# Ethnic Roots of Risk Attitudes: The Impact of Ancestral Lifestyles on Risk Taking Behaviour*

Angelina Nazarova†

Working paper

**Abstract**

This paper studies the role of ancestry in shaping risk attitudes and risky behaviour. I examine two spatially and culturally distant lifestyles: nomadic and sedentary. Using historical ethnographic atlases combined with modern data on risk behaviour, I exploit a novel instrument specification - initial biogeographic conditions. I find that having nomadic ancestry increases the willingness to take risks and prompts riskier health behaviour, such as smoking and neglecting contraception. Looking at different specifications and including a wide range of controls, this study shows that ancestral lifestyles partially explain within-country risk heterogeneity.
**JEL classification**: Z13, N30, O12, D81
**Keywords**:nomadism; risk attitudes; risk behaviour; persistence

*I would like to thank Paolo Masella, Eoin McGuirk, Enrico Spolaore for their invaluable feedback. My special gratitude goes to Gani Aldashev, Anke Becker, Enrico Cantoni, Matteo Cervellati, Kyle Emerick, Margherita Fort, Paola Gobbi, Cynthia Kinnan, Sara Lazzaroni, Alexander Lehner, Chiara Monfardini, Elias Papadopoulos, Giovanni Prarolo, Fabio Schiantarelli, Vincenzo Scrutinio, Alessandro Sforza, Tommasso Sonno and all the participants of EEA Congress, 1st Economic History Workshop, 10th Workshop on Economics of Risky Behaviour, EDEEM Doctoral Summer Workshop in Economics, 1st Summer School on Spatial Statistics & Econometrics, Applied Young Economist Webinar, research seminars at the University of Bologna, Tufts, ECARES, Institute of Advanced Studies and Centro Studi Luca d'Agliano for their useful comments and suggestions.
I would also like to thank the Department of Economics at the University of Bologna and the Institute of Advanced Studies for the grants awarded to me, which supported this project.
†Institute for Social and Economic Research, University of Essex, MiSoC, EEA, SIdE. E-mail: an21010@essex.ac.uk.

> "Tell me, Muse, of the man of many ways, who was driven far journeys..."
>
> *Homer*

# 1 Introduction

Risk and uncertainty are cornerstones of many crucial economic decisions. The growing amount of literature emphasized the importance of individual risk attitudes in understanding economic behaviour, from savings and investment to schooling, employment, and gender norms (Guiso and Paiella, 2005; Benjamin et al., 2010; Dohmen et al., 2010; Sutter et al., 2015; Becker et al., 2018). One of the most puzzling questions concerns the roots of modern heterogeneity in risk attitudes. Recent evidence has shown that the large variation exists not only within individual characteristics but also across countries. The main source of this cross-country divergence is focused on the environment and exposure to conflicts (Gächter and Schulz, 2016; Voors et al., 2012; Galor and Savitskiy, 2018). Yet, culture is one of the important candidates for explaining a country's heterogeneity across various dimensions. Therefore, this paper questions whether risk aversion could also be rooted in cultural traits. By bringing together the comparative development studies uncovering the importance of historical events and the persistence of culture (Alesina et al., 2013; Spolaore and Wacziarg, 2016; Michalopoulos et al., 2018; Giuliano and Nunn, 2017), this study shows that heterogeneity in risk attitudes can be traced to the ethnic origins and be partially explained by ancestral way of living.

During the course of human history, people were always in motion. We may consider ourselves a migratory species since our ancestors have been constantly moving at the dawn of human civilization. Some of them kept doing so even after settled life became more appealing for development and growth. Nomadic people were carriers of civilizations in the Old World for thousands years. They have always been a distinctive form of living. However, nomads were not always perceived as such. It is been only in the last few decades that nomads have been viewed not only as a separate societal phenomenon but as a fascinating form of human lifestyle (Cashdan, 1990; Leder and Streck, 2005). The importance of nomadism is now seen in a new light. This paper gets inspiration from the ethnographic literature and transmits that knowledge to the realm of economics in order to explain the ethnic component in risk attitudes.

Along a wide stretch of history, nomads, who were not necessarily small in groups, created their own peculiar form of lifestyle characterized by a great variety. One may instantly think of the pastoral groups, however, other forms of nomadic lifestyle do exist and include military nomads, hunter-gatherers, tinkers, and traders. All of them have the most crucial feature in common - mobility. This is the most efficient strategy applied by nomads to generate the highest possible returns while exploiting resources at the highest variance of risk. Thus, any nomad can be described as a member of a community without fixed habitation, which moves from place to place (Leder and Streck, 2005). This mobility has shaped nomadic living norms and created spatial and cultural distance to the settled ”sedentary” communities.

The notion of sedentarism and its role in the process of urbanization has been explored in the comparative development economic literature. Yet, little attention was given to nomadism, despite the large spread of nomadic populations. The last official figures estimate that there are 120 million nomadic groups worldwide (Rass, 2006). Evidence from anthropological literature emphasizes the advantage of the nomadic lifestyle, which allows one to take risks in order to generate the highest returns. In particular, nomadic pastoralists seek reliability in highly risky environments: they accept the variability of productive inputs and modify their herding/social systems appropriately. Moreover, nomads do not strive for stability, they capitalize on periodic good fortune and invest in social capital. In general, nomadic groups turn instability (high variance of risk) into an asset and perceive uncertainty as an opportunity to get higher returns (Cashdan, 1990; Galaty and Bonte, 1991; Chang and Koster, 1994; Bollig and Göbel, 1997; Kraetli et al., 2013; Shaughnessy, 2018).

The key observation in this paper is that nomadic lifestyle has an impact on risk preferences. Exploiting resources at a high variance of risk in order to generate the greatest returns associates with a higher willingness to take risks and creates long-standing differences with settled communities. Mobility is associated with changing landscapes, fast adaptation, and constant acquisition of new information, which makes risky behaviour appealing and self-sustaining. Mobile lifestyle shapes particular traits and behaviour among nomads. Attitude toward risk is part of those traits (Cashdan, 1990; Becker, 2019).

This paper, hence, tests the hypothesis that descendants of nomads are more willing to take risks and practice risky health behaviour. It evaluates whether our ancestry has an impact on risk attitudes nowadays. For this purpose, I link contemporary individual-level data on various proxies for risk attitudes to a historical ethnicity-level measure of nomadism. In a broad set of within-country analyses, I find that people who descend from the ethnic groups that historically practiced nomadism (i) are more willing to take risks, (ii) value security less, and (iii) have riskier health behaviour.

The data on historical lifestyle are based on information from Murdock’s Ethnographic Atlas (Murdock, 1967) and complimented by World Ethnographic Sample, and Standard Cross-Cultural Sample (Murdock and White, 1969). These data are based either on early written history or first accounts from the earliest (European) observers of these cultures prior to the industrialization of those societies. It makes the database the earliest available information covering a wide range of ethnic groups worldwide. There are 1309 ethnicities, each classified as nomadic or sedentary based on their lifestyle. Furthermore, the contemporary data on risk attitudes stem from two sources - the World Value Surveys and the Standard Demographic and Health Surveys (DHS). Both contain the information on respondents' ethnicity. Based on this, my empirical analysis manually links individuals' responses to their ethnic group's lifestyle from ethnographic data. This procedure generates substantial within-country variation. I cover 80 countries for risk preferences and 42 countries for risk health behaviour. Concerning the empirical strategy, it rests on two pillars. First, throughout the analysis, I compare individuals from different ethnic groups who live in the same country today, thereby holding constant the institutional environment and other factors that vary at the country level. In the same spirit, the analysis accounts for a large set of individual-level observables, ethnic-group-level characteristics and geographical controls. Second, nomadism is correlated with biodiversity. The domestication of animals that were able to travel long distances and carry loads determined the adoption of a nomadic lifestyle. The closer the ethnic group was to the domestication point, the higher the chance of it becoming nomadic. This distance is plausibly exogenous to the risk attitudes. As described in greater detail below, the distance towards the origins of domestication facilitates an instrumental variable approach.

The analysis shows that in a sample of about 45000 people from 80 countries worldwide, ancestral nomadic lifestyle affects willingness to take risks today. Coming from a nomadic background increases the willingness to take risks by 7 percentage points. Next, the analysis shows that in a sample of about 500000 people from 42 countries, the nomadic background is associated with riskier health behaviour. In particular, people with nomadic ancestry are by nearly 4 percentage points more likely to smoke regularly, by 8.7 percentage points less likely to have health insurance, and by 1.4 percentage points less likely to use contraception. These effects are quantitatively meaningful and account for region-time fixed effects. Moreover, these results are robust across a wide range of specifications that account for (i) individual-level observables such as age, religious denomination, urban residence, educational attainment, or marital status and (ii) historical ethnic group level characteristics such as plough use, subsistence, kinship structure, or the jurisdictional hierarchy and (iii) geographical characteristics, such as temperature, humidity, elevation, distance to the coast and distance to the equator. Next, I restrict the sample to movers only, people who currently live outside their ethnic homeland. The results stay fairly unchanged in terms of the direction and magnitude of the effect. To further support a causal interpretation of these results, I turn to an instrumental variable approach, which exploits the fact that nomadism was partially defined by the availability of animals that could be used for long-distance travel. Based on the data from genetic biology literature, I identify the points of first domestication and use the distance to the ethnic group's homeland as an instrument for the ethnic group's ancestral lifestyle. The resulting IV estimates are consistent with their OLS counterparts in terms of the coefficient's sign and statistical significance but tend to be larger in terms of the effect size.

Relating this work to the literature, this paper adds to the research on the origins of heterogeneity in risk attitudes, such as environment or conflicts (Voors et al., 2012; Gächter and Schulz, 2016). It also relates to the literature on cultural persistence, historical events and current economic outcomes (Spolaore and Wacziarg, 2009, 2013, 2016; Giuliano and Nunn, 2017; Xue, 2019). In particular, the contribution of this paper is (i) providing the first analysis on the ethnic origins of risk attitudes; (ii) focusing on within-country variation; (iii) analyzing the effect of nomadic lifestyle from the perspective of economics; (iv) introducing the novel instrumental approach. The paper thereby provides empirical evidence that ancestral experiences play a great role in defining our behaviour nowadays.

The rest of this paper is structured as follows. Section 2 shows the related literature on the origins of risk attitudes and the persistence of culture and history. In Section 3, I motivate the expected relationship between ancestry and modern risk attitudes. In Section 4 I discuss the data I used and the empirical strategy. Section 5 presents the results. Section 6 brings additional within-country evidence. Section 7 provides the concluding remarks. Section 1.8 is a bibliography. An appendix can be found in Section 8.

## 2 Literature Review

Evidence from ethnographic literature pointed out several crucial characteristics that nomadic life brings to people (Cashdan, 1990; Galaty and Bonte, 1991; Bollig and Göbel, 1997; Fratkin, 1997). Generally speaking, nomads are able to manage risks more successfully than sedentary counterparts under the same circumstances, since they turn instability into an asset and uncertainty of constant moving is seen as opportunity. For instance, according to Steinfeld et al. (2010); Kraetli et al. (2013), mobility is a production-boosting strategy, pulled by relative abundance rather than pushed by scarcity. Nomads exploit risky conditions to generate the highest returns, their perception of risk is lower compared to their sedentary counterparts. These studies are mainly focused on observing single tribes and communities in different regions of the world. This paper is bringing these findings in the realm of economics.

Risk preferences have long been known to be too complex to be described by a single parameter (Vickrey, 1945; Friedman and Savage, 1948). A broad range of economic literature shed light on the determinants of individual risk attitudes including wealth, income, age, gender, religion and nationality (Weber et al., 1998; Guiso and Paiella, 2005; Brown, 2007; Benjamin et al., 2010; Dohmen et al., 2010, 2017). This research went beyond individual determinants of risk preferences in its attempt to explain cross-country heterogeneity (Dohmen et al., 2012; Becker, 2019; Galor and Savitskiy, 2018). The main source of this divergence is focused on environmental characteristics and exposure to conflicts. Adverse weather conditions, war and conflicts are among the main candidates to explain country-level divergence in risk (Gächter and Schulz, 2016; Voors et al., 2012; Galor and Savitskiy, 2018). Yet, the roots of such heterogeneity are to be fully uncovered.

One possible explanation can be found in different historical experiences that have been accumulated over time and caused divergence in risk attitudes (Becker et al., 2020). Similar to the way historical factors have been shaping distinctive cultural norms, historical lifestyle may shape risk behaviour nowadays (Alesina et al., 2013; Giuliano and Nunn, 2017; Michalopoulos et al., 2018). Taken together, the debate regarding the origins of risk attitudes is ongoing and not fully explored. It suggests that there is a relationship between temporally distant events, persistent cultural characteristics and economic determinants. This paper attempts to provide insight into how our ancestry shapes risk behaviour by building on the literature on cultural persistence and transmission of risk attitudes.

Numerous studies emphasized the important role of culture and its persistence over generations. Guiso et al. (2006) was one of the pioneers in defining culture and its influence on economic outcomes. Spolaore and Wacziarg (2009, 2013) uncovered a strong correlation between genetic distance and income differences across countries. They showed that a lower genetic distance between two countries brings the diffusion of knowledge and technology leading to development. Starting from the early 2010s literature on the historical persistence of traits and preferences evolved widely. Among others, two prominent studies were conducted by Nunn and Wantchekon (2011) and by Voigtländer and Voth (2012). The first focused on the origins of mistrust in Africa while analyzing the slave trade patterns. They found that less trust today is the consequence for those groups whose ancestors were heavily raided in the time when the slave trade emerged and developed mistrust of everyone who was not from their respective group. The second one showed that the rise of anti-semitic violence in Nazi Germany had medieval origins. Precisely, plague-era pogroms were strongly associated with violence that occurred in the 1920s, votes for the Nazi Party, deportations and attacks on synagogues. Both brought evidence of the important role of individual ethnicity in shaping people's behaviour. Another study by Michalopoulos et al. (2018) focused directly on the effect of historical ancestral lifeways on the attained level of education and wealth among the descendants in Africa. Controlling for pre-colonial characteristics, attitudes towards violence and institutional changes, they showed that individuals, whose ancestors derived a larger share of subsistence from agriculture, are more educated and wealthy today. Emphasizing the important role of agriculture in the life of our ancestors, it is crucial to mention the work by Alesina et al. (2013). Their evidence of cultural persistence and evolution of individual beliefs was based on the origins of gender roles in modern societies. Shifting cultivation is labour-intensive and uses handheld tools, in particular, plough cultivation requires considerable strength involved in the process. Thus, practising plough agriculture caused males to work in the fields while females were specializing in home-related activities. With time this division of labour generated the belief that the natural place of a female is at home. These cultural views persisted and nowadays they influence entrepreneurship, labour market participation and political activity among females. In a similar way, analyzing cultural persistence, but exploiting ancestral living conditions, Giuliano and Nunn (2017) showed that adopting traditions of the previous generation is advantageous only in stable environments. When the environment is changing, the cultural heritage of the previous generation does not bring valuable information which would be relevant in the current living conditions. They controlled for environmental stability by measuring the average temperature fluctuations across 20 years of generations from 500-1900. Applying an epidemiological approach across countries and ethnic groups, they found that groups with ancestors who lived in fairly stable environments put a higher importance on keeping traditions nowadays. Also, these groups preserve their traditions with a higher degree of persistence over time.

