Journal of Economic Growth
https://doi.org/10.1007/s10887-025-09253-7

Cultural doorways in the barriers to development

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Accepted: 8 March 2025

Abstract
We develop novel indices of cultural similarity among ethnic groups derived from their oral traditions. We find that variation in these indices significantly affects currently observed pairwise disparities in income per capita, even after controlling for measures of geo-climatic, historical, religious, and linguistic barriers. We also propose an empirical exploration of the mechanisms linking folklore similarities to income differences. These findings lend support to the relevance of knowledge, information and technological transfers across people and societies in the diffusion of development.

Keywords Orality · Culture · Narratives · Cultural diffusion · Development

JEL Classification J15 · Z10

Multa sunt dicta ab antiquis de [...] rebus humanis. A lot has been said about [...] human affairs by our ancestors.
Cicero, De finibus bonorum et malorum, Liber V..

1 Introduction

Over the past two decades, a growing body of literature has emerged to investigate the historical origins of the disparities in economic development across nations and ethnic groups (Galor, 2011, 2022; Spolaore & Wacziarg, 2013; Nunn, 2020). Extensive empirical

We would like to thank the editor, Oded Galor, for guidance and insights. We would also like to thank Antonio Acconcia, Alberto Bisin, Mario Carillo, Klaus Desmet, Vincenzo Galasso, Oded Galor, Claudio Gigante, Andrea Ichino, Giovanni Immordino, Tullio Jappelli, Marc Klemp, Sergio Marotta, Eugenio Mazzarella, Stelios Michalopoulos, Massimo Morelli, Ugo Pagano, Enrico Spolaore, Alessandro Tarozzi, Melanie Meng Xue, Romain Wacziarg, three anonymous referees, and several seminar participants, for helpful comments and suggestions. All remaining errors are ours only.

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evidence has highlighted the relationships between contemporary variations in economic performance and modern or ancient traits and characteristics of populations (Galor, 2022). Several complementary explanations have been proposed for the historical roots of these disparities, and for the reasons behind their persistence, ranging from the role of legal or political institutions (Porta et al., 2008; Daron et al., 2001) and of geographic and environmental factors (Sachs, 2001; Alesina et al., 2013; Galor & Ozak, 2016) (Durante and Buggle, 2021), to the importance of population diversity (Ashraf & Galor, 2013), of modern post-1500 migrations (Putterman & Weil, 2010), of the barriers to the diffusion of knowledge and technology (Spolaore & Wacziarg, 2009), and of vertically transmitted cultural traits at the individual, lineage or ethnic group level (Algan & Cahuc, 2010; Spolaore & Wacziarg, 2013).

In this paper we empirically investigate the role of shared cultural heritage in economic development, with culture defined as the result of a process of information transmission through social learning (Boyd & Richerson, 2005) and of accumulation of knowledge across generations (Cavalli-Sforza, 2001). Our first contribution is the development of two novel indices of cultural similarity based on folklore, that is on the narratives that constitute the oral tradition of an ethnic group. Our second contribution is to provide evidence on the relationship between folklore similarity and differences in socio-economic outcomes, together with evidence on the transmission mechanisms. Our findings underscore the role of cultural diffusion as a mechanism for knowledge transfer (Spolaore and Wacziarg (Spolaore & Wacziarg, 2009)(SW henceforth), linking folklore similarities to income disparities.

The idea of constructing measures of cultural similarity based on folklore is rooted in the growing consensus that folklore provides valuable insights into the cultural history of ethnic groups[1] (Michalopoulos & Xue, 2021) (MX henceforth.) (Bortolini et al., 2017) and the episodes of cultural exchange between them.[2] Our source of information for folklore is the catalog and the database assembled by Yuri Berezkin, which was recently introduced to economics and validated by MX. The unit of analysis of the catalog is a *motif*, defined as “any episode or image [...] that are registered in at least two, but usually many more, distinct traditions” (Berezkin 2015, p. 37). More specifically, the motifs are abstract descriptions that include the main features, or combinations of features (images, episodes, or sequence of episodes), found in a large collection of folktales and traditional stories, and subject to replication.[3] Starting from the motifs descriptions in the folklore catalog, we

