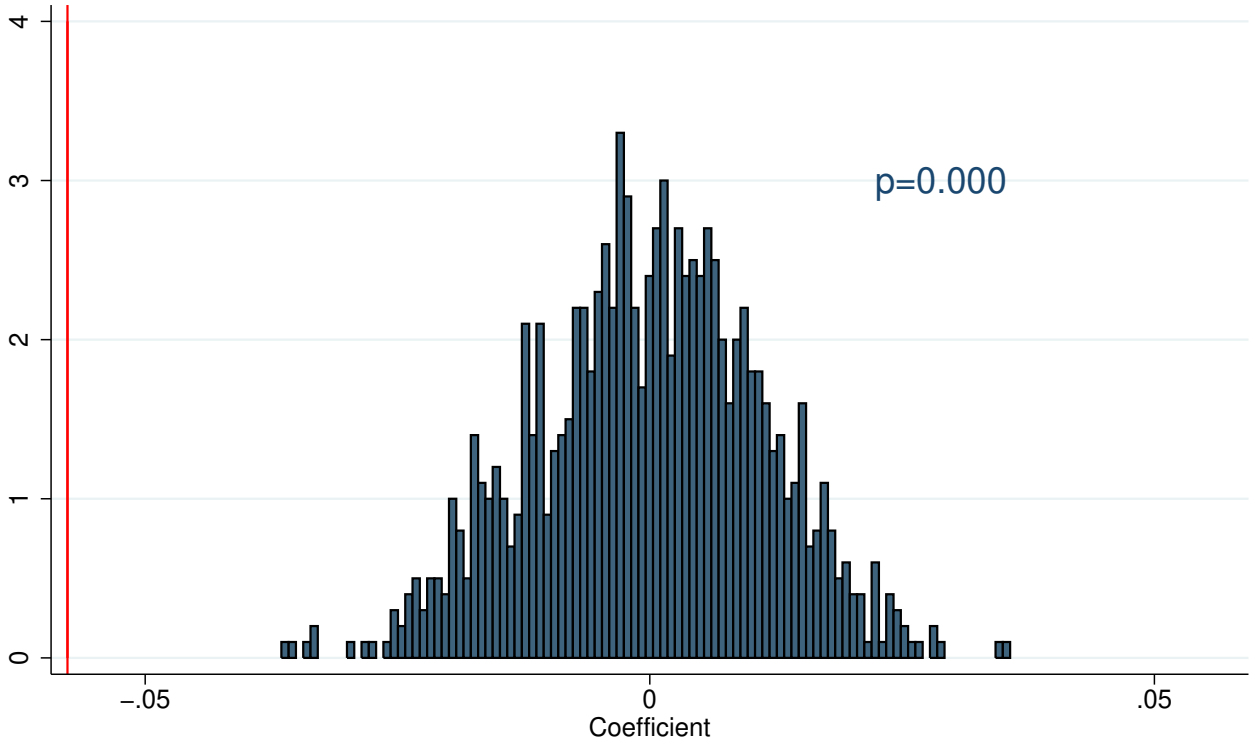
(c) Droping Ethnicity's Part 3

(d) Dropping Ethnicity's Part 4

Notes. This figure plots estimates based on the specification 2. See Table 1 for details on the controls. Point estimates for the effect of in Witch Beliefs, denoted by markers, and corresponding 95-percent confidence intervals represented by lines, as different subsets of Observations are excluded from the sample.