This paper supports the presented evidence on how ancestral beliefs are persistent and shaping our culture nowadays, but proposes to apply this way of thinking to risk attitudes.

Turning to the risk preferences, the literature grew in various dimensions. I will solely focus on the couple of papers uncovering risk heterogeneity and its transmission over generations. A prominent study on risk perception across states was done by Becker et al. (2020). They studied the worldwide distribution of risk preferences and found that ancestral migration patterns (proxied by human genetic variation) bear a strong association with the between-country heterogeneity in risk. Both actual and predicted population genetic distance explain the observed heterogeneity suggesting that the specific ways in which mankind migrated out of Africa thousands of years ago have left a footprint in the contemporary cross-country distribution of economic traits. Galor and Özak (2016) found that agro-climatic conditions before the Industrial Revolution have an impact on the orientation towards the future in the present days. Grosjean (2014) showed that in the areas where herders were settled during colonial times, the number of homicides is significantly higher nowadays. It can be explained by the reputation among herders to have a higher degree of violence in response to the theft contrary to farmers. More importantly, works by Cesarini et al. (2009); Dohmen et al. (2012) showed that attitudes of people, including risk aversion, are transmitted across generations and that part of transmission is genetic in nature. Moreover, recent literature points out that economic preferences, including risk preferences, are malleable by idiosyncratic experiences and by the composition of people's environment (Voors et al., 2012; Kosse et al., 2016; Alan and Ertac, 2018; Rao, 2018). Therefore, the differential historical experiences which have been acquired over generations and years might have given rise to various risk and time preferences as of today.

A key question is how risk attitudes perpetuate over time. In particular, Dohmen et al. (2011) shed light on where risk attitudes come from and found similarities in behaviour across generations, but differences across ethnic groups and countries. This paper showed how intergenerational transmission of risk attitudes from parents to children is an important channel of influence.

For instance, they observed that children end up with the same outcomes as their parents partially because they inherit the same attitudes and follow the same behaviour to make similar decisions in life. Similarly, based on a cross-country survey, Fehr et al. (2006) demonstrated that the sizeable difference between the average willingness to take risks in the USA and in Germany (5.6 versus 4.4 respectively, on a scale from 0 to 10) could be explained by the difference in immigrants' behaviour. In particular, US immigrants are more willing to take risks than people in their country of origin.

Overall, intergenerational transmission helps explain the persistence of heterogeneity in risk attitudes over time which in turn explains a variety of well-documented differences in risk behaviour across countries.

Bringing together the importance of ancestry and transmittable risk attitudes, this paper contributes to the different strands of economic literature by explaining the fraction of within-country group-level variation in risk through its ethnic origins. It emphasizes the role of nomadism in the formation of a lower degree of risk aversion and it brings evidence that heterogeneity in risk attitudes nowadays can be partially explained by ancestral lifestyle.

# 3 Theoretical Framework

This section proposes an evolutionary explanation for the origin of risk aversion for nomadic and sedentary types of populations. It shows how risk aversion evolves due to the difference in the type of risk, that individuals belonging to a certain group are facing. Nomads are constantly moving, and known for their fast adaptation and continuous update of knowledge (Kraetli et al., 2013; Shaughnessy, 2018). For them, idiosyncratic risks hide the danger to their survival and transmission of traits to their descendants. On the contrary, sedentary people learn how to cope with old age sickness and other forms of idiosyncratic shocks better given the advantages that their lifestyle presents them. However, they are more vulnerable to aggregate shocks such as flood, war and others which threaten their survival and their non-movable assets. I exploit this difference in the types of risk associated with both lifestyles and evaluate how the evolutionary perspective of transmission of traits may lead to heterogeneity in risk behaviour. Following Robson and Samuelson (2010); Zhang et al. (2014), I present here a simple model of how risk traits were propagating through generations and how this divergence may be explained by the difference in ancestral lifestyles.

Assume that individuals live for one period, have asexual random reproduction and die. During his/her life individual $i$ has only one decision to make: choose one of two possible actions $A1$ and $A2$. This decision results in one of two respective random quantities of offspring $q_{A1,i}$

and $q_{A2,i}$. So reproductive success of an individual is a weighted sum, where

$$\begin{cases} q_{A1,i} = \delta z_{A1} + (1-\delta) y_{A1,i} \\ q_{A2,i} = \delta z_{A2} + (1-\delta) y_{A2,i} \end{cases}$$

where ($z_{A1}$,$z_{A2}$) is assumed to be i.i.d over time and for all individuals in a given generation, hence, it represents systematic (or aggregate) risk. In other words, one person experiences the same outcome as others who chose the same action. Similarly, ($y_{A1,i}$,$y_{A2,i}$) is assumed to be i.i.d both over time and across person $i$ in a given generation, hence, it represents idiosyncratic risk. Both components are described by some well-behaved probability distributions and $\delta$ is a real number between zero and one representing the share of each type of risk.
Every person chooses $A1$ with some probability $p \in [0,1]$ and $A2$ with probability $1-p$. In this specification $p$ determines the way person chooses between $A1$ and $A2$, so $p$ is an individual behavior. Additionally, individual $i$ of type $p$ produces random quantity $q_i^p$ of offspring. Hence, $q_i^p = I_i^p q_{A1,i} + (1-I_i^p) q_{A2,i}$ where $I_i^p$ is the Bernoulli random variable that equals 1 with probability $p$ and $0$ otherwise. Offspring behaves in the same manner as parents. Therefore, the population could be segmented to types $p$. This assumption demonstrates perfect genetic transmission of traits including risk attitudes from one generation to the next. Another assumption is that initial population contains an equal number of all types, so it is normalized to 1 for each type without loss of generality. Lets rewrite $q_i^p$ as a combination of systematic and idiosyncratic risks:

$$q_i^p = \delta z_i^p + (1-\delta) y_i^p,$$

where

$$\begin{cases} z^{p_i} = I_i^p z_{A1} + (1-I_i^p) z_{A2} \\ y_i^p = I_i^p y_{A1,i} + (1-I_i^p) y_{A2,i} \end{cases} \tag{1}$$

The coefficient $\delta \in [0,1]$ shows the proportion of systematic risk in the environment. When $\delta = 1$, all risk is systematic, when $\delta = 0$, all risk is idiosyncratic, and when $0 < \delta < 1$, both risks are there. In the environment described by $\delta$, the total number of offspring of type $p$ in generation $G$ is denoted by $g_G^p$. The average of the log population $G^{-1} log(g_G^p)$ converges in probability to the log geometric average growth rate[1]:

$$\gamma_\delta(p) = \mathbb{E}_z[log(\delta z^p + (1-\delta)\mathbb{E}_y[y^p])], \tag{2}$$

[1]The proof of this equation is given in the Appendix Section 1.9.2

where $\mathbb{E}_z$ denotes the expectation taken with respect to $z^p$ and $\mathbb{E}_y$ is expectation with respect to $y^p$. Let's rewrite the previous equation as follows:

$$\gamma_\delta(p) = \mathbb{E}_z[log(p\phi^\delta_{A1} + (1-p)\phi^\delta_{A2})] \tag{3}$$

where

$$\begin{cases} \phi^\delta_{A1} = \delta z_{A1} + (1-\delta)\mathbb{E}_y[y_{A1}] \\ \phi^\delta_{A2} = \delta z_{A2} + (1-\delta)\mathbb{E}_y[y_{A2}] \end{cases} \tag{4}$$

Maximizing equation (2):

$$p^*_\delta = \begin{cases} 1 \text{ if } \mathbb{E}_z[\phi^\delta_{A1}/\phi^\delta_{A2}] > 1 \text{ and } \mathrm{E}\mathbb{E}_z[\phi^\delta_{A2}/\phi^\delta_{A1}] < 1 \\ 0 = \mathbb{E}_z[\frac{\phi^\delta_{A1} - \phi^\delta_{A2}}{p\phi^\delta_{A1} + (1-p)\phi^\delta_{A2}}] \text{ if } \mathbb{E}_z[\phi^\delta_{A1}/\phi^\delta_{A2}] \geq 1 \text{ and } \mathbb{E}_z[\phi^\delta_{A2}/\phi^\delta_{A1}] \leq 1 \\ 0 \text{ if } \mathbb{E}_z[\phi^\delta_{A1}/\phi^\delta_{A2}] < 1 \text{ and } \mathbb{E}_z[\phi^\delta_{A2}/\phi^\delta_{A1}] > 1 \end{cases} \tag{5}$$

If population consists of people facing different risks, some are exposed to idiosyncratic risk, some - to systematic, some - mix of both.

The lifestyle of the group of individuals determines the proportion of the certain type of risk to occur. I model the extreme cases for nomadic and sedentary lifestyles. I refer to the categorization of risks for population adopted from World Development Report (2000) in the table below.

| Type of risk | Idiosyncratic Risk | Systematic Risk |
|---|---|---|
| Natural | | Rainfall, flood, drought |
| Health | Illness, injury, disability, old age, death | Pandemic |
| Social | Crime, domestic violence | War, social uprising |
| Economic | | Unemployment, epidemic |
| Political | | Riots, coup d'état |
| Environmental | | Pollution, deforestation, desertification |

Table 1: Categorization of risks: from World Development Report (2000)

From this table, I differentiate two types of risk which are best related to a particular lifestyle supported by Cashdan (1990), Kraetli et al (2013), Shaughnessy (2018). In particular, nomadic tribes are mainly exposed to the idiosyncratic type of risk, since if the person gets sick or disabled, it has a much stronger effect on the well-being of the group given continuous movement and its small size. If the aggregate shock occurs, nomads can change their location and leave the troublesome zone. The contrary could be observed for sedentary counterparts, where systematic shock hits harder taking away the opportunity to mitigate it by leaving the affected area. Idiosyncratic shock, otherwise, has less effect, since injuries and illnesses are treated better in stable environments.

Now let's assume that individual preferences are described by the objective function $V_\delta(z, y)$ with $z, y$ representing different types of risk (systematic and idiosyncratic, respectively). Let $(z_1, y_1)$ be preferred over $(z_2, y_2)$ if and only if $V_\delta(z_1, y_1) > V_\delta(z_2, y_2)$. In order to make a choice over random outcomes, a person maximizes $V_\delta(z, y)$. Let's model the perception of risk into the equations above. When $\delta = 1$, the person faces systematic risk. The evolutionary dominant behaviour $f^*$ is given by $f^* = argmax_f \mathbb{E}_z[log(z^f)]$, so maximization criterion is

$$V_{\delta=1}(z, y) = \mathbb{E}_z[log(z)] \tag{6}$$

When $\delta = 0$, the person faces idiosyncratic risk. The evolutionary dominant behaviour $f^*$ is given by $f^* = argmax_f log(\mathbb{E}_y[y^f])$, so maximization criterion is

$$V_{\delta=0}(z, y) = \mathbb{E}_y[y] \tag{7}$$

This function is expected linear utility. The optimal criteria for a person is the expected value, meaning that individuals are risk-neutral. The level of risk aversion is a function of systematic risk in the environment. Keeping the general case, $0 < \delta < 1$, risk contains both systematic and idiosyncratic components. The maximization will look like:

$$V_\delta(z, y) = \mathbb{E}_z[log(\delta z + (1 - \delta)\mathbb{E}_y[y])] \tag{8}$$

The idiosyncratic component is giving a rise to the linear expectation in $y$, and the systematic component is giving a rise to a logarithmic function of $z$ and the expectation in $y$. Risk aversion emerges as a consequence of systematic risk and risk neutrality or risk-seeking - as a result of idiosyncratic risk. As a result, people who are most threaten by systematic risk tend to be more risk averse than those who are vulnerable to idiosyncratic one. Implying that sedentary people tend to be more risk-averse in comparison to nomads.

# 4 Data and Empirical Strategy

## 4.1 Data

Ethnographic data on ancestral ethnicity comes from Murdock's Ethnographic Atlas (Murdock, 1967) and is complimented by World Ethnographic Sample, Standard Cross-Cultural Sample (Murdock and White, 1969)[2]. These data are based either on early written history or first accounts from the earliest (European) observers of these cultures prior to the industrialization of those societies. It makes the database the earliest available information covering a wide range

[2]see Appendix for more details

of ethnic groups worldwide. There are 1309 ethnicities, each classified as nomadic or sedentary based on their lifestyle. In addition, it contains ethnic group level information on subsistence, kinship organization, size of community, domestic organization, marital structure, religious beliefs, settlement patterns, political organizations, institutional complexity, class stratification, slavery, inheritance rules, rigidness of the society (openness and acceptance of foreigners) and is intended to reflect ancestral ways of living before colonization and industrialization, even when the exact timing of observation differs between ethnic groups. The constructed map below shows the location of centroids coming from the combined ethnographic dataset.