[1] Notice that the most common definition of folklore among ethnographers is close to the most common definition of culture among anthropologists and evolutionary biologists, i.e. in terms of oral knowledge that an ethnic group “has experienced, learned and practiced across the ages as popular and traditional knowledge” (Leach 1959, p. 257). Thus ethno-anthropologists, quite unanimously, consider oral culture as a collection of traits forming the identity of the group, that is vertically preserved at the group level and horizontally transmitted across them. Importantly, within-group cultural variation is generally thought to play a less relevant role, and it cannot be accurately observed, especially for the case of ancient cultures.

[2] We build on Berezkin’s focus on the “replication of forms that can be borrowed from culture to culture [...] to reveal the particular and, to some degree, random peculiarities of processes such as migrations and cultural contacts” (Berezkin 2015, pp. 34-35).

[3] In ethnography and folklore studies, a motif is defined as a recurring thematic element, narrative pattern, or symbolic feature in oral traditions, myths, legends, or folktales that serves as a building block for storytelling. Motifs are conceptual units that can appear independently or as part of a larger narrative structure. Motifs are used as tools for comparative studies of oral traditions, helping researchers identify shared cultural elements, trace their distribution, and analyze the mechanisms of cultural transmission, such as diffusion or inheritance. See Appendix for further details.

compute indices of folklore similarity to evaluate the extent of cultural contact and information exchange between ethnic group pairs, which we denote *Cultural Doorways*. A distinctive feature of folklore is its universal accessibility within societies; unlike specialized technical knowledge or literature, folklore is shared broadly across all members of a community, regardless of social role (Ong, 2002). As such, cultural doorways reflect similarities in "popular" culture, transmitted orally within families and across groups.

As a historical example of cultural doorways, consider how interactions between different groups have shaped cultural identities and distinctions. A classic case involves the Etruscans and Romans, who reconnected long after their genetic and linguistic divergence. This renewed contact led the Romans to adopt several Etruscan cultural practices, such as Aruspicina.[4] Similarly, cultural exchange occurred between the Romans and Greeks. Initially, this took the form of Greek migration and colonization along the southern Italian coast. Over time, it evolved into a deeper demographic and cultural integration ("*Grecia capta ferum victorem cepit*" - A militarily defeated Greece culturally conquered its fierce victor). This intense process of trade, conflict, and cultural blending erased the original genetic and linguistic differences within a few centuries, ultimately merging the two groups into a unified identity as the "Populus Romanus".

More broadly, historians and researchers across various disciplines have documented the significant role of cultural exchanges among populations since ancient times (Bentley, 1993; Curtin, 1984; McNeill & McNeill, 2003). Theoretical studies, such as those by Boyd and Richerson (2005), emphasize the importance of these exchanges in shaping socio-economic structures and facilitating technological transfers. For example, extensive historical and archaeological evidence link shared cultural traits among ancient groups to advancements in agronomy, pottery production and decoration, metallurgy, naval engineering, and navigation techniques.[5]

Our first index of folklore similarity uses Latent Semantic Analysis (LSA) to measure the textual similarity of the motifs, to account for the possibility of a shared oral tradition in slightly different text variants. The second index focuses on the relative importance of specific themes within the oral tradition, identified using a rich set of keywords or tags found in the motifs, to account for the possibility of different stories with a similar content.

Both indices broadly measure cultural relatedness between populations, akin to linguistic, religious, and genetic distances, which have been extensively studied in economic literature, as in SW. However, although these markers are correlated, they capture different aspects of historical cultural evolution, reflecting distinct events, transmission mechanisms, and rates of diffusion.[6] For example, genetic distance is considered "[...] a direct proxy of the movement of human groups over time and space, and as such, used as a potential marker of demic mechanisms" (Bortolini et al. 2017, p. 9143), including migration and

[4] Fortunetelling made by priests, named Aruspices, using inner organs of sacrificed animals.