A.2.B Permutation Tests

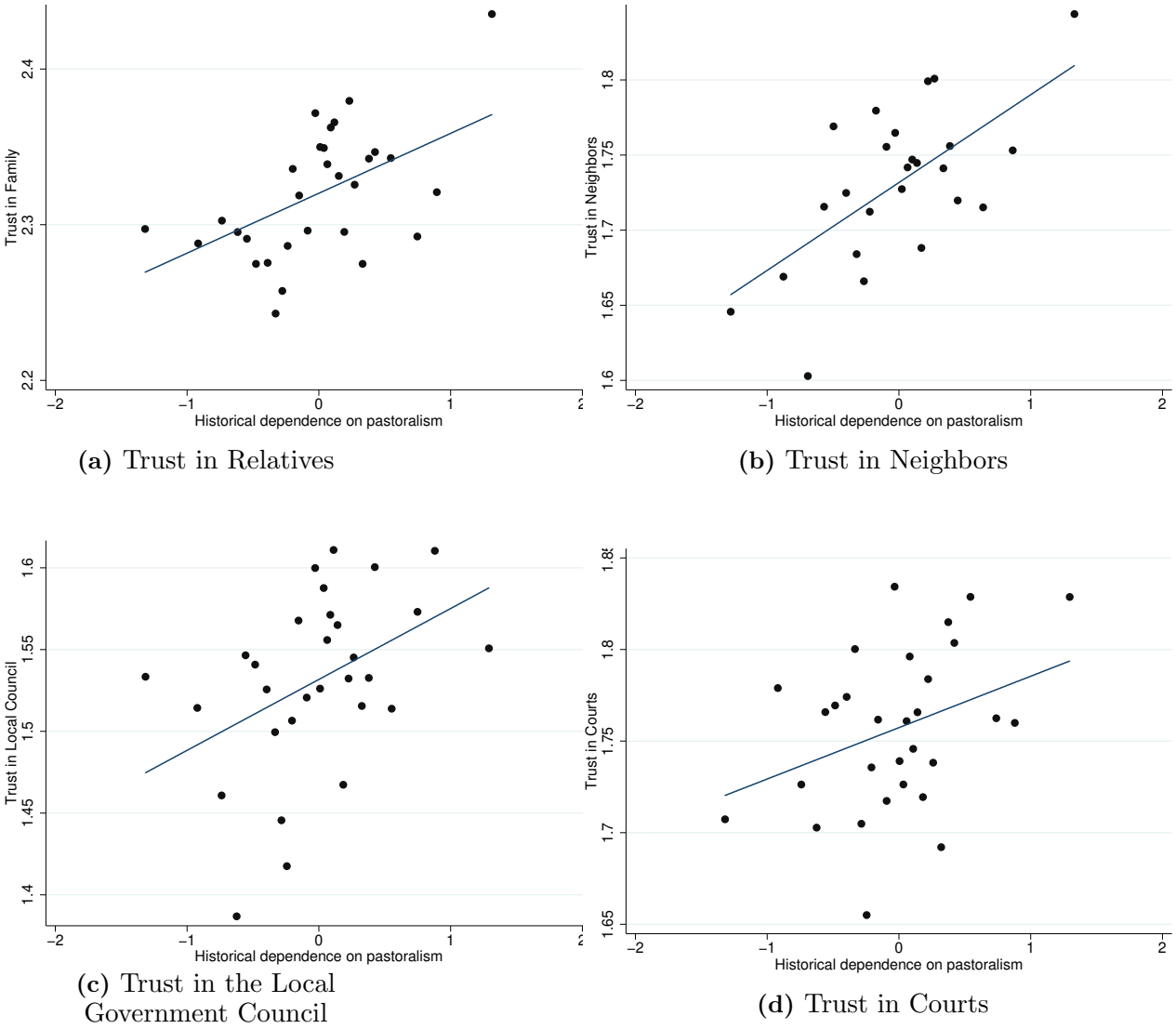
Figure A.3: Permutation Tests: Placebo Historical Dependence on Pastoralism Measures



Notes. These figures plot the distribution of placebo coefficients. We randomly assign each ethnicity a placebo historical dependence on Pastoralism measure, and re-estimate model 2 using the implied placebo treatment measure. This procedure is repeated 1000 times. The share of the 1000 absolute placebo coefficients that are larger than the absolute actual coefficient is the p-value for the hypothesis that $\beta = 0$. The vertical lines represent the true estimates.