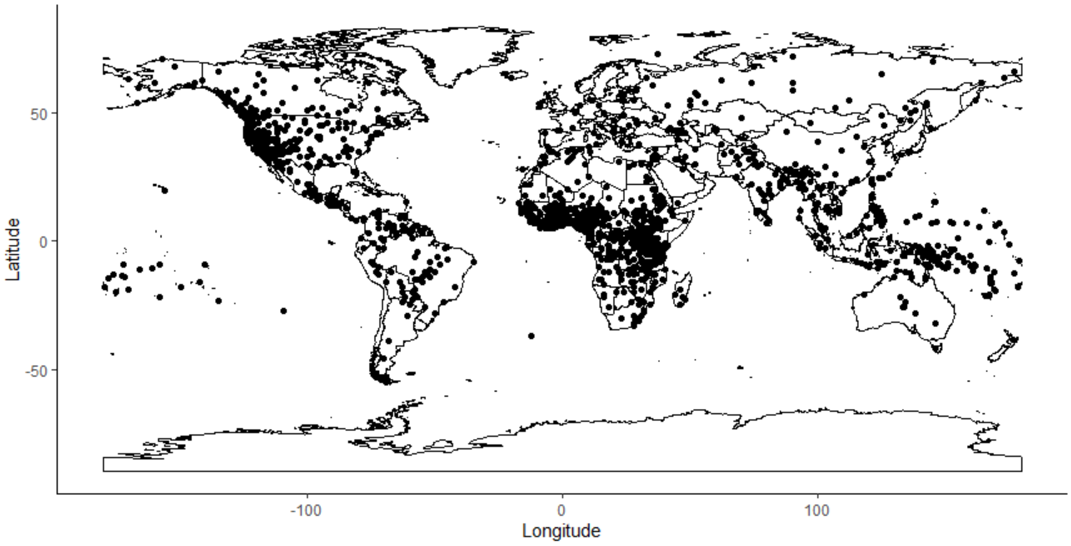



Figure 1: Location of centroids for each ethnicity from Ethnographic Atlas and Standard Cross-Cultural Sample

The validity of the Atlas was questioned by some anthropologists and historians (Leach, 1964; Jerven, 2011). The work by Bahrami-Rad et al. (2021) tests the concerns across a wide range of dimensions. They conclude that Atlas is a valid source of information about various human societies. Since the accounts captured in the Atlas are informative and considerably analogous to the self-reported records of the descendants of the portrayed societies.

I construct my main explanatory variable - ancestral lifestyle - by aggregating together the information on settlement patterns and lifestyle. I create a dummy variable (0;1) where 1 stands for Nomadic or fully migratory and 0 - for all other different layers of sedentary life. Sedentary complexity includes several types of settlements: compact, dispersed, partially dispersed, impermanent, and permanent settlements, each of different sizes. I aggregate them all together to account for a sedentary lifestyle. There are two additional levels: seminomadic and semisedentary, which I do not include in my main analysis, since I am solely focusing on the difference between nomadic and sedentary forms of living. Figure 2 shows the distribution of areas (yellow coloured) where people were practicing nomadism.

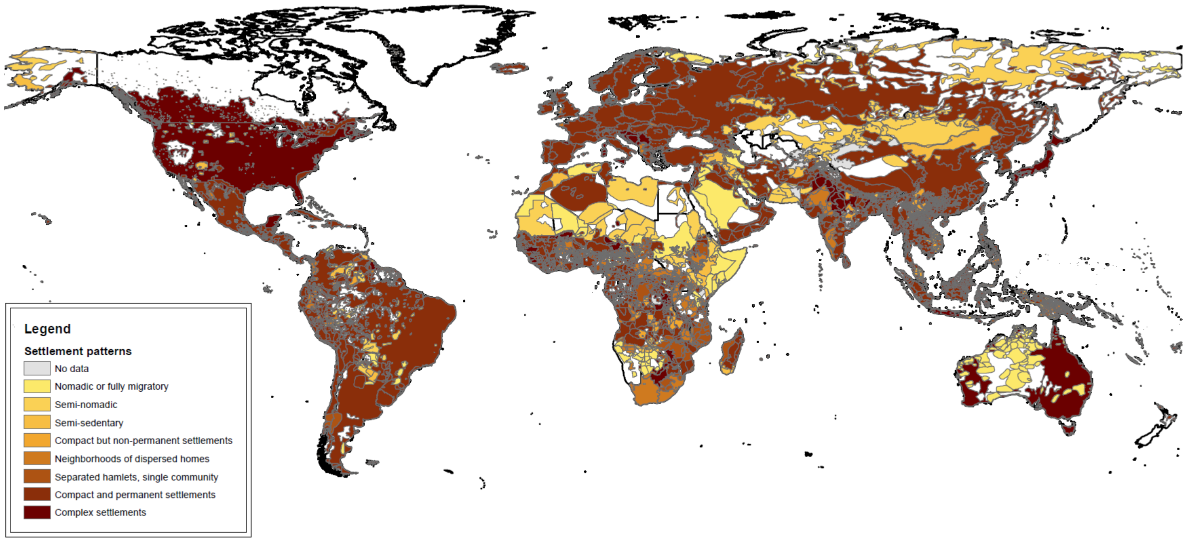



Figure 2: Distribution of nomadism: Murdock (1967); Gray (1999); Giuliano and Nunn (2017)

The contemporary individual-level data stem from the World Value Surveys (hereafter, WVS) and Demographic Health Surveys (hereafter, DHS). In order to measure risk preferences and risk behaviour I used different proxies. The proxies for willingness to take risks are taken from WVS and a set of proxies for risky health behaviour are taken from DHS. The World Values Survey (WVS) is a common questionnaire survey used to study the changing attitudes and values of individuals in almost 100 countries. It is a cross-national time series study that is conducted in waves, with each wave covering a span of five years. The WVS has conducted interviews with almost 400,000 respondents and covers a broad range of countries with very different wealth levels and cultural backgrounds.

The DHS surveys are nationally representative household surveys covering more than 90 countries worldwide. From 1984 until today, seven waves have been conducted. The country samples are quite large, with typically between 5,000 and 30,000 households being surveyed. The DHS elicits detailed household and respondent characteristics. It records not only standard socio-demographic variables but also, for example, information on housing quality, availability of electricity, literacy, access to clean water, sanitation, types of insurance, and location of households.

Importantly, for some countries and waves, both WVS and DHS contain information about respondents' ethnicity. This information allows me to match respondents in the DHS to their ancestors' ethnic groups in the ethnographic dataset.

In order to link this information about ancestral lifestyle to risk proxies for each individual I use a manual matching procedure. It involves manual correction of each ethnicity indicated in WVS and DHS datasets to directly match with the ethnographic data (refer to Figure 3).

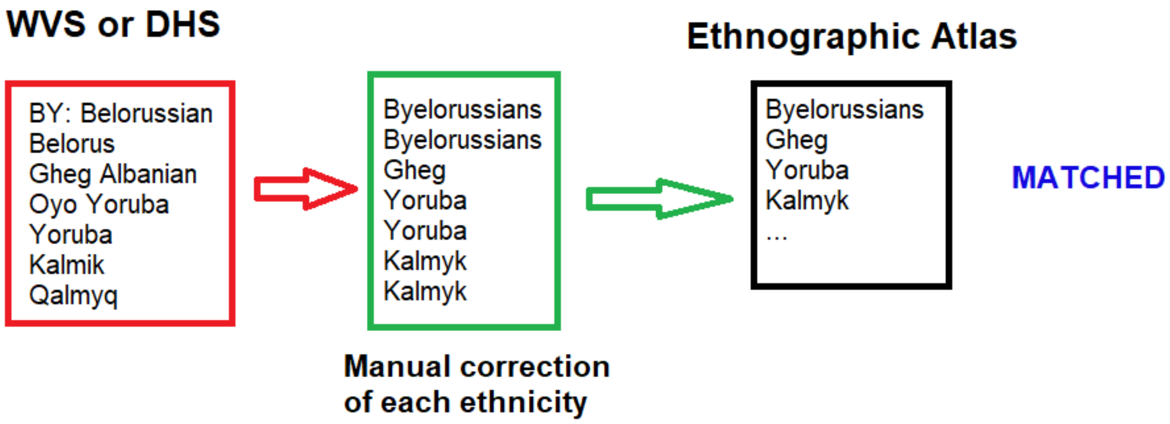
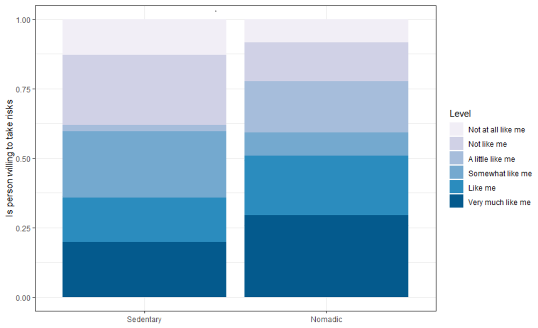



Figure 3: Matching procedure

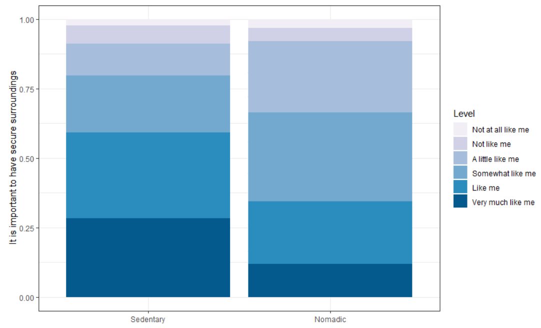
The list of ethnicities that each individual indicated in the WVS and DHS is manually processed and corrected in order to be matched with ethnographic data with the list of ancestral ethnicities. Some corrections are made based on information in those ethnographic sources, such as changing ethnic names over time, geographical location along with language spoken and some corrections based on the country where the respondent is living in.

In total, I match almost 60000 individuals representing 104 ethnicities and nearly 500000 individuals from 332 ethnicities, correspondingly. In particular, I cover 450 regions, 80 countries in WVS, and 403 regions, 42 countries in DHS over time 1981-2016. Risk preferences are measured by the following three variables: 1) TakingRisks: Whether it is important to this person to take risks (following Dohmen et al. (2011)); 2) JobSecurity: Important in a job: job security (a measure of loss aversion by Galor and Savitskiy (2018)); 3) FeelingSecure: It is important to this person living in secure surroundings. Subsequently, risk behaviour is proxied as follows: 1) Smoking habits: Are you smoking regularly?; 2) Contraception use: Are you using any contraceptive method?; 3) Health insurance: Do you have health insurance?.

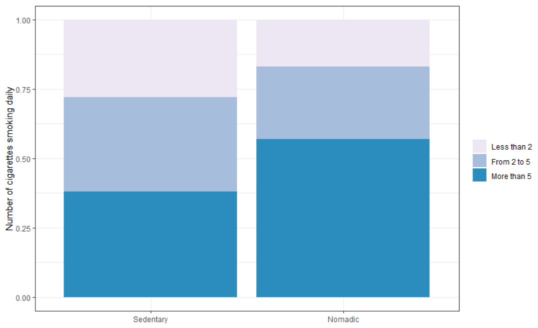
The main measure of willingness to take risks is at the Schwartz scale from 1 to 6, asking whether the person is willing to take risks and engage in adventures. The distribution across sedentary and nomadic groups can be observed in Figure 4(a). Standardizing this measure into dummy variables from 0 to 1 and applying for people from sedentary and nomadic ethnic groups, Figure 4(a) shows that people with nomadic backgrounds associate themselves more as risk takers in contrary to their sedentary counterparts.



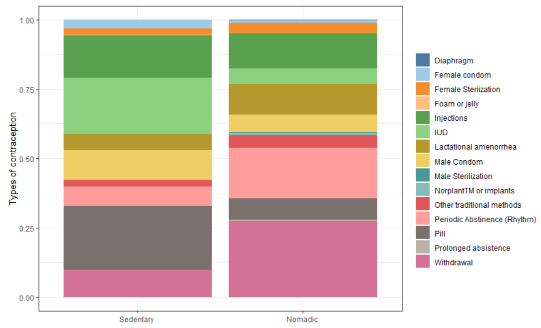

(a) Willingness to take risks




(b) Important to have secure surroundings




(c) The number of cigarettes smoked daily




(d) Types of contraception used

Figure 4: Proxies for risk attitudes and risky behaviour

Another measure of risk or loss aversion taken by Galor and Savitskiy (2018) is valuing job security more than any other job characteristics including salary, career opportunities, and working hours. It reflects people not being willing to take any risks and valuing security and stability above all. From Table 2 it can be seen that people from sedentary backgrounds are among those who prefer stability of job above other factors, which signals that these individuals do not want to take risks on a daily basis.

The third proxy for risk is whether the person values the security of surroundings, which is calculated according to the Schwartz scale from 1 to 6 (similar to the willingness to take risks). The allocation of preferences among the two groups can be seen in the Figure 4(b). Afterward, the measure is harmonized to (0;1) dummy for valuing security for each person. Individuals with nomadic backgrounds tend to put less importance on the security of the surroundings supporting the hypothesis that a nomadic lifestyle in the past is associated with risk-taking behaviour nowadays (refer to Table 2). In order to look into another dimension of risk, namely, risky lifestyle

| | Sedentary | Nomadic | Tstats | p-value |
|---|---|---|---|---|
| TakingRisks | 0.11 | 0.25 | -1.48 | 0.93 |
| JobSecurity | 0.65 | 0.44 | -18.52 | 1.00 |
| FeelingSecure | 0.83 | 0.69 | -4.34 | 1.00 |

Table 2: T-statistics for main variables of interest

behaviour, I constructed three health proxies described above, that reflect the current attitude to the lifestyle and associated risk among individuals with a nomadic and sedentary background. According to Cawley and Ruhm (2011); Teh et al. (2019); Arni et al. (2020) among others, risky health practices reflect risky behaviour and could be considered as a determinant of risk attitudes. Smoking, unsafe sex practices and not having health insurance are among the most important factors of risky health behaviour described in the literature (Weber et al., 2002; Nosic and Weber, 2007; Galizzi and Miraldo, 2012; Akasaki et al., 2019). I constructed these three factors from DHS data. In particular, the variable used in the analysis to capture the effect of smoking is a dummy variable which takes a value of 1 if the person smokes regularly. In order to have a better overview of smoking patterns among the descendants of nomads and sedentarists, I made a comparison based on the number of cigarettes smoked daily by the representatives of each group (see Figure 4(c)). It can be seen that descendants of nomads tend to be heavy smokers compared to their counterparts.

Comparing means for standardized variables of smoking, contraception use, and having insurance (refer to Table 3), it can be observed that people with nomadic backgrounds smoke regularly more on average than those with sedentary, they tend to neglect contraception and lack insurance coverage. Looking at the types of contraception used by people with different

| | Sedentary | Nomadic | Tstats | p-value |
|---|---|---|---|---|
| Smoking | 0.22 | 0.39 | -14.55 | 1.00 |
| Contraception | 0.67 | 0.47 | 27.97 | 1.00 |
| Insurance | 0.04 | 0.01 | 24.62 | 1.00 |

Table 3: T-statistics for main variables of interest

ethnic backgrounds, it is interesting to notice that descendants of nomads mainly used withdrawal, which is one of the riskiest ways of contraception (refer to Figure 4(d)). They are also more likely to practice periodic abstinence, which could be referred to the nature of nomadic life. This observation supports Becker (2019), who found the strong effect of historical pastoralism on female genital-cutting practices nowadays. Descendants of sedentarists tend to prefer pills and IUC, which may signal about heritage of greater dependencies on pharmaceuticals and better quality of the health system among sedentary communities.