[5] For the demic diffusion of the ancient technological breakthroughs see for example Cavalli-Sforza and Menozzi (1993). In particular Table 1, p.645. For the role of social learning in shipbuilding techniques, see Gould (2011). For the role of cultural diffusion in the spread of pottery technologies among hunters and gatherers populations, see Peter et al. (2016). For a general account of the role of demic versus cultural diffusion of ancient technical breakthroughs, see Fort (2015) and (Joaquim et al., 2018).

[6] See Cavalli-Sforza (2001) for a general discussion. For a very brief summary of the issue about whether or not languages and genes share the same cultural evolutionary history, see Greenhill (2021).

admixture. In contrast, folklore similarity is more closely associated with horizontal cultural transmission between groups.[7]

Our analysis reveals that geographic, genetic, linguistic, and religious distances, along with migratory distance from East Africa, explain only part of the variability in folklore similarity. This indicates that oral traditions carry unique information about cultural diversity, which is potentially important to explain differences in socio-economic outcomes. For example, we observe genetically similar ethnic groups with little shared folklore, as well as genetically distant groups with significant overlap in their oral traditions. Adapting SW's metaphor regarding genetic distance and family lineages, we find "brothers" (recently separated genetic groups) who feature little oral tradition in common, and "distant cousins" (more ancient separations) with a higher level of similarity. Similar patterns emerge for geographic, linguistic, and religious distances .

We seek to understand the unique informational content of folklore similarity, that is the origin of its large residual variability, unexplained by other measures of cultural and geo-climatic distance. Excluding the effects of demic processes and vertical transmission from a common ancestor, accounted for by genetic distance, the remaining explanations for the presence of similar oral traditions are convergent evolution and cultural diffusion. Convergent evolution, a term borrowed from evolutionary biology, refers to the independent emergence of similar motifs, in response to similar geo-climatic or ecological environments. However, as argued by Berezkin, convergent evolution is not a process that can explain large scale folklore similarities.[8] Therefore, we rely on Berezkin's hypothesis that the observed oral tradition similarity is a marker of episodes of cultural diffusion experienced by ethnic groups throughout their histories.[9] Thus, conditioning on geographic distances, climatic conditions, and traditional measures of ethnic separation and shared ancestry, our folklore similarity indices capture the historical processes of cultural diffusion. These processes involve individuals from different groups and cultures learning from one another through imitation, teaching, and other forms of social interaction, and subsequently transmitting this knowledge to future generations, which is what Boyd and Richerson (2005) define: "Cumulative cultural adaptation". This interpretation also supports the diffusionist theory (Newell, 1895), which posits that folktales spread through social contact, and it is in line with the empirical evidence emphasizing the role of cultural diffusion in the transmission of folktales (Tehrani, 2013).

Historically, cultural diffusion has resulted from both random variation and a wide range of forces, including trade diasporas, violent confrontations, mass pilgrimages, missionary activities, and explorations.[10] However, we lack historical data on these events that

[7] The central tenet in the lifetime work of Cavalli Sforza (and coauthors) is that genetic distances represent the main marker for the reconstruction of the demic channel for the study of the historical spread of technological innovations due to mass migrations. The main working hypothesis by archaeologists and anthropologists who study the spread of ancient technologies is that the similarity of cultural traits is to be considered as a marker of cultural transmission, as in Bortolini et al. (2017), who also rely on folktales.

[8] "A multiple emergence of specific motifs is rare, and the formation of whole sets of similar motifs in areas that do not exchange information regularly looks practically impossible." (Berezkin, 2023, p. 305). This assertion has also been corroborated in many historical cases studies he investigated.

[9] Cultural diffusion refers, instead, to a process of horizontal transmission through which a motif originating in one group, or some important elements of it, has been transmitted and preserved, in the form of more or less similar variants, in the oral tradition of another group.

[10] Curtin (1984) provides a detailed account of the role of trade diasporas as a major form of cross-cultural trade in global history. One characteristic he highlights is how, after ancestral groups started organizing their social lives in cities, the most common institutional organization form of long distance trade was that of settlement of commerce specialists in a foreign town important for the economy of the host commu-

would allow for a detailed quantitative analysis. The key assumption underlying our empirical strategy is that the myriad of historical episodes and shocks shaping oral traditions at the ethnic group level can be considered exogenous with respect to current differences in income per capita.