A.2.C Correlations of Historical Dependence on Pastoralism in the Afrobarometer data

Figure A.4: Correlation between Historical dependence on pastoralism, Trust in relatives, Trust in neighbors, and Trust in the local government council



(a) Trust in Relatives

(b) Trust in Neighbors

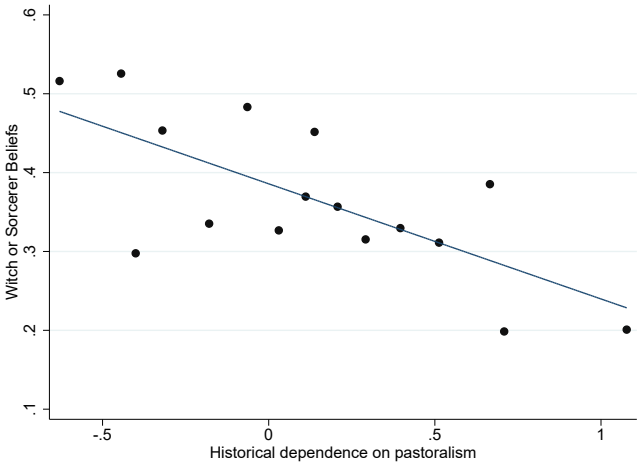
(c) Trust in the Local Government Council

(d) Trust in Courts

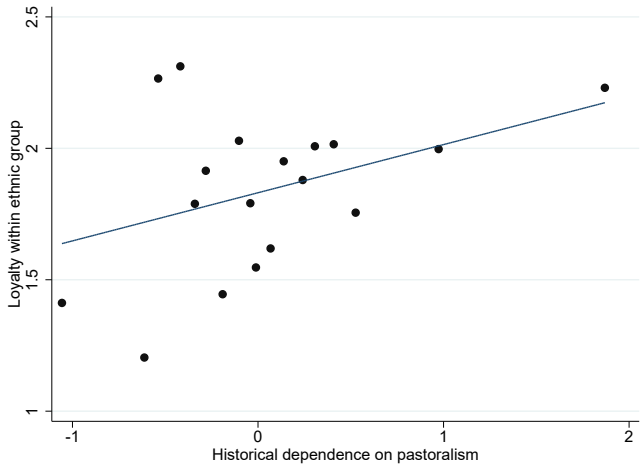
Notes. Binscatter plot: Trust outcomes and Historical dependence on pastoralism in the Afrobarometer data, conditional the full set of controls. See table 4 for detail in the controls

A.2.D Correlations of Dependence on Pastoralism in Standard Cross-Cultural Sample and Pew Survey (Asia and North Africa)

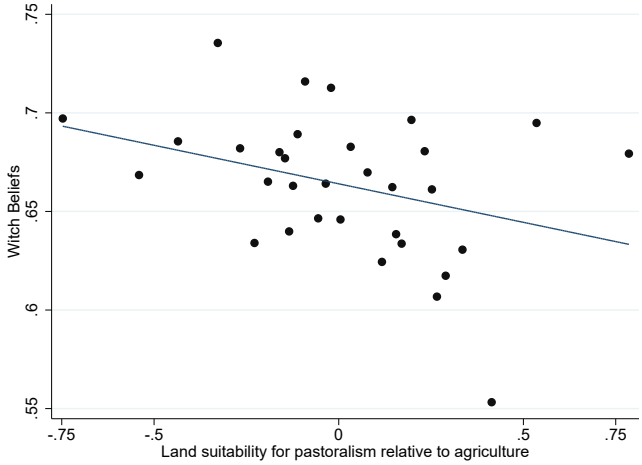
Figure A.5: Correlation between dependence on pastoralism, Witchcraft Beliefs and Loyalty in Standard cross-cultural sample and Pew Survey (Asia and North Africa)



(a) Correlation between Witch or Sorcerer beliefs and Historical dependence on pastoralism in the Standard cross-cultural sample data



(b) Correlation between Loyalty in Ethnic group and Historical dependence on pastoralism in the Standard cross-cultural sample data

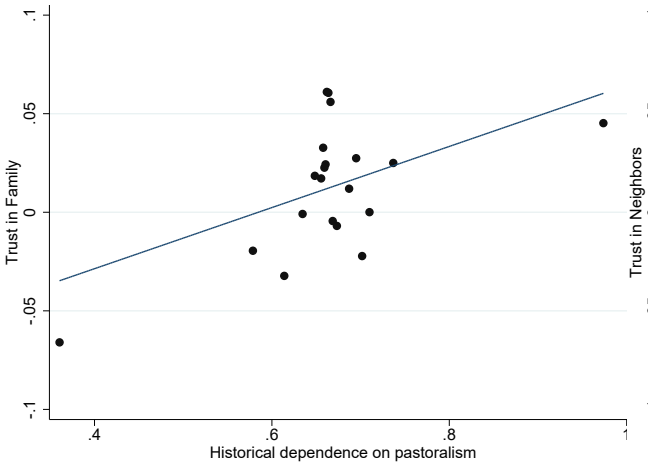


(c) Correlation between Witchcraft beliefs and Land Suitability to pastoralism in the Pew Survey for Asia and North Africa