Overall, this section presents the main features of the variables of interest, while the next one will describe the identification techniques used to address the question of nomadic influence on current risk attitudes and behaviour.

## 4.2 Identification Strategy

The empirical analysis overcomes considerable challenges in the identification of the causal effect of ancestral lifestyle on risk attitudes. The analysis adopts an empirical strategy that is designed to mitigate concerns about the potential role of omitted variables in the observed association between ancestral lifestyle and willingness to take risks (reverse causality is not an issue given the historical nature of the main explanatory variable). Potential concerns about the role of omitted geographical, institutional, cultural, and human characteristics in the observed association between nomadic background and risk attitudes are mitigated by accounting for a large set of confounding characteristics that might have determined risk aversion. In particular the analysis accounts for potentially confounding effects of: (i) geographical and climatic characteristics (e.g., elevation, distance to equator, historical temperature and humidity, distance to coast, level of precipitation), (ii) regional fixed effects, capturing unobserved time-invariant heterogeneity at the regional level; (iii) country fixed effects, and thus time-invariant country-specific factors, (e.g., geography, institutions, history, and culture); (iv) individual characteristics (e.g., age, gender, number of siblings, religion, education level, and income); (v) ethnographic characteristics (e.g., the intensity of agriculture, subsistence, kinship organization, size of the community, domestic organization, marital structure, religious beliefs, settlement patterns, political organizations, institutional complexity, class stratification, slavery, inheritance rules).

Additionally, the adoption of the epidemiological approach and the exploration of the determinants of risk attitudes among movers, e.g. people who live outside their ethnic homeland, permits the analysis to overcome two major concerns: (i) it distinguishes between the effect of ancestral lifestyle in the place of origin (rather than where they currently reside) on risk aversion, capturing the culturally embodied, intergenerationally-transmitted component of the effect of nomadic way of living; (ii) it accounts for time-invariant unobserved heterogeneity in the place of living (e.g., geographical, cultural and institutional characteristics), and thus, mitigating possible concerns about the confounding effect of place-specific characteristics.

## 4.3 Baseline Specification

In this section, I present the following baseline specification:

$$Y_{i,e,r,c,t} = \beta_1 Nomadic_e + \beta_2 X_{i,e,r,c,t} + \beta_3 Z_{e,t} + \beta_4 G_{e,r,c,t} + \sum_r \sigma_r Region_i + \sum_c \sigma_c Country_i + \varepsilon_{e,t}$$

where $Y_{i,e,r,c,t}$ is a binary measure of risk attitudes (a proxy for willingness to take risks and risky health behaviour) of an individual *i* belonging to the ethnic group *e* in region *r* of the country *c* at time *t*; $Nomadic_e$ depicts ethnic group being nomadic (0,1); $X_{i,e,r,c,t}$ is a set of individual socio-economic characteristics; $Z_{i,e,r,c,t}$ is a set of ethnic group characteristics; $G_{e,c,t}$ is a set of geographical and climate controls; $Region_i$ is a dummy variable for the region and $Country_i$ is a dummy variable for the country, where individual *i* is living. Standard errors are clustered at the ethnic group level[3]. A similar specification is applied for a subsample of people, who are

[3]Clustering at region and country level did not change the results much

currently living outside their ethnic homelands.

# 5 Main Results

I start with baseline results for the willingness to take risks and I proceed with findings for risky health behaviour. Also, I reduced the sample to people living outside their ethnic homeland and discussed the implications.

## 5.1 WVS

This section focuses on the results from baseline specification regarding risk attitudes using proxies from WVS data.

### 5.1.1 WVS Baseline results

| | TakingRisks | | | JobSecurity | | | FeelingSecure | | |
|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| Nomad | 0.087** | 0.0700** | 0.067** | -0.189** | -0.187** | -0.172** | -0.104* | -0.180* | -0.171* |
| | (0.0290) | (0.0265) | (0.0211) | (0.0700) | (0.0797) | (0.0701) | (0.1160) | (0.0861) | (0.0791) |
| Individual Controls | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Group Controls | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Geographical Controls | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Country FE | No | Yes | - | No | Yes | - | No | Yes | - |
| Region FE | No | - | Yes | No | - | Yes | No | - | Yes |
| Time FE | No | Yes | Yes | No | Yes | Yes | No | Yes | Yes |
| Mean (Y) | 0.261 | 0.261 | 0.261 | 0.735 | 0.735 | 0.735 | 0.799 | 0.799 | 0.799 |
| SD (Y) | 0.367 | 0.367 | 0.367 | 0.441 | 0.441 | 0.441 | 0.400 | 0.400 | 0.400 |
| Obs | 43421 | 43421 | 43421 | 43421 | 43421 | 43421 | 43421 | 43421 | 43421 |

Table 4: WVS Baseline results

Note: Standard errors are clustered at the ethnic group level and the analysis covers 104 ethnic groups in 450 regions of 80 countries. Individual controls include gender, having a partner, number of children, highest education, religion, being unemployed, income group, age, financial situation satisfaction, working class (e.g. middle class), urban; group controls include domestic organization, inheritance rules, mean size of the community, jurisdictional hierarchy, belief in God, subsistence; geographical controls include historical average temperature and humidity, elevation, distance to the equator and distance to the coast. * p <0.10,** p <0.05,*** p <0.01

From Table 4 it can be seen that people with nomadic background are more prone to take risks. Column 1 of Table 4 shows the positive correlation between willingness to take risks and having nomadic background documents without any additional controls. In Column 2 I add individual-level controls with ethnic group and geographical controls. The inclusion of these controls makes the coefficient on ancestral lifestyle go up. In particular, having a nomadic background in preindustrial times leads to a 8.7 percentage point increase in the willingness to take risks. In light of the fact that the unconditional willingness to take risks is only 16%, this effect is large. In a final step, I include country and then region time fixed effects with a broad set of variables that might be outcomes of nomadism themselves. At the individual level, I have educational attainment, marital status, a dummy for living in an urban area, age, religion, income group, number of children, and if the person is unemployed. At the historical ethnic group level, I include a measure for subsistence to alleviate the concern that the effect of nomadism is not merely the result of pastoralism as opposed to agriculture. Similarly, I include a measure for how hierarchical a society was in terms of its political organization and inheritance rules with the society to ensure that nomadic groups are not simply better organized to cope and insure themselves against risks. Most importantly, I include geographical controls to ensure that risk-taking behaviour is affected by ancestral lifestyle and not associated variation in climatic conditions. Adding the controls and fixed effects decreases the coefficient on a nomadic lifestyle, but it remains large and statistically significant. It can be concluded that having a nomadic background in preindustrial times increases the willingness to take risks by approximately 7 percentage points.

Column 4 documents the negative relationship between nomadic background and loss/risk aversion. People with nomadic backgrounds tend to value less job security among other characteristics, which signals their lower degree of loss aversion. Adding the controls and region-time fixed effects in Column 6 shows that ancestral nomadism reduces the choice of job security as the most valuable job characteristic by 17.2 percentage points.

Similarly, people with nomadic backgrounds tend to value less the security of their surroundings (Column 7). Controlling for individual-, and group-level variations and including geographical covariates, keeping region and time fixed, it demonstrates that nomadic background makes people care about feeling secure by 17 percentage points less than their sedentary counterparts. Overall, using these proxies for the willingness to take risks shows that a nomadic background in preindustrial times is associated with a higher degree of risk-taking today.

### 5.1.2 WVS Results for movers

The analysis of movers (people living outside their ancestral homeland) accounts for time-invariant unobserved heterogeneity in the country of current residence (e.g., geographical and institutional characteristics). Moreover, since a wide range of characteristics of the place of origin are distinct from those of the country of residence, the estimated effect captures the culturally-embodied, intergenerationally-transmitted effect, rather than the direct effect of geography or environment.

I define movers as people living outside their ethnic homeland. The way I allocate people is as follows: each ethnic group has a location defined by centroid on the map. I follow Michalopou-

los and Papaioannou (2016) and draw a boundary of 200km around, anyone who is living 10 km further away is considered a mover (Figure 1.14 in Appendix).
Table 5 demonstrates the results using baseline specification. Adding the controls and region-time fixed effects, results for movers mirror the main findings. Column 1 shows that the nomadic background in preindustrial times increases willingness to take risks by 6 percentage points.

| | TakingRisks | JobSecurity | FeelingSecure |
|---|---|---|---|
| | (1) | (2) | (3) |
| Nomad | 0.06** | -0.15** | 0.05** |
| | (0.078) | (0.067) | (0.023) |
| Individual Controls | Yes | Yes | Yes |
| Group Controls | Yes | Yes | Yes |
| Geographical Controls | Yes | Yes | Yes |
| Region FE | Yes | Yes | Yes |
| Time FE | Yes | Yes | Yes |
| Mean (Y) | 0.31 | 0.65 | 0.79 |
| SD (Y) | 0.45 | 0.44 | 0.39 |
| # of obs | 27551 | 27551 | 27551 |
| Clustered s.e | Yes | Yes | Yes |

Table 5: WVS Regression Results for people living outside their ethnic homeland

Note: Standard errors are clustered at the ethnic group level. Individual controls include gender, having a partner, number of children, highest education, religion, being unemployed, income group, age, financial situation satisfaction, working class (e.g. middle class), and urban; group controls include domestic organization, inheritance rules, the mean size of the community, jurisdictional hierarchy, belief in God, subsistence; geographical controls include historical average temperature and humidity, elevation, distance to the equator and distance to the coast. * p <0.10,** p <0.05,*** p <0.01

Similarly, in column 2 people with nomadic backgrounds tend to value job security less than other job characteristics. They also tend to put less value on the security of their surroundings (column 3). The magnitude and direction of the coefficient are in line with the baseline results from the complete sample.

Table 6 shows the results for a more restricted sample where I focus on the people who have nomadic or sedentary ancestors from one region, but now are residing in another region. I am also able to identify people who come from different sedentary and nomadic backgrounds but live outside both of their ethnic homelands. For instance, I observe individual 1 from ethnicity 1 (sedentary) and individual 2 from ethnicity 2 (nomadic), both living outside their ethnic homeland, in the area of ethnicity 3. The results are almost completely similar to the movers' sample. These findings capture the culturally embodied component of the effect of nomadic lifestyle and account for time-invariant unobserved heterogeneity in the place of residence mitigating concerns about place-specific characteristics.

Overall, this shows that descendants of nomads have a greater willingness to take risks, lower loss aversion and they put less value on security in general. It signals that our ancestry has an impact on risk attitudes. In order to bring another dimension of risk to this analysis, I use DHS data to evaluate whether ancestry is also affecting risk behaviour.

| | TakingRisks | JobSecurity | FeelingSecure |
|---|---|---|---|
| | (1) | (2) | (3) |
| Nomad | 0.09** | -0.17** | 0.07** |
| | (0.081) | (0.063) | (0.031) |
| Individual Controls | Yes | Yes | Yes |
| Group Controls | Yes | Yes | Yes |
| Geographical Controls | Yes | Yes | Yes |
| Region FE | Yes | Yes | Yes |
| Time FE | Yes | Yes | Yes |

Table 6: People living outside their ethnic homeland in the third region

Note: Standard errors are clustered at the ethnic group level. Individual controls include gender, having a partner, number of children, highest education, religion, being unemployed, income group, age, financial situation satisfaction, working class (e.g. middle class), urban; group controls include domestic organization, inheritance rules, mean size of the community, jurisdictional hierarchy, belief in God, subsistence; geographical controls include historical average temperature and humidity, elevation, distance to the equator and distance to the coast. * p <0.10,** p <0.05,*** p <0.01

## 5.2 DHS

In this section, I employ the same baseline specification to analyze the effect of nomadic lifestyle on risky health behaviour. Nosic and Weber (2007); Galizzi and Miraldo (2012); Dohmen et al. (2017); Teh et al. (2019); Arni et al. (2020) among others showed that risk preferences, in particular, willingness to take risks, are positively correlated with several determinants of risky health behaviour. For instance, smoking, drinking and having unsafe sex. Taking health indicators as a proxy of risky behaviour, I evaluate whether having a nomadic background affects risky behaviour in addition to the evidence on risk preferences discussed in the previous section.

### 5.2.1 DHS Baseline Results

Table 7 presents the results analogous to the baseline results for risk preferences proxied with WVS data. It can be seen that the direction of the effect supports the hypothesis that having a nomadic ancestry makes people to adopt riskier health behaviour. Column 1 of Table 7 shows the positive correlation between nomadic ancestry and smoking habits. The inclusion of individual- and group-level controls alongside geographical ones doubles the coefficient (column 2). Adding region and time-fixed effects to level out regional differences, e.g. institutional or social, increases the coefficient on nomadic background even further (column 3). In particular, nomadic ancestry increases the probability of the person to be a regular smoker by 3.8 percentage points[4].

| | Smoking_habits | | | Health_insurance | | | Contraception_use | | |
|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| Nomadic | 0.013*** | 0.0201* | 0.038*** | -0.0302*** | -0.1215* | -0.0862** | -0.069*** | -0.089* | -0.014* |
| | 0.0013 | 0.0104 | 0.013 | 0.0064 | 0.0619 | 0.0352 | 0.0025 | 0.049 | 0.006 |
| Individual Controls | No | Yes | Yes | No | Yes | Yes | No | Yes | Yes |
| Group Controls | No | Yes | Yes | No | Yes | Yes | No | Yes | Yes |
| Geographical Controls | No | Yes | Yes | No | Yes | Yes | No | Yes | Yes |
| Region FE | No | No | Yes | No | No | Yes | No | No | Yes |
| Time FE | No | No | Yes | No | No | Yes | No | No | Yes |
| Mean (Y) | 0.57 | 0.57 | 0.57 | 0.037 | 0.037 | 0.037 | 0.67 | 0.67 | 0.67 |
| SD (Y) | 0.23 | 0.23 | 0.23 | 0.189 | 0.189 | 0.189 | 0.46 | 0.46 | 0.46 |
| # of obs | 211990 | 211990 | 211990 | 202768 | 202768 | 202768 | 331344 | 331344 | 331344 |
| # of regions | 403 | 403 | 403 | 403 | 403 | 403 | 403 | 403 | 403 |
| # of ethnicities | 332 | 332 | 332 | 332 | 332 | 332 | 332 | 332 | 332 |
| Clustered s.e | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |

Table 7: DHS Baseline Results

Note: Standard errors are clustered at the ethnic group level and the analysis covers around 300,000 individuals in 403 regions and 332 ethnicities. Individual controls include gender, having a partner, number of children, years of education, religion, occupation, wealth group, age, having a bank account, and urban; group controls include domestic organization, inheritance rules, mean size of the community, jurisdictional hierarchy, belief in God, subsistence; geographical controls include historical average temperature and humidity, elevation, distance to the equator and distance to the coast. * p <0.10,** p <0.05,*** p <0.01

Concerning health insurance the results are similar. From column 4 it can be seen that the correlation with nomadic ancestry is negative and the coefficient goes up after adding the controls and region time fixed effects (columns 5-6). The final estimate is an 8.6 percentage point increase in the likelihood of not having health insurance, which is huge given the low mean of the dependent variable. A potential explanation could be that there are few regions in the world where health insurance exists as a state policy, therefore, there is a small number of people actually having health insurance. Hence, people do not have it because of lack of service and not by choice.