We find that oral tradition similarity is statistically associated to smaller differences in income per capita, both in a cross section of country pairs and in a cross section of ethnic group pairs. The empirical challenge we face in the country pairs regressions is the need to aggregate our ethnic-group level measures of folklore similarity at the country level, with a country ethnic composition (i.e. the population shares by ethnic groups) that is potentially endogenous to income differences because of, among others, mechanisms of selective migration. To overcome this issue, which is in fact common in the literature, we borrow the empirical strategy by SW, using, as an instrument, folklore similarities between the pre-1500 dominant ethnic groups, that is between the most important ethnicity in the country before the great migrations of the modern era. We show that our main result is robust to the inclusion of various measures of geographic distances and after accounting for a large set of potential confounders, including: the commonality of exogenous shocks faced by the ethnic groups, such as the exposure to eclipses, earthquakes, and to similar climatic conditions, that further control for the possibility of convergent evolution; the similarity of out-of-Africa migration patterns; the similarity of production modes; country or ethnic groups fixed effects.

We then turn to the investigation of the empirical evidence about the mechanisms linking folklore similarities to income differences. First, in line with the work of MX, we document a robust empirical relationship between similarities in oral traditions and similarities in contemporary cultural traits, as they emerge from the World Values Survey. This we take as evidence that narratives traveled together with beliefs, customs, habits and preferences. Along similar lines, we find that folklore similarity is associated with a specific cultural behavior: fertility choices emerging from cultural traits or preferences. Second, in line with the barrier interpretation of cultural differences in SW, we show that folklore similarities are associated to the diffusion of technology. More specifically, we find that: countries that share folklore are more likely to adopt similar technologies and are more likely to share patents; FDI are more likely among countries with similar folklore; relative cultural distances from the technological frontier predict relative distances in GDP. Moreover, we also find that cultural similarity to the poorest countries predicts similarity in GDP per capita, which we interpret as evidence of the presence of cultural roots of poverty traps due to "Mal-adaptation", i.e. the reliance on disfunctional information exchange (Boyd & Richerson, 2005). Third, using information from the World Management Survey, we show that folklore similarities predict similar management practices, a specific technology that is influenced by cultural aspects and which, being an essential part of the production technology of an economy, explains long-run growth (Bloom et al., 2016).

In the last part of the analysis we study the relevance of specific subsets of folklore motifs. The empirical approach consists in computing disaggregated measures of folklore

Footnote 10 (continued)

nity. Trade diaspora did not necessarily imply a permanent settlement of people in a foreign country, but it always involved important linguistic, religious and cultural exchanges. In botany the term diaspora refers to the scattering of the seeds on the terrain due to meteorological forces. See Bentley (1993) for a detailed history of cultural encounters enshrined in the diffusion process of religious traits in Eurasia, and its relationship with trade and conflicts.

similarity based on subsets of motifs in the folklore catalog, with subsets obtained with various classification criteria, including: the expert classification proposed by Berezkin, a classification of themes reproduced from the Ethnographic Atlas, a novel classification based on motif diffusion, both in terms of number of groups that share the motif and in terms of the geographical area of the World in which the motifs are found.

The rest of the paper is organized as follows: Sect. 2 offers a discussion of the relationship with the literature; Sect. 3 illustrates the details of the construction of our indices of folklore-based cultural similarities and discusses the resulting measures; Sect. 4 summarizes the empirical strategy and the main results; Sect. 5 discusses the robustness of these results; Sect. 6 discusses the mechanism linking folklore similarities to income differences; Sect. 7 proposes several disaggregations of the folklore similarity measures; Sect. 8 concludes. A companion appendix features several details on the construction of the measures of folklore similarity, a simple model of cultural evolution, and further robustness checks.

2 Related literature and contribution

We build on the seminal work by MX, who introduced the Berezkin catalog to economics. Given the pairwise structure of the elementary observational units- the motifs- in the Berezkin catalog, we adopt the bilateral regression framework of SW to investigate the role of cultural doorways in comparative economic development. Our contribution extends their analysis by focusing on an additional dimension of between-group variation, the sharing of oral traditions, while using genetic distance as a control for separation shocks. These latter shocks account for demic processes, including ancient local migrations, intermarriages, and broader patterns of genetic and cultural admixture. For an in-depth discussion of the interplay between demic and cultural transmission channels and the biological basis for using genetic distances to measure population admixture,[11] we refer to Cavalli-Sforza (2001).