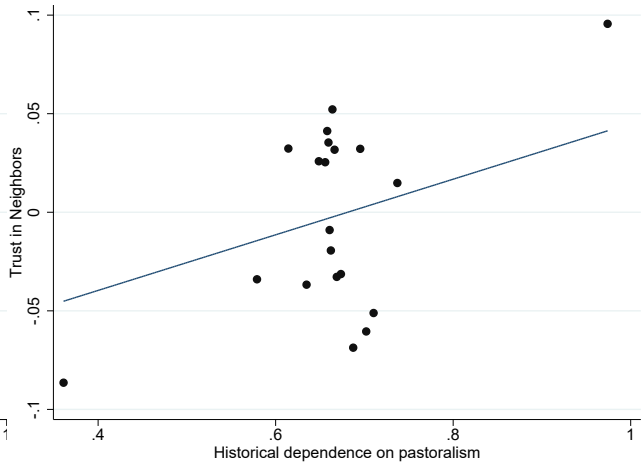
Notes. Binscatter plot: Standard cross-cultural sample outcomes and Historical dependence on pastoralism conditional on baseline controls and region or country fixed effects.

A.2.E Correlations of Historical Dependence on Pastoralism in the World Value Survey data

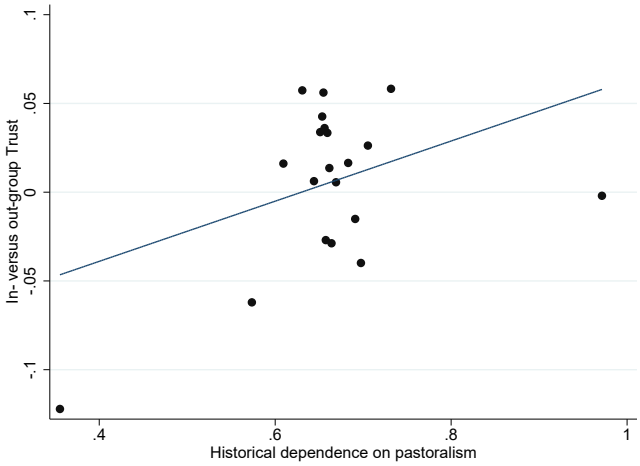
Figure A.6: Correlation between Historical dependence on pastoralism, Trust in family, Trust in neighbors, and In versus out-group Trust in the World Value Survey data data



(a) Trust in Family



(b) Trust in Neighbors



(c) Trust in People You Know

Notes. Binscatter plot: Trust outcomes and Historical dependence on pastoralism in the World Value Survey, conditional on baseline controls, country and wave fixed effects.

A.3 Tables

A.3.A Descriptive Statistics

Table A.1: Descriptive Statistics

	Pew Survey					
Dependent variables:	Mean	Standard Error	Observations	Min	Median	Max
Individual-level variables:						
Witch Beliefs	0.5582	0.4966	16,673	0	1	1
Hist. Dep. on Pastoralism	0.2642	0.2268	16,673	0	0.205	0.93
Age	33.5222	12.870	16,673	18	30	95
Male	0.5384	0.4985	16,673	0	1	1
Group Religion	1.4548	.59176	16,673	1	1	4
Education	1.8152	0.7425	16,673	1	2	3
Urban Indicator	0.3961	0.4891	16,673	0	0	1
Ethnic-level variables:						
Settlement patterns	5.9013	1.8736	16,673	1	7	8
Jurisd. Hierarchies	2.6959	.9163	16,673	1	3	4
Polygyny	0.4766	0.4994	16,673	0	0	1
Historical Slavery	0.8727	0.3332	16,673	0	1	1
Atlantic Slave Trade	0.4039	0.8037	16,673	0	0.0005	3.6559
Indian Slave Trade	0.0313	0.1709	16,673	0	0	3.3298
European explorers	0.5174	0.4997	16,673	0	1	1
Colonial railways	0.3508	0.4772	16,673	0	0	1
Missions/area	0.1730	0.3582	16,673	0	0.0233	2.7072
Malaria suit. index	14.1713	8.5125	16,673	0	13.9961	34.6587
Plow Indicator	0.0696	0.2545	16,673	0	0	1
Regional-level variables:						
Nighttime lights per capita	0.0048	0.0083	16,673	0	0.0019	0.0634
Ethnolinguistic frac.	0.5703	0.2555	16,673	0.0228	0.6299	0.9547
Land Suit. to Agriculture	4.3592	1.6942	16,673	1	4.1052	8
Rainfall anomaly	98.1062	3.8096	16,673	74.6479	100	100
Ruggedness Indicator	0.6398	0.7077	16,673	0.0398	0.3663	3.7963