As regards contraception, the behaviour of people with nomadic background tend to be riskier compared with sedentary counterparts. Column 7 shows that the correlation is negative, while the coefficient increases after adding controls (column 8). The interesting point is that the effect of nomadic ancestry decreases drastically when I introduce region-time fixed effects. It could be due to the regional differences in norms and contraception behaviour, respectively. Some regions may not support contraception informally due to cultural or social views regardless of the state of legislation on this matter.

Baseline results for risk behaviour are in line with the evidence on risk preferences. Particularly, nomadic ancestry has an impact on risk attitudes nowadays. Risk-taking behaviour

[4] It can be also noticed that for some cases the coefficient increased instead of going down when I add controls. The possible explanation is that these controls have an opposite effect on the dependent variable, so their inclusion increases the effect of our target one

| | Smoking_habits | | Health_insurance | | Contraception_use | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Nomadic | 0.018** | 0.029** | -0.068** | -0.065** | -0.071* | -0.017* |
| | 0.009 | 0.011 | 0.0517 | 0.033 | 0.041 | 0.005 |
| Individual Controls | Yes | Yes | Yes | Yes | Yes | Yes |
| Group Controls | Yes | Yes | Yes | Yes | Yes | Yes |
| Geographical Controls | Yes | Yes | Yes | Yes | Yes | Yes |
| Region FE | No | Yes | No | Yes | No | Yes |
| Time FE | No | Yes | No | Yes | No | Yes |
| # of obs | 65323 | 65323 | 34791 | 34791 | 64901 | 64901 |
| # of ethnicities | 104 | 104 | 104 | 104 | 104 | 104 |
| Clustered s.e | Yes | Yes | Yes | Yes | Yes | Yes |

Table 8: DHS Baseline Results: same sample as WVS

Note: Standard errors are clustered at the ethnic group level. Individual controls include gender, having a partner, number of children, years of education, religion, occupation, wealth group, age, having a bank account, and urban; group controls include domestic organization, inheritance rules, mean size of the community, jurisdictional hierarchy, belief in God, subsistence; geographical controls include historical average temperature and humidity, elevation, distance to the equator and distance to the coast. * p <0.10,** p <0.05,*** p <0.01

imposed by nomadic lifestyle holds over generations and is well pronounced among descendants of nomads.

Yet one may think that DHS results are not compatible with WVS, since the number of ethnic groups increases substantially and may affect the findings. For this reason, I restrict the DHS sample to exactly the same ethnic groups covered in WVS and redo the evaluation for risk health behaviour proxies. Table 1.8 shows the results for 104 ethnic groups used in WVS. I report only results with included controls and fixed effects skipping simple correlation for better comparison. It can be seen that the results are very much in line with the whole sample, the magnitude and direction of the effect hold and support the hypothesis established above.

### 5.2.2 DHS Results for movers

This section uses moving as a setting to identify the portable component of cultural influence on current outcomes. First, I check if these results hold among those people, who have moved to their current place of residence as it is indicated in DHS data. Second, I focus on movers, who are living outside their original ethnic homeland as I defined above.

Table 9 presents the results for people who have moved to their current place of residence as indicated in DHS data. They are in line with the baseline results from the whole sample. I will focus on columns 3, 6, and 9 since they include all controls and region time fixed effects. It can be seen that the coefficient of interest has the same direction across all three variables. Magnitude stays the same for smoking and contraception usage. For instance, nomadic ancestry increases the likelihood of being a regular smoker by 4.2 percentage points and decreases usage of contraception by 1.5. However, the coefficient for health insurance decreased a lot and lost its significance. One possible explanation for the decrease in the coefficient is that, potentially, movers are people moved for a better quality of life, so the choice of having health insurance

| | Smoking_habits | | | Health_insurance | | | Contraception_use | | |
|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| Nomadic | 0.009*** | 0.026* | 0.042** | -0.028*** | -0.028* | -0.025 | -0.013*** | -0.022* | -0.015* |
| | 0.002 | 0.0105 | 0.016 | 0.007 | 0.015 | 0.027 | 0.001 | 0.0127 | 0.0113 |
| Individual Controls | No | Yes | Yes | No | Yes | Yes | No | Yes | Yes |
| Group Controls | No | Yes | Yes | No | Yes | Yes | No | Yes | Yes |
| Geographical Controls | No | Yes | Yes | No | Yes | Yes | No | Yes | Yes |
| Region FE | No | No | Yes | No | No | Yes | No | No | Yes |
| Time FE | No | No | Yes | No | No | Yes | No | No | Yes |
| Mean (Y) | 0.54 | 0.54 | 0.54 | 0.04 | 0.04 | 0.04 | 0.66 | 0.66 | 0.66 |
| SD (Y) | 0.22 | 0.22 | 0.22 | 0.19 | 0.19 | 0.19 | 0.47 | 0.47 | 0.47 |
| # of obs | 102103 | 102103 | 102103 | 87870 | 87870 | 87870 | 161954 | 161954 | 161954 |
| # of regions | 347 | 347 | 347 | 347 | 347 | 347 | 347 | 347 | 347 |
| # of ethnicities | 270 | 270 | 270 | 270 | 270 | 270 | 270 | 270 | 270 |
| Robust s.e | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |

Table 9: DHS Results for Movers

Note: Standard errors are clustered at the ethnic group level. Individual controls include gender, having a partner, number of children, years of education, religion, occupation, wealth group, age, having a bank account, and urban; group controls include domestic organization, inheritance rules, mean size of the community, jurisdictional hierarchy, belief in God, subsistence; geographical controls include historical average temperature and humidity, elevation, distance to the equator and distance to the coast. * p <0.10,** p <0.05,*** p <0.01

goes in line with risk attitudes and most probably we are comparing people who have an opportunity to get insurance but make their choices according to risk preferences. Yet, statistical significance is probably lost due to the shrinkage of the sample and the introduction of fixed effects.

| | Smoking_habits | | | Health_insurance | | | Contraception_use | | |
|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| Nomadic | 0.007** | 0.028** | 0.033** | -0.011*** | -0.044* | -0.092 | -0.09** | -0.005* | -0.015* |
| | 0.0014 | 0.0102 | 0.0117 | 0.001 | 0.02 | 0.064 | 0.002 | 0.0021 | 0.005 |
| Individual Controls | No | Yes | Yes | No | Yes | Yes | No | Yes | Yes |
| Group Controls | No | Yes | Yes | No | Yes | Yes | No | Yes | Yes |
| Geographical Controls | No | Yes | Yes | No | Yes | Yes | No | Yes | Yes |
| Region FE | No | No | Yes | No | No | Yes | No | No | Yes |
| Time FE | No | No | Yes | No | No | Yes | No | No | Yes |
| Mean (Y) | 0.19 | 0.19 | 0.19 | 0.03 | 0.03 | 0.03 | 0.8 | 0.8 | 0.8 |
| SD (Y) | 0.39 | 0.39 | 0.39 | 0.16 | 0.16 | 0.16 | 0.39 | 0.39 | 0.39 |
| # of obs | 26487 | 26487 | 26487 | 26487 | 26487 | 26487 | 26487 | 26487 | 26487 |
| # of regions | 193 | 193 | 193 | 193 | 193 | 193 | 193 | 193 | 193 |
| # of ethnicities | 139 | 139 | 139 | 139 | 139 | 139 | 139 | 139 | 139 |
| Robust s.e | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |

Table 10: DHS Results for GeoMovers (more than 10 km from ancestral homeland)

Note: Standard errors are clustered at the ethnic group level. Individual controls include gender, having a partner, number of children, years of education, religion, occupation, wealth group, age, having a bank account, and urban; group controls include domestic organization, inheritance rules, mean size of the community, jurisdictional hierarchy, belief in God, subsistence; geographical controls include historical average temperature and humidity, elevation, distance to the equator and distance to the coast. * p <0.10,** p <0.05,*** p <0.01

Despite the fact that movers's sample gives the opportunity to find the portable component of culture, due to the data limitation it is not possible to track whether people have moved far from their origins or just changed the house. For this reason, using the geolocation of households helps to better identify those respondents, who live outside their respective ethnic homeland.

These individuals, so-called geomovers, are defined in the same way as described before. Each ethnic homeland is defined by the centroid and 200 km buffer around it. Everyone living 10 km further from the homeland is considered geomovers. 10 km is chosen due to the official perturbation of borders by 5-10 km done by DHS data constructors.

Table 10 shows the results for geomovers, which are very close both in magnitude and direction to the baseline ones. From column 3 it can be seen that the probability of being a regular smoker is increased by 3.3 percentage points for descendants of nomadic lifestyle. Similarly, nomadic ancestry is negatively associated with having health insurance and decreases the likelihood of safe sex practices by 1.5 percentage points.

Table 11 demonstrates the results for a more restricted sample where I focus on people who have nomadic or sedentary ancestors from one region, but now are residing in another region. The results are almost completely similar to both movers' samples. These findings capture the culturally embodied component of the effect of nomadic lifestyle and account for time-invariant unobserved heterogeneity in the place of residence mitigating concerns about place-specific characteristics.

| | Smoking_habits | Health_insurance | Contraception_use |
|---|---|---|---|
| | (1) | (2) | (3) |
| Nomadic | 0.041** | -0.089 | -0.055* |
| | (0.012) | (0.071) | (0.021) |
| Individual Controls | Yes | Yes | Yes |
| Group Controls | Yes | Yes | Yes |
| Geographical Controls | Yes | Yes | Yes |
| Region FE | Yes | Yes | Yes |
| Time FE | Yes | Yes | Yes |

Table 11: GeoMovers: nomadic and sedentary descendants in the third region

Note: Standard errors are clustered at the ethnic group level. Individual controls include gender, having a partner, number of children, years of education, religion, occupation, wealth group, age, having a bank account, and urban; group controls include domestic organization, inheritance rules, mean size of the community, jurisdictional hierarchy, belief in God, subsistence; geographical controls include historical average temperature and humidity, elevation, distance to the equator and distance to the coast. * p <0.10,** p <0.05,*** p <0.01

Overall, these findings bring evidence that nomadic ancestry not only affects risk preferences but also risk behaviour. In both cases, the findings suggest a strong negative correlation between nomadic lifestyle and risk aversion. In particular, descendants of nomads are more willing to take risks and exhibit riskier health behaviour. However, given the nature of the data collection and multiple ethnographic sources, one may be concerned about measurement error problems, which may cause downward bias in OLS.

Another natural question to ask is how nomadism originated. This is important, since one may be concerned that similar factors determining lifestyles also determine individual outcomes. For instance, certain cultures may be more militant or belligerent, which induces practicing nomadism to conquer other lands. Thus, these people would be more likely to choose the nomadic way of living and be risk-takers, but nomadism itself would not be relevant. In this case, OLS results may overstate the effect of nomadism. In order to mitigate these concerns, I apply the instrumental variable approach that will be described in more detail in the next section.

## 5.3 IV: The importance of origins of biodiversity

An important question when interpreting the results presented in the preceding sections is what generates the variation in ancestral lifestyle. It has been hypothesized that an important determinant of whether the tribe became nomadic was the characteristics of animals that were present in the same habitual areas (Vigne et al., 2011). To lead a nomadic life one needs support that makes mobility sustainable.

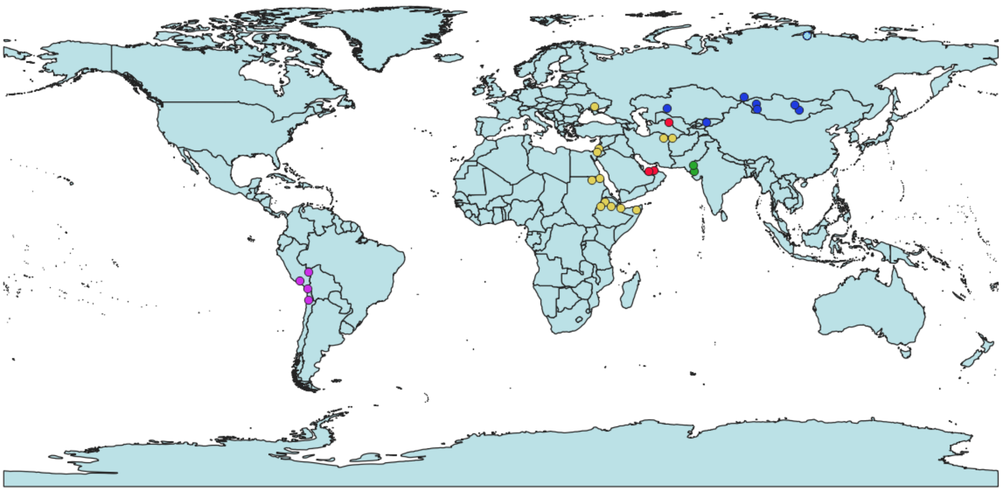


Figure 5: Original domestication points

- each dot corresponds to the centroid of the location where the first domestication took place. Purple – llamas/pacos, blue – horses, red – camels, green – elephants, yellow – donkeys, onagers. Data were taken from Rossel et al. (2008); Larson and Fuller (2014); Almathen et al. (2016); Kaczensky et al. (2018); Khan (2019)

Indeed, in different parts of the world nomadic tribes extensively used animals that can travel long distances and are of great endurance: horses, camels, donkeys/onagers, llamas, and elephants. Thus, in the areas where those animals were first domesticated during the early Neolithic time (mid-Helocene period), there was a higher probability that people would choose to pursue a nomadic lifestyle.

Since 2006, the study of the domestication process through a complete genome sequence has become possible, and it has been associated with the detection of selection in a large number of genomic loci that have likely evolved by selective pressures (Carneiro et al., 2014; Larson and Fuller, 2014). Therefore, in order to test my argument, I collected data from genetic biology literature (Rossel et al., 2008; Larson and Fuller, 2014; Almathen et al., 2016; Kaczensky et al., 2018; Khan, 2019), which dissect genetic codes in the modern animals to track their existence back to the common ancestor of one specie. Knowing the common ancestor made it possible to locate the origins of where the domestication took place for the first time (refer to Figure 5).