Bortolini et al. (2017) document a relationship between the geographic distribution of ancient folktales in Eurasia and Africa and the distribution of genetic markers, showing that both demic and non-demic cultural diffusion processes contribute to cultural similarities. Building on their work, we demonstrate on a larger dataset that differences in folktales significantly influence currently observed disparities in income per capita. Our research also connects to the phylogenetic analysis of myths, as explored in studies by Tehrani (2013), d'Huy (2013, 2016), and Thuillard et al. (2018).

A recent study by Galor et al. (2023) identifies a "Founding Fathers" effect for folklore, linking out-of-Africa migrations to variations in folklore motifs in the Berezkin catalog. While their focus is on ancient migrations, we emphasize cultural diffusion, making our analyses complementary. We control for common ancient migratory patterns to isolate the specific impact of shared oral traditions on income per capita. Additionally, an independent study by Asanov et al. (2020) also reports a relationship between folklore similarities and income differences. However, we contribute more detailed measures by considering motif variants, by employing a different empirical strategy that accounts for the demic channel of

[11] It is important to notice that, as a molecular clock, genetic distances measure time from separation, whereas in force of the arguments provided in the Introduction, our folklore based measures of cultural similarity, represent a measure of the intensity of cultural exchanges in the history of the ethnic groups.

cultural diffusion, and by offering a comprehensive discussion of the mechanisms linking cultural similarities to income disparities.

Blouin and Dyer (2023) propose a measure of cultural diffusion based on loanwords (words borrowed from one language into another). Unlike our measure, which relies on ancestral oral traditions and reflects ancient interactions, loanwords capture the full spectrum of relationships between populations-both historical and contemporary. This broader scope introduces potential endogeneity to current income differences. Blouin and Dyer (2023) also report a positive correlation between loanword adoption and folklore similarity, which we interpret as evidence of persistent cultural ties between populations. Similarly, Cao et al. (2021) find a link between reliance on pastoralism and the prominence of motifs related to vengeance and violence in folklore.

More broadly, our research is related to the literature that examines the connections between economic, social, and political outcomes and cultural differences (e.g., (Guiso et al., 2006; Burchardi et al., 2018)) as well as the historical roots of economic development (e.g., (Nunn, 2020)). Our unique contribution lies in providing a new measure and evidence of the role of historical traits embedded in oral traditions. Additionally, our measure of cultural similarity, rooted in the historical forces shaping group identity and intergroup distances, offers valuable insights into the persistence, evolution, and transformation of cultural identities (Giuliano & Nunn, 2021; Daron & Robinson, 2021; Bisin & Verdier, 2023).

3 Measuring cultural similarity with folklore

We propose and describe two novel measures of cultural similarity between ethnic groups and countries based on their oral traditions, using textual similarity and content extraction. We preliminarily describe the the main features of the Folklore Catalog by Yuri Berezkin (Sect. 3.1) that is our data source, then we briefly describe the baseline measure of folklore similarity used in the literature (3.2), and then spell out the details of the construction of the two indices of folklore similarity that we developed (Sects. 3.3 and 3.4). Next, we illustrate the results of the computations (Sect. 3.5) and the relationship with other measures of relatedness between populations, together with a discussion of the informational content of folklore similarity (Sect. 3.6). Finally, we discuss the issue of aggregation of our measures at country-level (Sect. 3.7).

3.1 The folklore catalog

The starting point of our analysis is the folklore catalog assembled, over decades, by Berezkin (2015), and introduced to economics by MX.[12] The raw data from which the catalog is constructed from a vast collection of traditional stories and folktales that make up the oral traditions of 957 ethnic groups around the World, with ethnic groups defined along linguistic lines.[13] Berezkin's research effort consists in identifying, within the stories, the

[12] Some other comparative mythology studies employ the Thomson's catalog, whose coverage is however smaller with respect to Berezkin's, as discussed in Thuillard et al. (2018).