*Notes.*The table reports the summary statistics for the variables in the Pew Religion Survey (2008).

Table A.2: Descriptive Statistics

	Afrobarometer					
Dependent variables:	Mean	Standard Error	Number of Observations	Min	Median	Max
Individual-level variables:						
Trust in Relatives	2.3192	0.9097	42,515	0	3	3
Trust in Neighbors	1.7288	0.9991	29,567	0	2	3
Trust in Courts	1.7608	1.0344	40,769	0	2	3
Trust in Local Council	1.5341	1.0764	40,744	0	2	3
Hist. Dep. on Pastoralism	0.2029	0.1304	40,159	0	0.2	0.9
Age	35.7809	14.0771	40,159	18	32	130
Male	0.5014	0.5000	40,159	0	1	1
Group(Religion)	1.4655	0.8768	40,159	1	1	5
Education	3.3130	2.0381	40,159	0	3	9
Urban Indicator	0.3918	0.4881	40,159	0	0	1
Ethnic-level variables:						
Settlement patterns	6.1948	1.1265	40,159	1	7	8
Jurisd. Hierarchies	2.6724	0.9374	40,159	1	3	4
Polygyny	0.4107	0.4919	40,159	0	0	1
Historical Slavery	0.7921	0.4058	40,159	0	1	1
Atlantic Slave Trade	0.5682	0.9256	40,159	0	0.0190	3.6559
Indian Slave Trade	0.0318	0.1372	40,159	0	0	3.3298
European explorers	0.5266	0.4992	40,159	0	1	1
Colonial railways	0.4335	0.4955	40,159	0	0	1
Missions/area	0.2872	0.4339	40,159	0	0.1099	2.7072
Malaria suit. index	13.8569	9.5198	40,159	0	12.866	34.6587
Plow Indicator	0.0572	0.2322	40,159	0	0	1
Regional-level variables:						
Nighttime lights per capita	0.0082	0.0141	40,159	0	0.0028	0.0794
Ethnolinguistic frac.	0.6136	0.2220	40,159	0.0359	0.6484	0.9503
Land Suit. to Agriculture	3.9427	1.2989	40,159	1.9469	3.5788	8
Rainfall anomaly	98.6260	2.6743	40,159	86.9873	100	100
Ruggedness	0.6270	0.6604	40,159	0.0398	0.3598	3.190

Notes. The table reports the summary statistics for the variables in the Afrobarometer.

A.3.B Witchcraft Beliefs: Probit Estimates

Table A.3: Historical Pastoralism and Contemporary Witchcraft Beliefs: Probit Estimates

	Contemporary Witchcraft Beliefs				
	(1)	(2)	(3)	(4)	(5)
Pastoralism	-0.1198***	-0.1968***	-0.1783***	-0.1728***	-0.1450***
	[0.0383]	[0.0514]	[0.0459]	[0.0473]	[0.0390]
N	18,201	17,136	16,673	16,673	16,383
Country Fixed Effects	Yes	Yes	Yes	Yes	No
Region Fixed Effects	No	No	No	No	Yes
Historical controls	No	Yes	Yes	Yes	Yes
Individual controls	No	No	Yes	Yes	Yes
Regional controls	No	No	No	Yes	No

Notes. OLS estimates in all columns. Standard errors shown in parentheses are clustered at ethnic level. For details on the controls see table 1. (***$p \leq 0.01$, **$p \leq 0.05$, *$p \leq 0.1$)