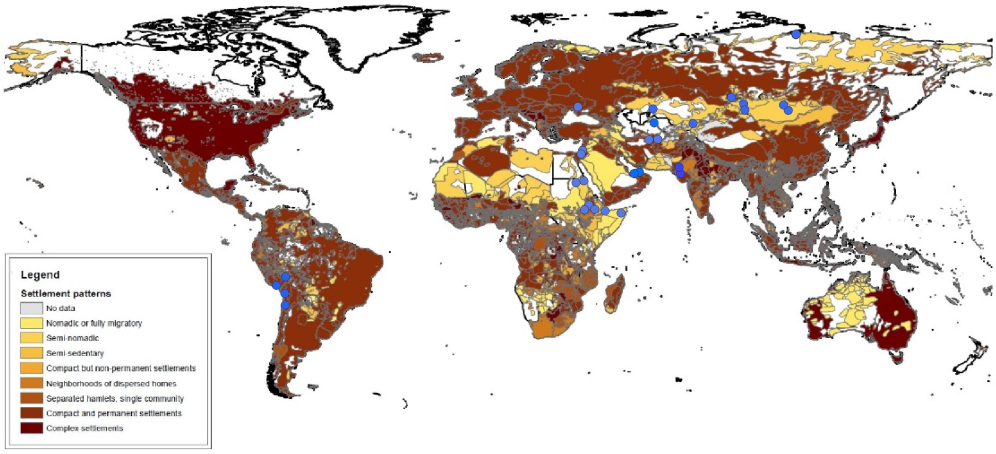



Figure 6: Distribution of nomads and original locations of domestication

Notes: data taken from Rossel et al. (2008); Larson and Fuller (2014); Almathen et al. (2016); Kaczensky et al. (2018); Khan (2019) - for domestication points; from Ethnographic Atlas - for distribution of nomads.

Importantly for this identification strategy, the origins of domestication strongly influence the likelihood that and the extent to which an ethnic group practiced nomadism in pre-industrial times. More specifically, the closer an ethnic group was to the point of domestication, the more likely it would adopt nomadism. Figure 6 depicts this relationship by overlaying the map of the distribution Since I know the location of each ethnic group, I am able to calculate the set of Euclidian distances between the centroid of certain ethnic group locations and the first domestication point of each animal that was used for traveling and carrying loads at long distances. Afterward, I choose the shortest distance in the set which will be linked to a particular ethnic group in the dataset that I have constructed (refer to Figure 7).

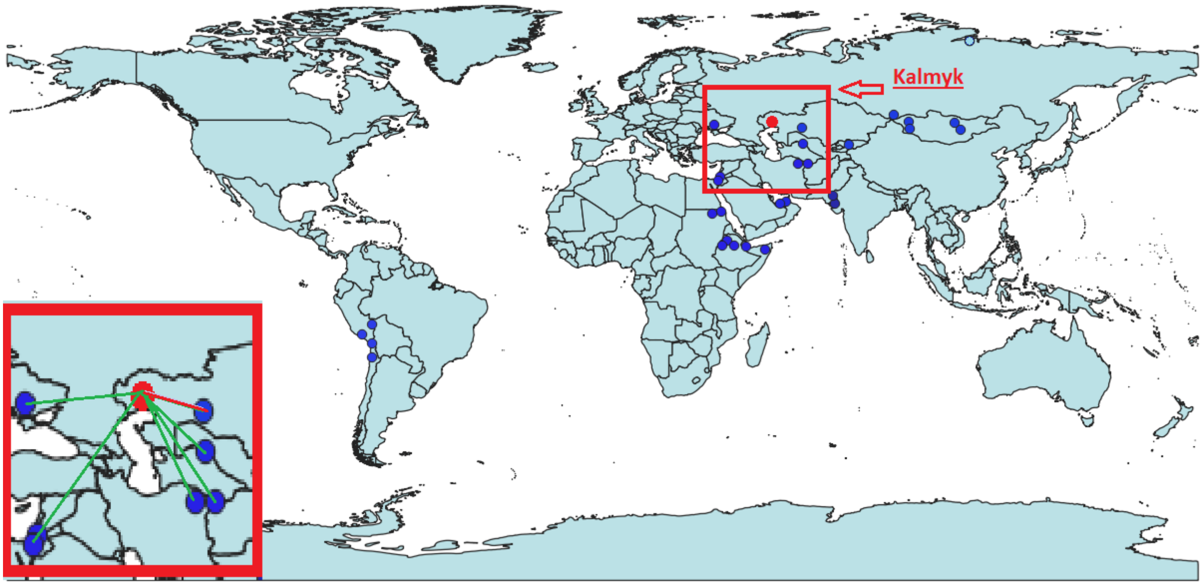



Figure 7: Shortest distance as an instrument

Notes: data taken from Rossel et al. (2008); Larson and Fuller (2014); Almathen et al. (2016); Kaczensky et al. (2018); Khan (2019) - for domestication points.

Therefore, in order to provide evidence that the relationship between nomadism and current risk attitudes is causal, I use the shortest distance to the point of domestication as an instrument for nomadic lifestyle. The assumption underlying the exclusion restriction is that the origins of domestication do not affect modern risk attitudes through channels other than nomadism. Table 12 provides the first stage regression. The first stage F-statistic is 87.34 and for the exclusion restriction to hold it needs to be true that the location of domestication does not affect risk attitudes through channels other than nomadism.

| | Being nomadic |
|---|---|
| The shortest distance to the point of domestication | -0.011***<br>(0.0012) |
| Controls | Yes |
| Region FE | Yes |
| Time FE | Yes |
| Obs | 43274 |
| F-statistic | 87.34 |

Table 12: Instrumental variable analysis: First stage

Note: Standard errors are clustered at ethnic group level. Controls are the same as in the main regressions. * $p < 0.10$,** $p < 0.05$,*** $p < 0.01$

Generally speaking, I do not expect the direct effect of the distance between ethnic group location and domestication point on the risk attitudes nowadays (around 6000 years after). However, one may be concerned whether environmental or climate conditions were driving the effect rather than the lifestyle. Looking at Figure 8, it can be seen that the estimations made recently with ice samples from Greenland cores show a fairly stable temperature around 4000BC (corresponds to 6BP), when most domestication happened, and nowadays.

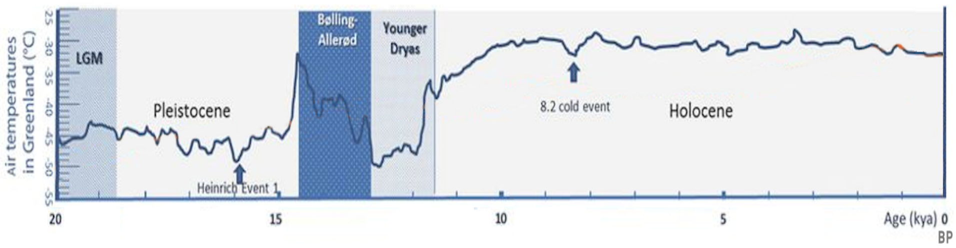



Figure 8: Evolution of the temperature in the Post-Glacial period
Source: Zalloua and Matisoo-Smith (2017)

Using the data from the National Climatic Data Center and estimations from different parts of the world, Figure 9 also demonstrates that the temperature fluctuated no more than 0.5 degrees during the last 5-6 thousand years.

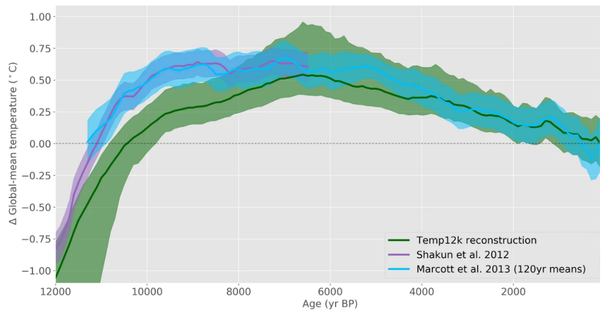



Figure 9: Holocene Temperature variations
Source: Kaufman et al. (2020)

Therefore, adding climate controls from 1835 till nowadays aims to alleviate the concern that distance towards the domestication point may affect current risk attitudes, because of climatic and environmental conditions of the past.

Another potential concern is that domestication was endogenous given the skills of people indigenous to the area to which the species was native. In other words, nomads were more likely to tame large animals due to their skills rather than it was a random event. On this, I follow Diamond (1997, 2002), who argues that although domestication arose in only a few areas of the world and in certain places of those areas earlier than in others, it was a biogeographic luck overall. The roots of animal domestication included the ubiquitous tendency of all people to try to tame or manage wild animals (including such unlikely candidates as ospreys, hyenas, and grizzly bears).

Diamond (1997, 2002) questioned the selectivity of domestication in two ways: whether the difficulty lay with the species itself or with people indigenous to the area where the species were native. He claims that there are six independent lines of evidence that are converging to prove that the difficulty lies with the species itself, not with local people. Particularly, the quick acceptance of introduced Eurasian domesticates by non-Eurasian people; the fast ancient domestication of the most valued species; the repeated independent domestication of many of them; the failure of even modern animal breeders to make a considerable contribution to the short list of valuable domesticates; the identification of certain reasons preventing the domestication of many species.

To go more into detail, Diamond also provided an example of how European horse breeders who settled in South Africa in the 1600s tried to domesticate zebra (like African herders did for previous millennia). After several centuries they gave up, because zebras are vicious, have the bad habit of biting a handler, and do not let go until the handler is dead. Moreover, they have better peripheral vision than horses, making it impossible even for professional rodeo cowboys to lasso, since they see the coming rope and flick away their head.

Given divergence across species, Diamond classified six main obstacles for a wild mammal to be domesticated: the diet which is hard to be provided by humans, slow growth rate and long birth spacing (e.g. gorillas), nasty disposition (grizzly bears and rhinoceroses), reluctance to breed in captivity (pandas and cheetahs), lack of follow-the leader dominance hierarchies (bighorn sheep and antelope) and tendency to panic in enclosures or when facing predators (deer, gazelles). There are many species that satisfy five out of six criteria but were not domesticated. Recent developments in genetic biological literature (Larson and Fuller, 2014; Blaustein, 2015) showed that domestication happened due to certain genetically random generated characteristics and supported Diamond's claim that this is biogeographic luck to be in a place where species were successfully domesticated.

Last, but not least, this instrument addresses the concern of some groups being belligerent and having a culture or spirit of conquests. However, the domestication of animals, that are capable of long-distance travel, captures the possibility of groups to travel far and conquer new lands. Overall, I believe that the presented evidence is a strong motivation for exogeneity of this instrument.

Tables 13 and 14 present the results. Columns 2, 6, and 10 show the OLS coefficient from baseline results including all controls and fixed effects. Columns 4, 8, and 12 present the respective second-stage IV coefficients. The IV estimates confirm the results from the OLS regressions in terms of coefficient signs and statistical significance for both risk preferences and risk behaviour. Historical nomadism predicts the risk attitudes of people nowadays. In terms of magnitude, the IV coefficients are consistently larger than their OLS counterparts for a set of risk-taking proxies, while IV coefficients on the determinants of risky health behaviour are

| | TakingRisks: OLS | | TakingRisks: IV | | JobSecurity: OLS | | JobSecurity: IV | | FeelingSecure: OLS | | FeelingSecure: IV | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
| Nomad | 0.087** | 0.070** | 0.163*** | 0.171*** | -0.189** | -0.187** | -0.371*** | -0.373*** | -0.104 | -0.181* | -0.327*** | -0.326*** |
| | (0.029) | (0.026) | (0.081) | (0.079) | (0.070) | (0.079) | (0.077) | (0.086) | (0.116) | (0.086) | (0.141) | (0.142) |
| Individual Controls | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Group Controls | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Geographical Controls | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Country FE | No | Yes | No | Yes | No | Yes | No | Yes | No | Yes | No | Yes |
| Time FE | No | Yes | No | Yes | No | Yes | No | Yes | No | Yes | No | Yes |
| Obs | 43421 | 43421 | 43274 | 43274 | 43421 | 43421 | 43274 | 43274 | 28476 | 28476 | 23698 | 23698 |

Table 13: WVS Baseline Results

Note: Standard errors are clustered at the ethnic group level. Individual controls include gender, having a partner, number of children, highest education, religion, being unemployed, income group, age, financial situation satisfaction, working class (e.g. middle class), and urban; group controls include domestic organization, inheritance rules, mean size of the community, jurisdictional hierarchy, belief in God, subsistence; geographical controls include historical average temperature and humidity, elevation, distance to the equator and distance to the coast. * p <0.10,** p <0.05,*** p <0.01

mostly consistent with OLS results. One potential explanation for the difference in coefficient size is the non-perfect take-up of the treatment. It could be that those groups who 'received treatment', did so because they live closer to domestication points, but they do not practice nomadism. Another plausible explanation that could result in a downward bias in the OLS coefficients is measurement error in defining ancestral lifestyles. The measure of lifestyle and subsistence for each society was collected by different ethnographers in different ways, which possibly induced biased OLS results. Moreover, the binary nature of the variable may cause the measurement error alone.

| | Smoking habits: OLS | | Smoking habits: IV | | Health insurance: OLS | | Health insurance: IV | | Contraception use: OLS | | Contraception use: IV | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
| Nomad | 0.0201* | 0.038** | 0.041*** | 0.045*** | -0.0715** | -0.0862** | -0.087 | -0.096 | -0.089* | -0.014* | -0.079** | -0.077** |
| | (0.0104) | (0.013) | (0.015) | (0.016) | (0.0619) | (0.0352) | (0.124) | (0.189) | (0.049) | (0.006) | (0.047) | (0.045) |
| Individual Controls | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Group Controls | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Geographical Controls | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Country FE | No | Yes | No | Yes | No | Yes | No | Yes | No | Yes | No | Yes |
| Time FE | No | Yes | No | Yes | No | Yes | No | Yes | No | Yes | No | Yes |
| Obs | 211990 | 211990 | 211990 | 211990 | 95262 | 95262 | 95262 | 95262 | 313344 | 313344 | 313344 | 313344 |

Table 14: DHS Baseline Results

Note: Standard errors are clustered at the ethnic group level. Individual controls include gender, having a partner, number of children, years of education, religion, occupation, wealth group, age, having a bank account, and urban; group controls include domestic organization, inheritance rules, mean size of the community, jurisdictional hierarchy, belief in God, subsistence; geographical controls include historical average temperature and humidity, elevation, distance to the equator and distance to the coast. * p <0.10,** p <0.05,*** p <0.01

Overall, the IV approach supports the story in which the ethnic groups who were close to the origins of animal domestication, were more likely to become nomadic, and that nomadism then conferred portable characteristics on descendants of these groups which made them less risk averse even after moving away from their homelands. As expected, the IV approach also provides more precise estimation by correcting existing biases in OLS. This identification approach increases the confidence in the conclusion derived from OLS, and provides further support for a causal interpretation of the results.