[13] The coverage of the catalog is quite high. In fact MX use the folklore catalog to fill gaps in the ethnographic records, i.e. to supplement the missing information in the Ethnographic Atlas. For the ethnic groups classification along linguistic lines, see MX, p.2000. As a further check for the classification criterion used by Berezkin for ethnic groups, we computed linguistic distances (see infra) between all ethnic groups pairs

so-called *Motifs*, defined as images, narrative episodes, plots, or group of characters found in two or more traditions. Thus the motifs contain all the structurally important elements of a story that enter the oral traditions through "Replication Units", and abstract from details. The folklore database is then simply arranged as a binary matrix (ethnic groups × motifs) with entries equal to one in case the motif is found in the oral tradition and zero otherwise.[14] In total, the catalog lists 2564 of such motifs, and also contains a description of each of them. As analytical units, these motifs can be simple or complex textual structures made of text strings. As such they can be further analyzed using the tools from text analysis: these we propose to use in order to uncover similarities between them. In the following we describe the details of our procedure, that is indeed consistent with Berezkin's own idea of feasible improvements upon the binary structure of the catalog constructed around motifs.[15] Figure 1 summarizes the logical steps involved in the extraction of information from oral traditions and stories as texts.

Although the folklore catalog is about oral traditions, its source material is written text. However, folklore fundamentally differs from written traditions, such as literature or technical and scientific knowledge, which are also vertically transmitted. Folklore, as an integral part of a group's cultural identity, is shared by all members of a society regardless of their literacy or functional role. It is a common heritage equally embraced by farmers, artisans, clerks, merchants, warriors, and scholars alike (Ong, 2002), encompassing both the general populace and societal elites.[16] A notable feature of folklore, tied to its popular nature, is its persistence. Within families, stories are often passed down through generations, largely unaffected by the broader social or political context. This enduring quality ensures that folklore remains a vital component of cultural identity.

The sources used to construct the catalog document the existence of shared motifs across oral traditions. Instead, they do not systematically indicate the time when these motifs first emerged or were exchanged. Given the nature of folklore, it is presumed that such narratives originated in the distant past as a mean to convey accumulated knowledge to future generations-teaching them how to navigate their environment, resolve conflicts, and uphold moral values or, in short,[17] "maintaining the stability of culture" (Bascom, 1954).

In terms of geographic coverage of the catalog, 290 ethnic groups, accounting for 30% of the sample, are located in Asia, 250 in North America (26%), 165 in South

Footnote 13 (continued)

in the catalog, finding that they are equal to zero only for 3 out of 457446 pairs: Gujarati and Rajasthani, Hindhi and Sindhi-i and Tujia and Lisu.

[14] Note that, for a given tradition, more than one folktale can be mapped into the same motif. This can happen when local or regional variations of the same story exist within a linguistically and culturally homogeneous group. So the construction of the catalog involves some aggregation at the level of the ethnic group. See the appendix for further details.

[15] "No fixation of a story or a description of cosmological ideas is an exact copy of any other. Even minor differences between variants can become important in light of further research. The mapping of such details in the global, regional or local scale can reveal regularities crucial for understanding of different historical processes" (Berezkin 2023, p. 305).

[16] See Bisin and Verdier (2023, 2024)) for a theoretical model of the interactions between the elites and the civil society.

[17] See Bascom (1954) for a more detailed discussion on the functions of folklore: education, especially in non-literate societies; culture validation, in the sense of justifying institutions and rituals; enforcement of conformity, with respect to the socially accepted behaviors; escape in fantasy from the repressions imposed by society.