A.3.C Witchcraft Beliefs: Estimates based only on the first question of Pew Survey

Table A.4: Witchcraft Beliefs: Estimates based only on the first question of Pew Survey

	Contemporary Witchcraft Beliefs				
	(1)	(2)	(3)	(4)	(5)
Pastoralism	-0.0422***	-0.0678***	-0.0600***	-0.0564***	-0.0454***
	[0.0105]	[0.0199]	[0.0182]	[0.0181]	[0.0119]
N	19,265	18,137	17,589	17,589	17,587
R-squared	0.1922	0.1970	0.2184	0.2226	0.2811
Country Fixed Effects	Yes	Yes	Yes	Yes	No
Region Fixed Effects	No	No	No	No	Yes
Historical controls	No	Yes	Yes	Yes	Yes
Individual controls	No	No	Yes	Yes	Yes
Regional controls	No	No	No	Yes	No

Notes. OLS estimates in all columns. Standard errors shown in parentheses are clustered at ethnic level. For details on the controls see table 1. (***$p \leq 0.01$, **$p \leq 0.05$, *$p \leq 0.1$)

A.3.D Two-way Clustering

Table A.5: Two way clustered: Historical Pastoralism and Contemporary Witchcraft Beliefs

	Contemporary Witchcraft Beliefs				
	(1)	(2)	(3)	(4)	(5)
Pastoralism	-0.0396***	-0.0646***	-0.0591***	-0.0577***	-0.0446***
	[0.0114]	[0.0152]	[0.0130]	[0.0130]	[0.0125]
N	18,201	17,136	16,673	16,673	16,671
R-squared	0.1530	0.1585	0.1806	0.1826	0.2374
Ethnic clusters	247	236	234	234	234
Regional clusters	171	171	171	171	169
Country Fixed Effects	Yes	Yes	Yes	Yes	No
Region Fixed Effects	No	No	No	No	Yes
Historical controls	No	Yes	Yes	Yes	Yes
Individual controls	No	No	Yes	Yes	Yes
Regional controls	No	No	No	Yes	No

Notes. OLS estimates in all columns. Standard errors shown in parentheses are clustered at ethnic and regional levels. For details on the controls see table 1. (***$p \leq 0.01$, **$p \leq 0.05$, *$p \leq 0.1$)

A.3.E Robustness to Spatial Diffusion

Table A.6: Robustness to Spatial Diffusion

	Contemporary Witchcraft Beliefs				
	(1)	(2)	(3)	(4)	(5)
Pastoralism	-0.0600***	-0.0604***	-0.0611***	-0.0545***	-0.0564***
	[0.0161]	[0.0157]	[0.0159]	[0.0154]	[0.0152]
Distance to 600 AD Trade Routes [std.]		-0.0081			-0.0065
		[0.0236]			[0.0434]
Distance to 1800 AD Trade Routes [std.]		-0.0105			0.0013
		[0.0168]			[0.0202]
Distance to Ottoman Empire [std.]			0.1022		0.0463
			[0.0658]		[0.0919]
Distance to Islamic Empire [std.]			-0.1089*		-0.0652
			[0.0596]		[0.1026]
Distance to Addis Ababa [std.]			0.0894		0.0821
			[0.0812]		[0.0807]
European explorers				0.0241	0.0233
				[0.0172]	[0.0168]
Colonial railways				0.0237	0.0199
				[0.0223]	[0.0219]
Ethnic Density of missionary stations among ethnic group [std.]				0.0057	0.0068
				[0.0061]	[0.0063]
Distance to the Coast [std.]				-0.0361***	-0.0336*
				[0.0137]	[0.0174]
N	16,673	16,673	16,673	16,673	16,673
R-squared	0.1819	0.1820	0.1826	0.1834	0.1838
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes
Baseline Controls	Yes	Yes	Yes	Yes	Yes

Notes. OLS estimates in all columns. Standard errors shown in parentheses are clustered at ethnic and regional levels. For details on the controls see table 1. (***$p \leq 0.01$, **$p \leq 0.05$, *$p \leq 0.1$)

Table A.7: Oster (2019): Assessing unobservables selection and Coefficient Stability