# 6 Evidence from Russia

This section complements the main analysis across countries and regions by zooming into one country with a great variety of different ethnicities and several geographical zones, namely, Russia. Focusing on Russia would address the concern of imperfect accounting for the time-varying differences across countries and regions. It also brings additional evidence to the influence of nomadic lifestyle on current determinants of risk-taking behaviour. The same empirical strategy exploiting the instrumental variable approach discussed above is used for this analysis. The data comes from the Russia Longitudinal Monitoring Survey (RLMS, hereafter), which is a series of nationally representative surveys designed to monitor the effects of Russian reforms on the health and economic welfare of households and individuals in the Russian Federation including relevant community- and region-level data.

| | Life insurance | Entrepreneurship | Security | Physical assets insurance |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| Nomadic | -0.021*** | 0.104** | -0.321* | -0.015** |
| | (0.00704) | (0.0530) | (0.191) | (0.00615) |
| Individual Controls | Yes | Yes | Yes | Yes |
| Group Controls | Yes | Yes | Yes | Yes |
| Geographical Controls | Yes | Yes | Yes | Yes |
| Country FE | Yes | Yes | Yes | Yes |
| Time FE | Yes | Yes | Yes | Yes |
| # of obs | 41,353 | 17,853 | 4,334 | 39,192 |
| # of ethnicities | 132 | 132 | 132 | 132 |
| # of regions | 39 | 39 | 39 | 39 |

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 15: RLMS IV Results

Note: Standard errors are clustered at the ethnic group level. Individual controls include gender, having a partner, number of children, years of education, religion, occupation, income, age, and urban; group controls include domestic organization, inheritance rules, mean size of the community, jurisdictional hierarchy, subsistence; geographical controls include historical average temperature and humidity, elevation, distance to the equator.

Similarly to the main section, these data were manually matched with the ethnographic information at the ethnic group level, which produced a successful match of 132 ethnic groups. Overall, the data covers 39 regions within Russia. The peculiarity of this analysis lies in the different sets of proxies for risk-taking behaviour, which provides a better understanding of the nature of risk-taking. Particularly, I focus on life insurance, engagement in entrepreneurship, perception of security and insurance of physical assets, such as cars or flats, which proxy risk-taking behaviour and are complimentary to the main analysis. In particular, I use the following questions: 1) Have voluntary insurance: life insurance; 2) Engagement in entrepreneurial activity; 3) Importance of security; 4) Have voluntary insurance: flat, car or dacha. I construct dummy variables to keep the uniform specification. From Table 15 it can be seen that the direction and the magnitude of the effect are in line with the main analysis. As expected, having a nomadic background has a strong negative impact on the probability of getting insurance for life and for physical assets, around 2 percentage points less probable. The result on security is similar to the main analysis, where the nomadic background is associated with caring less about the security of surroundings. More importantly, a nomadic background is strongly associated with the probability of being engaged in entrepreneurship, which is one of the main determinants of risk-taking behaviour (Rauch et al., 2004; Komulainen et al., 2009; Becker, 2020). Having nomadic ancestry increases the chance that the person becomes an entrepreneur by 10 percentage points. Hence, these results bring additional support to the established cross-country evidence regarding the effect of nomadic ancestry on risk-taking behaviour.

# 7 Conclusion

This paper provides evidence that heterogeneity in risk attitudes can be understood through the prism of ethnic roots. In particular, the difference in ancestral lifestyle has created certain traits that differentiate people in their perception of risk. This paper shows that people having nomadic ancestry tend to be more willing to take risks and practice riskier health behaviour than those with sedentary background. This relationship holds at individual level bot country and region fixed effects across more than 40 thousand people in 450 regions of 80 countries in risk preference sample and across more than 300 thousand people in 403 regions of 42 countries for risk health behaviour sample. Moreover, it is robust to a wide range of specifications with a large number of controls.

Furthermore, by making use of the fact that variation in nomadic lifestyle is determined by biodiversity, this paper suggests a novel instrumental variable approach by using the location of domestication of the animals used for long-distance travel as an instrument for the adoption of nomadic lifestyle. These findings show that IV coefficients are similar in sign and significance to the initial OLS results with a small divergence. They conclude that people, whose ancestors historically practised nomadism (i) are more willing to take risks, (ii) value security less, and (iii) have riskier health behaviour. The paper thereby points out that risk attitudes could be rooted in culture and can be explained by the difference in the lifestyle that our ancestors led.

## References


Akasaki, M., G. B. Ploubidis, B. Dodgeon, and C. P. Bonell (2019): "The clustering of risk behaviours in adolescence and health consequences in middle age," *Journal of Adolescence*, 77, 188–197.

Alan, S. and S. Ertac (2018): "Fostering Patience in the Classroom: Results from A Randomized Educational Intervention," *Journal of Political Economy*, 126, 1865–1911.

Alesina, A., P. Giuliano, and N. Nunn (2013): "On the origins of gender roles: Women and the plough," *The Quarterly Journal of Economics*, 128, 469–530.

Almathen, F., P. Charruau, E. Mohandesan, J. M. Mwacharo, P. Orozco-terWengel, D. Pitt, A. M. Abdussamad, M. Uerpmann, H.-P. Uerpmann, B. De Cupere, P. Magee, M. A. Alnaqeeb, B. Salim, A. Raziq, T. Dessie, O. M. Abdelhadi, M. H. Banabazi, M. Al-Eknah, C. Walzer, and P. A. Burger (2016): "Ancient and modern DNA reveal dynamics of domestication and cross-continental dispersal of the dromedary," *Proceedings of the National Academy of Sciences of the United States of America*, 113, 6707–6712.

Arni, P., D. Dragone, L. Götte, and N. Ziebarth (2020): "Biased Health Perceptions and Risky Health Behaviors: Theory and Evidence," *IZA Discussion Papers*.

Bahrami-Rad, D., A. Becker, and J. Henrich (2021): "Tabulated Nonsense? Testing the Validity of the Ethnographic Atlas," *Economic Letters*, 204, 109880.

Becker, A. (2019): "On the Economic Origins of Restrictions on Women's Sexuality," *CESifo Working Paper Series*.

——— (2020): "Pastoralism and Female Entrepreneurship," https://sites.google.com/site/ankebeckerecon/EntrepreneurshipJanuary2020.pdf.

Becker, A., B. Enke, and A. Falk (2020): "Ancient Origins of the Global Variation in Economic Preferences," *AEA Papers and Proceedings*, 110, 319–323.

Becker, A., A. Falk, T. Dohmen, B. Enke, D. Huffman, and U. Sunde (2018): "Global Evidence on Economic Preferences," *Quarterly Journal of Economics*, 133, 1645–1692.

Benjamin, D. J., J. J. Choi, and A. J. Strickland (2010): "Social Identity and Preferences," *American Economic Review*, 100, 1913–28.

Blaustein, R. (2015): "Unraveling the Mysteries of Animal Domestication," *BioScience*, 65, 7–13.

Bollig, M. and B. Göbel (1997): "Risk, uncertainty, and pastoralism: An introduction," in *Risk and Uncertainty in Pastoral Societies*, Nomadic Peoples (NS) 1. Oxford: Berghahn, 5–21.

Brown, A. S. (2007): "Identifying risk using a new risk assessment tool: The missing piece of the jigsaw in medical device risk assessment," *Clinical Risk*, 13, 56–59.

Carneiro, M., F. W. Albert, S. Afonso, R. J. Pereira, H. Burbano, and R. Campos (2014): "The Genomic Architecture of Population Divergence between Subspecies of the European Rabbit," *PLoS Genet*, 10, e1003519.

Cashdan, E. (1990): *Risk and Uncertainty in Tribal and Peasant Economies*, Westview, Boulder.

Cawley, J. and C. Ruhm (2011): "The Economics of Risky Health Behaviors," *NBER Working Paper No. 17081*.

Cesarini, D., C. Dawes, M. Johannesson, P. Lichtenstein, and B. Wallace (2009): "Genetic Variation in Preferences for Giving and Risk Taking," *The Quarterly Journal of Economics*, 124, 809–842.

Chang, C. and H. Koster (1994): *Pastoralists at the Periphery: Herders in a Capitalistic World*, Tucson: University of Arizona Press.

Diamond, J. (1997): *Guns, Germs and Steel. A Short History of Everybody for the Last 13,000 Years*, London: Jonathan Cape.

——— (2002): "Evolution, consequences and future of plant and animal domestication," *Nature*, 418, 700–707.

Dohmen, T., A. Falk, D. Huffman, and U. Sunde (2010): "Are Risk Aversion and Impatience Related to Cognitive Ability?" *American Economic Review*, 100, 1238–1260.

——— (2012): "The Intergenerational Transmission of Risk and Trust Attitudes," *The Review of Economic Studies*, 79, 645–677.

——— (2017): "Risk Attitudes across the Life Course," *The Economic Journal*, 127, F95–F116.

Dohmen, T., A. Falk, D. Huffman, U. Sunde, J. Schupp, and G. Wagner (2011): "Individual Risk Attitudes: Measurement, Determinants, and Behavioral Consequences," *Journal of the European Economic Association*, 9, 522–550.

Fehr, E., U. Fischbacher, M. Naef, J. Schupp, and G. Wagner (2006): "A Comparison of Risk Attitudes in Germany and the U.S." Mimeo, Institute for Empirical Research in Economics, University of Zurich.

Fratkin, E. (1997): "Pastoralism: Governance and development issues," *Annual Review of Anthropology*, 26, 235–261.

Friedman, M. and L. J. Savage (1948): "The Utility Analysis of Choice Involving Risk," *Journal of Political Economy*, 56, 279–304.

Galaty, J. G. and P. Bonte (1991): "Herders, Warriors, and Traders: Pastoralism in Africa," Routledge.

Galizzi, M. M. and M. Miraldo (2012): "Are You What You Eat? Experimental Evidence on Health Habits and Risk Preferences," Discussion Paper No. 2012/04, Healthcare Management Group, Imperial College Business School.

Galor, O. and V. Savitskiy (2018): "Climatic Roots of Loss Aversion," Working Paper, Brown University.

Galor, O. and □. Özak (2016): "The agricultural origins of time preference," *American Economic Review*, 106, 3064–3103.

Giuliano, P. and N. Nunn (2017): "Understanding cultural persistence and change," *National Bureau of Economic Research Working Paper*.

Gray, J. P. (1999): "A Corrected Ethnographic Atlas," *World Cultures*, 10, 24–85, department of Anthropology, University of Wisconsin-Milwaukee, Milwaukee, WI 53201. Email: jpgray@uwm.edu.

Grosjean, P. (2014): "A History of Violence: The Culture of Honor and Homicide in the US South," *Journal of the European Economic Association*, 12, 1285–1316.

Guiso, L. and M. Paiella (2005): "The role of risk aversion in predicting individual behaviour," Temi di Discussione (Economic Working Papers), Bank of Italy.

Guiso, L., P. Sapienza, and L. Zingales (2006): "Does culture affect economic outcomes?" *Journal of Economic Perspectives*, 20, 23–48.

Gächter, S. and J. Schulz (2016): "Intrinsic honesty and the prevalence of rule violations across societies," *Nature*, 531, 496–499.

Jerven, M. (2011): "A clash of disciplines? Economists and historians approaching the African past," *Economic History of Developing Regions*, 26, 111–124.

Kaczensky, P., E. Kovtun, and R. Habibrakhmanov (2018): "Genetic characterization of free-ranging Asiatic wild ass in Central Asia as a basis for future conservation strategies," *Conservation Genetics*, 19, 1169–1184.

Kaufman, D. S., N. P. McKay, C. C. Routson, M. P. Erb, C. Dätwyler, P. S. Sommer, O. Heiri, and B. A. S. Davis (2020): "NOAA/WDS Paleoclimatology - Global Holocene Mean Surface Temperature Reconstructions," Accessed: 2025-05-01.

Khan, N. (2019): "The genomic origins of modern horses revealed by ancient DNA: from early domestication to modern breeding," Mimeo, University of Copenhagen.

Komulainen, K., M. Korhonen, and H. Räty (2009): "Risk-taking abilities for everyone? Finnish entrepreneurship education and the enterprising selves imagined by pupils," *Gender and Education*, 21, 631–649.

Kosse, F., T. Deckers, H. Schildberg-Hörisch, and A. Falk (2016): "The Formation of Prosociality: Causal Evidence on the Role of Social Environment," IZA Discussion Paper No. 9861.

Kraetli, S., C. Huelsebusch, S. Brooks, and B. Kaufmann (2013): "Pastoralism: a critical asset for food security under global climate change," *Animal Frontiers*, 3, 42–50.

Larson, G. and D. Fuller (2014): "The Evolution of Animal Domestication," *Annual Review of Ecology, Evolution, and Systematics*, 45, 115–136.

Leach, E. (1964): "Reply to Raoul Naroll's on ethnic unit classification," *Current Anthropology*, 5, 283–312.

Leder, S. and B. Streck (2005): "Nomadic and Sedentary Peoples: A Misleading Dichotomy? The Bedouin and Bedouinism in the Arab Past Shifts and Drifts in Nomad-Sedentary Relations," in *Wiesbaden Reichert*, 401–419.

Michalopoulos, S. and E. Papaioannou (2016): "The long-run effects of the scramble for Africa," *American Economic Review*, 106, 1802–1848.

Michalopoulos, S., L. Putterman, and D. N. Weil (2018): "The influence of ancestral lifeways on individual economic outcomes in Sub-Saharan Africa," NBER Working Paper No. 21907.

Murdock, G. P. (1967): *Ethnographic Atlas*, University of Pittsburgh Press.

Murdock, G. P. and D. R. White (1969): "The standard cross-cultural sample," *Ethnology*, 8, 329–369.

Nosic, A. and M. Weber (2007): "Determinants of Risk Taking Behavior: The role of Risk Attitudes, Risk Perceptions and Beliefs," Mimeo.

Nunn, N. and L. Wantchekon (2011): "The slave trade and the origins of mistrust in Africa," *American Economic Review*, 101, 3221–52.