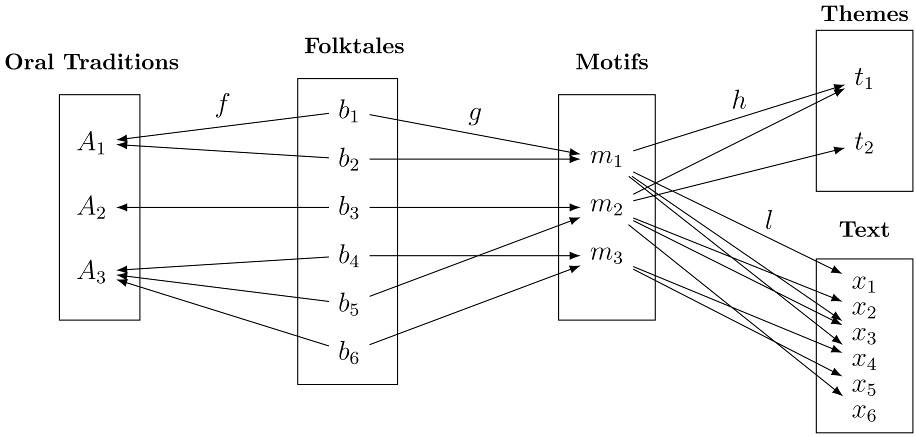

Fig. 1 Oral traditions, folktales, motifs, themes, and text. Oral traditions coincide with ethnic groups, defined along linguistic lines. Motifs are "any episode or image [...] that areregistered in at least two, but usually many more, distinct traditions". Starting from written sources, folktales are assigned tooral traditions (operator f) and mapped into motifs (operator g) by the ethnographer. Themes are identified using keywords inthe motifs (operator h). Text is extracted using Latent Semantic Analysis (operator l). See Sects. 3.1, 3.3 and 3.4 for a fulldescription of the mappings

America (17%) , 143 in Africa (15%), 54 in Europe (5.6%) and the rest in Oceania (6.4%). At a finer geographic disasggregation, in descending order of importance: 142 ethnic groups (14.8% of the total) have ancestral location or centroid within the modern-day boundaries of the US, like the Cherokee and the Cheyenne; 81 within Russia (8.5%), like the Tatars and the Ossetians; 59 within Brazil (6.2%), like the Paresi and the Kamaiura; 53 within Canada (5.5%), like the Ojibwa and the Ottawa; 46 within India (4.8%), like the Kashmiri and the Gujarati; 36 within Mexico (3.76%) , like the Zapotec and the Itza; 31 within China (3.2%), like the Uyghur and the Evennki; 27 within Indonesia (2.8%), like the Aceh and the Sumbawa, and within Colombia, like the Choco and the Guajiro; 24 within Perú (2.5%), like the Kechua and the Ticuna; 17 within the Democratic Republic of the Congo (1.8%), like the Bemba and the Mbuti; 12 within Papua New Guinea (1.25%), like the Sepik-Ramu Papuans and the New Guinea Melanesians. The rest of the groups is scattered between 145 other countries, each of which has 10 or less ancestral ethnic locations within its borders. Figure 2 shows a map of the ethnic groups centroids.

In terms of the most represented linguistic families in the folklore catalog, 93 groups (9.7% of the total) speak Indo-European languages such as French, English and Dutch, and languages of the Niger-Kongo family such as Kru and Mande; 86 speak Austronesian languages (8.9%), such as Malay and Tagalog; 65 speak Altaic languages (6.8%) like Turkish and Manchu; 39 speak Afrasian languages (4.1%) like Egyptian and Berber; 28 speak Sino-Tibetan languages (2.9%), like Burmese and U-Tsang; 25 speak Uralic languages (2.6%), like Hungarian and Estonian; 22 speak Austroasiatic and Tupian languages (2.3%) like Khmer and Nicobarese. The remaining groups speak languages in other families such as the Quechua, the Arawak and the Macro-Ge. We refer to Berezkin (2015), and to MX, for further details, especially on the definition of ethnic groups and for summary statistics.