	Values of R_{max} =				
	$1.1 \times \bar{R}$	$1.15 \times \bar{R}$	$1.2 \times \bar{R}$	$1.25 \times \bar{R}$	$1.3 \times \bar{R}$
	(1)	(2)	(3)	(4)	(5)
Oster's Estimated δ for $\beta = 0$	3.029	2.077	1.580	1.275	1.069

Notes. This table present results from Oster (2019) analysis of unobservable selection bias. Here, δ measures the degree of proportionality between selection in observables and unobservables variables. In columns (1) to (5) we present results of the estimated necessary value of δ for which the effect of the historical dependence on pastoralism in Contemporary Witchcraft Beliefs (β) would be equal to zero. For instance, if $\delta = -1.5$, the bias on unobservables should be on the opposite direction and 50% stronger than the bias on observables to explain away baseline results. Each column assumes a different value of R_{max}, where R_{max} is the R-squared of a regression that would include all relevant unobservable variables. We follow Oster (2019) and set R_{max} as proportions of the R-squared of baseline estimates $\bar{R}$. All results where estimated using Stata *psacalc* command, and conditional on the country fixed effects and ethnic controls.

A.3.F Alternative Potential Explanations

Table A.8: Alternative Potential Explanations: Contemporary effect on Witch Beliefs controlling for Atlantic Slave Trade, Plow Use and Jurisdictional Hierarchy

	Contemporary Witch Beliefs			
	(1)	(2)	(3)	(4)
Pastoralism	-0.0591***	-0.0648***	-0.0675***	-0.0577***
	[0.0166]	[0.0172]	[0.0168]	[0.0160]
Atlantic Slave Trade [Std.]	0.0240*			0.0248*
	[0.0142]			[0.0139]
Plow Use Indicator		0.1188**		0.1243**
		[0.0591]		[0.0594]
Jurisdictional Hierarchy				
One level			-0.0187	-0.0245
			[0.0198]	[0.0202]
Two levels			0.0005	-0.0026
			[0.0176]	[0.0186]
Three levels			0.0098	0.0083
			[0.0356]	[0.0314]
N	16,960	16,960	16,673	16,673
R-squared	0.1796	0.1795	0.1812	0.1826
Country Fixed Effects	Yes	Yes	Yes	Yes
Baseline Controls	Yes	Yes	Yes	Yes

Notes. OLS estimates in all columns. Based on Pew Survey data. All specifications include country fixed effects and the full set of individual, historical, and regional controls, except the Atlantic slave trade, Historical Plow Use Indicator, and the jurisdictional hierarchy introduced in the table. For details in the controls see Table 1. (***$p \leq 0.01$, **$p \leq 0.05$, *$p \leq 0.1$)

A.4 Differences between movers and non-movers

Table A.9: Differences between movers and non-movers

	Mover indicator variable	
Dependent variables:	Coefficient	Standard error
Witch Measure:		
Witch Beliefs	0.0240	[0.0153]
Pastoralism measures:		
Ethnicity-based Dep. on Past. measure (Baseline measure) [Std.]	0.0091	[0.0952]
Location-based Dep. on Past. measure [Std.]	0.0458	[0.0551]
Ethnicity-based Land. Suit. to Past. measure [Std.]	0.0827	[0.0697]
Location-based Land. Suit. to Past. measure [Std.]	-0.0097	[0.0178]
Control variables:		
Currently living in an urban city indicator	0.1655	[0.0293]***
Ethnic fractionalization in current region	0.0389	[0.0196]**
Share of ethnic group in current region	-0.2989	[0.0345]***
Some secondary school education or higher indicator	0.0567	[0.0146]***
Age	-0.5795	[0.2875]**
Male indicator	0.0121	[0.0091]
Ethnicity based slave export measure [Std.]	-0.0083	[0.0586]
Ethnicity-based Density of missionary stations among the ethnic group [Std.]	0.0312	[0.0344]

*Notes.*The table reports the within-country difference in means between movers and non-movers in the sample. A mover is defined as a person who lives in a location today that is different from where their ethnic group lived in the 19th century. Non-movers are those living in the same location. OLS estimates in all columns. Standard errors shown in parentheses are clustered at ethnic level. (***$p \leq 0.01$, **$p \leq 0.05$, *$p \leq 0.1$)