Rao, J. (2018): "Fundamental Functionings of Landowners: understanding the relationship between land ownership and wellbeing through the lens of 'capability'," *Land Use Policy*, 72, 74–84.

Rass, N. (2006): "Policies and strategies to address the vulnerability of pastoralists in sub-Saharan Africa," PPLPI Working Paper No. 37. Pro-Poor Livestock Policy Initiative, FAO, Rome.

Rauch, A., J. Wiklund, M. Freese, and G. T. Lumpkin (2004): "Entrepreneurial orientation and business performance: Cumulative empirical evidence," in *Proceedings of the 23rd Babson College Entrepreneurship Research Conference*, Glasgow, UK.

Robson, A. J. and L. Samuelson (2010): "The evolutionary foundations of preferences," in *The Social Economics Handbook*, ed. by A. B. Jess Benhabib and M. Jackson, Elsevier, New York.

Rossel, S., F. Marshall, J. Peters, T. Pilgram, M. Adams, and D. O'Connor (2008): "Domestication of the donkey: Timing, processes, and indicators," *Proceedings of the National Academy of Sciences*, 105, 3715–3720.

Shaughnessy, S. (2018): "How do East Africa's pastoralists deal with risk?" Cambridge Judge Business School and McKinsey & Co's Global Risk Practice.

Spolaore, E. and R. Wacziarg (2009): "The Diffusion of Development," *The Quarterly Journal of Economics*, 124, 469–529.

——— (2013): "How deep are the roots of economic development?" *Journal of Economic Literature*, 51, 325–369.

——— (2016): "Ancestry, language and culture," in *The Palgrave Handbook of Economics and Language*, Palgrave Macmillan, London, 174–211.

Steinfeld, H., H. A. Mooney, F. Schneider, and L. E. Neville (2010): *Livestock in a changing landscape: volume 1, drivers, consequences, and responses*, Island Press, Washington.

Sutter, M., S. Angerer, D. Rützler, and P. Lergetporer (2015): "The effect of language on economic behavior: Experimental evidence from children's intertemporal choices," .

Teh, C. H., M. W. Teh, and K. H. Lim (2019): "Clustering of lifestyle risk behaviours and its determinants among school-going adolescents in a middle-income country: A cross-sectional study," *BMC Public Health*, 19, 1177.

Vickrey, W. (1945): "Measuring Marginal Utility by Reactions to Risk," *Econometrica*, 13, 319–333.

Vigne, J. D., I. Carrere, F. Briois, and J. Guilaine (2011): "The early process of mammal domestication in the Near East," *Current Anthropology*, 52, S255–S271.

Voigtländer, N. and H. J. Voth (2012): "Persecution perpetuated: the medieval origins of anti-Semitic violence in Nazi Germany," *The Quarterly Journal of Economics*, 127, 1339–1392.

Voors, M. J., E. E. M. Nillesen, P. Verwimp, E. H. Bulte, R. Lensink, and D. P. Van Soest (2012): "Violent Conflict and Behavior: A Field Experiment in Burundi," *American Economic Review*, 102, 941–964.

Weber, E., C. Hsee, and J. Sokolowska (1998): "What Folklore Tells Us about Risk and Risk Taking: Cross-Cultural Comparisons of American, German, and Chinese Proverbs," *Organizational Behavior and Human Decision Processes*, 75, 170–186.

Weber, E. U., A.-R. Blais, and E. Betz (2002): "A Domain specific risk-attitude scale: Measuring risk perceptions and risk behaviors," *Journal of Behavioral Decision Making*, 15, 263–290.

Xue, M. (2019): "High-Value Work and the Rise of Women: The Cotton Revolution and Gender Equality in China," Revise and Resubmit, Review of Economic Studies.

Zalloua, P. and E. Matisoo-Smith (2017): "Mapping Post-Glacial expansions: The Peopling of Southwest Asia," *Scientific Reports*, 7, 40338.

Zhang, R., T. J. Brennan, and A. W. Lo (2014): "Variety Is the Spice of Life: Irrational Behavior as Adaptation to Stochastics Environments,” Technical Report, MIT Laboratory for Financial Engineering, Cambridge, MA.

# 8 Appendix

## 8.1 Matching Procedure

- Manually corrected ethnicity names and disentangled from country name
  - e.g. BY: Belorussian – Byelorussians
- Manual direct match with ethnographic data
- Manual indirect match based on old original names and/or language/dialect name within language family defined by Glottolog
  - e.g. Gheg Albanian – Gheg, Oyo Yoruba – Yoruba
- Glottolog database classification (Max-Planck-Institut für evolutionäre Anthropologie): Languages are classified into 243 families and 189 isolates, i.e., one-member families.

## 8.2 Definition of movers and Differential selection into migration

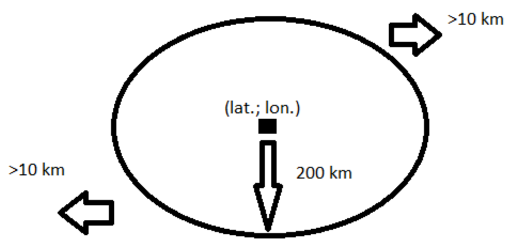



Figure 10: Definition of movers

| | Smoking_habits | Health_insurance | Contraception_use |
|---|---|---|---|
| Nomadic | 0.038** | -0.086** | -0.013* |
| | 0.013 | 0.035 | 0.006 |
| Geomover_nomad | 0.01 | -0.011 | -0.05 |
| | 0.017 | 0.007 | 0.031 |
| All Controls | Yes | Yes | Yes |
| Region FE | Yes | Yes | Yes |
| Time FE | Yes | Yes | Yes |
| # of obs | 211990 | 202768 | 331344 |
| # of regions | 403 | 403 | 403 |
| # of ethnicities | 332 | 332 | 332 |

Table 16: Differential Selection into migration

## 8.3 Summary Statistics

| Variable | Obs | Mean | SD | Min | Max |
|---|---|---|---|---|---|
| Nomadic Lifestyle | 59,004 | 0.15 | 0.35 | 0 | 1 |
| Willingness to Take Risks | 59,004 | 0.16 | 0.37 | 0 | 1 |
| Value Job Security | 26,350 | 0.74 | 0.44 | 0 | 1 |
| Feel Secure | 28,476 | 0.80 | 0.40 | 0 | 1 |
| Male | 59,004 | 0.48 | 0.50 | 0 | 1 |
| Has Partner | 59,004 | 0.59 | 0.49 | 0 | 1 |
| Number of Children | 57,791 | 1.84 | 1.80 | 0 | 8 |
| Highest Education Level | 53,161 | 4.95 | 2.12 | 1 | 8 |
| Religion Code | 60,212 | 26.72 | 13.79 | 1 | 53 |
| Age | 59,004 | 39.93 | 15.97 | 15 | 98 |
| Unemployed | 59,004 | 0.09 | 0.29 | 0 | 1 |
| Income Decile | 55,152 | 4.80 | 2.30 | 1 | 10 |
| Financial Satisfaction | 59,004 | 0.31 | 0.46 | 0 | 1 |
| Life Satisfaction | 59,004 | 0.46 | 0.50 | 0 | 1 |
| Middle Class Identification | 59,004 | 0.53 | 0.50 | 0 | 1 |
| Second-Generation Immigrant | 60,212 | 0.03 | 0.17 | 0 | 1 |
| Marital Status Code | 52,408 | 3.69 | 2.54 | 1 | 7 |
| Domestic Organization Code | 52,408 | 4.53 | 2.25 | 1 | 8 |
| Crop Production Type | 52,408 | 4.85 | 0.62 | 1 | 6 |
| Mean Community Size | 52,408 | 7.72 | 1.30 | 1 | 9 |
| Social Hierarchy Level | 52,408 | 2.01 | 0.82 | 1 | 4 |
| Belief in God Level | 52,408 | 3.60 | 1.00 | 1 | 5 |
| Competitive Games Score | 52,408 | 5.45 | 0.80 | 1 | 6 |
| Animal Husbandry Type | 52,408 | 5.84 | 0.71 | 1 | 7 |
| Subsistence Strategy | 52,408 | 4.78 | 0.73 | 1 | 7 |
| Class Stratification Level | 52,408 | 4.33 | 1.23 | 1 | 6 |
| Slavery Presence | 52,408 | 1.69 | 0.95 | 1 | 4 |
| Inheritance System | 52,408 | 6.17 | 1.60 | 1 | 8 |
| Rigid Society Indicator | 52,408 | 1.97 | 0.17 | 1 | 2 |
| Mean Temperature | 52,408 | 7.76 | 10.57 | -14.05 | 27.35 |

Table 17: WVS Summary Statistics

| Variable | Obs | Mean | SD | Min | Max |
|---|---|---|---|---|---|
| Smoking Habits | 211,990 | 0.58 | 0.23 | 0 | 1 |
| Use of Contraception | 500,999 | 0.67 | 0.47 | 0 | 1 |
| Has Health Insurance | 204,104 | 0.04 | 0.19 | 0 | 1 |
| Nomadic Lifestyle | 500,999 | 0.14 | 0.35 | 0 | 1 |
| Female Gender | 500,999 | 0.13 | 0.34 | 0 | 1 |
| Age | 500,999 | 29.43 | 10.05 | 13 | 91 |
| Place of Residence | 500,999 | 1.39 | 0.49 | 1 | 2 |
| Years of Education | 292,981 | 10.59 | 3.56 | 1 | 20 |
| Religion Code | 433,703 | 61.84 | 22.75 | 1 | 119 |
| Household Size | 493,085 | 6.39 | 3.43 | 1 | 20 |
| Occupation Code | 484,749 | 21.03 | 11.11 | 1 | 38 |
| Wealth Group | 271,661 | 3.07 | 1.45 | 1 | 5 |
| Marital Status Code | 498,675 | 4.97 | 1.83 | 1 | 8 |
| Has Bank Account | 409,931 | 2.95 | 1.49 | 1 | 6 |
| Moved in Life | 433,872 | 0.52 | 0.50 | 0 | 1 |
| Marital Code | 494,369 | 2.27 | 2.01 | 1 | 7 |
| Domestic Organization Code | 492,007 | 5.39 | 2.52 | 1 | 8 |
| Crop Production Type | 482,097 | 5.71 | 0.66 | 1 | 6 |
| Mean Community Size | 348,437 | 5.88 | 2.33 | 1 | 8 |
| Social Hierarchy Level | 487,439 | 2.93 | 0.64 | 2 | 4 |
| Belief in God Level | 399,938 | 2.73 | 1.24 | 1 | 4 |
| Competitive Games Score | 181,950 | 7.17 | 1.41 | 2 | 8 |
| Subsistence Strategy | 494,369 | 6.23 | 0.94 | 1 | 9 |
| Class Stratification Level | 462,953 | 3.39 | 1.59 | 1 | 5 |
| Slavery Presence | 477,497 | 1.96 | 0.68 | 1 | 3 |
| Inheritance System | 453,114 | 5.34 | 1.58 | 1 | 7 |
| Change in Precipitation | 353,696 | -5.24 | 22.78 | -249.76 | 126.95 |
| Change in Aridity | 353,696 | -2.25 | 7.76 | -96.41 | 39.63 |
| Change in Mean Temperature | 353,696 | 0.52 | 0.31 | -0.88 | 1.65 |
| Drought Frequency | 283,347 | 4.91 | 2.48 | 1 | 10 |
| Change in Vegetation | 353,696 | 112.76 | 178.21 | -749.20 | 1326.67 |
| Change in Malaria Risk | 353,696 | -0.11 | 0.13 | -0.56 | 0.29 |
| Nighttime Light Intensity | 350,264 | 3.73 | 9.70 | 0 | 118.97 |
| Proximity to National Borders (m) | 350,848 | 77,985.40 | 85,857.12 | 5.41 | 571,976.60 |
| Proximity to Water Bodies (m) | 350,848 | 109,552.80 | 115,293.10 | 0 | 798,912.50 |
| Change in Rainfall | 353,696 | -47.03 | 304.94 | -3191.27 | 1208.30 |
| Terrain Roughness Index | 350,054 | 1.49 | 2.14 | 0 | 22.80 |

Table 18: DHS Summary Statistics

## 8.4 The proof of Equation 1.1

The amount of descendants of type $p$ in generation $G$ comprises to the summation of all descendants from the people of this type in the previous generation $G-1$.

$$g_G^p = \sum_{i=1}^{g_{G-1}^p} q_{i,G}^p = \delta \sum_{i=1}^{g_{G-1}^p} z_{i,G}^p + (1-\delta) \sum_{i=1}^{g_{G-1}^p} y_{i,G}^p = \delta(z_{A1,G} \sum_{i=1}^{g_{G-1}^p} I_{i,G}^p + z_{A2,G} \sum_{i=1}^{g_{G-1}^p} (1 - I_{i,G}^p) + \tag{9}$$

$$+(1-\delta)(\sum_{i=1}^{g_{G-1}^p} I_{i,G}^p y_{A1,i,G} + \sum_{i=1}^{g_{G-1}^p} (1 - I_{i,G}^p) y_{A2,i,G}) \tag{10}$$

Since the amount of descendants is infinitely increasing, applying the Law of Large Numbers produces the following:

$$g_G^p \overset{\rho}{=} g_{G-1}^p(\delta(pz_{A1,G} + (1-p) * z_{A2,G}) + (1-\delta)(p\mathbb{E}_y[y_A 1] + (1-\delta)\mathbb{E}_y[y_A 2] = \tag{11}$$

$$= g_{G-1}^p(\delta(pz_{A1,G} + (1-p) z_{A2,G}) + (1-\delta)(p\mathbb{E}_y[y^p]) \tag{12}$$

Without much loss of generality, it can be assumed that $g_0^p$ =1. Using backward recursion, the next step is the following:

$$g_G^p \overset{\rho}{=} \prod_{G=1}^{p} (\delta(pz_{A1,G} + (1-p) z_{A2,G}) + ((1-\delta)(\mathbb{E}_y[y^p]) \tag{13}$$

Applying the Law of Large Numbers and logs:

$$\frac{1}{G} log(g_G^p) \overset{\rho}{=} \frac{1}{G} \sum_{G=1}^{G} log(\delta(pz_{A1,G} + (1-p) z_{A2,G}) + (1-\delta)\mathbb{E}_y[y^p]) \xrightarrow{\rho} \tag{14}$$

$$\xrightarrow{\rho} \mathbb{E}_z[log(\delta z^p + (1-\delta)\mathbb{E}_y[y^p])] \tag{15}$$

Equation 1.15 is the same as Equation 1.1 as was intended to be proven.