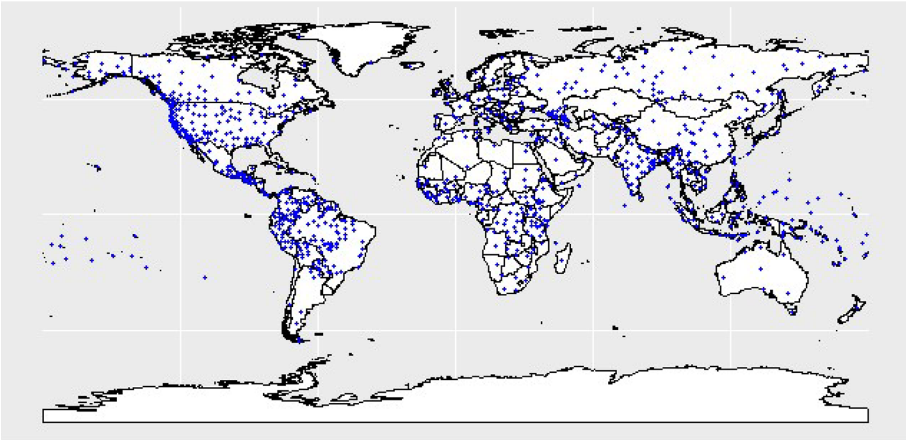

Fig. 2 Ethnic groups in the folklore catalog. Centroids of the ethnic groups covered in the Berezkin folklore catalogue

3.2 Folklore similarity: the jaccard coefficient

The baseline approach to measure folklore similarity (Bortolini et al., 2017; Asanov et al., 2020) entails the computation of the Jaccard coefficient of the catalog entries for each pair of ethnic groups. This is equal to the number of common motifs (cardinality of the intersection of the sets) divided by the total number of motifs that can be found in either one of the oral traditions (cardinality of the union):

$$J_{kl} = \frac{|M^k \cap M^l|}{|M^k \cup M^l|} \tag{1}$$

where $M^k = \{m_1, m_2, \dots, m_{N_k}\}$ is the set of motifs of the ethnic group k, $M^l = \{m_1, m_2, \dots, m_{N_l}\}$ is the set of motifs of the ethnic group l (shared with at least another ethnic group in the catalog), and $|M|$ is the cardinality of the set M, that is the total number of motifs that are coded in the catalog. The resulting coefficient is a number between zero and one, with one in case of a perfect overlap of the oral traditions, and zero in case of completely disjoint traditions.

As already discussed in Sect. 3.1, the binary nature of the folklore catalog, together with the possibility of similarities between the motifs, imply that the Jaccard coefficient can underestimate the true extent of oral tradition similarity between groups. We therefore propose two alternative approaches to measure folklore motif similarity based on text analysis, that we outline in the next sections.

3.3 Folklore similarity: cosine measure

The first new measure of folklore similarity that we propose is designed to account for textual similarities in motifs. It is based on Latent Semantic Analysis (LSA), a machine learning algorithm that measures text similarity on the basis of the context in which the words are used[18] (Deerwester et al., 1990).

Operationally, starting from the motifs descriptions in English, we produce a document-component matrix with 300 components obtained through singular value decomposition starting from the document-term matrix, that is the matrix that collects the occurrence of each word used in each motif[19] (motifs description in rows and words in columns). We then use cosine similarity of the component vectors, which is akin to a correlation coefficient, as a measure of motif similarity.[20] Folklore cosine similarity between ethnic groups is then computed as follows:

$$\chi_{kl} = \frac{1}{|M^k \cup M^l|} \sum_{i=1}^{N_k} \max_{m_j} \left[C(m_i, m_j) \right] \qquad |M^k| \leq |M^l| \tag{2}$$

where the function C is the cosine similarity of the components of the description of the motif pairs m_i, m_j. Therefore instead of summing dummies equal to one in case a motif is found in both oral traditions, as in the Jaccard coefficient, we sum the maximal cosine similarities of the motifs.[21] We normalize our measure for the total number of motifs in either one of the oral traditions to make our index comparable to the Jaccard.

To illustrate the computations with a simple example, take two ethnic groups both of which have 4 motifs, say $\{A, B, C, D\}$ for the first group, $\{A, B, E, F\}$ for the second. Suppose that the motifs C and E are very similar, with cosine similarity equal to 0.9, while D and F are not similar, so with cosine similarity 0. Suppose also that C and F are slightly similar, with cosine similarity 0.3, and that D and E are also slightly similar, with cosine similarity 0.1. Finally suppose that A and B are not similar to all others. The cosine measure of folklore similarity, in this example, is equal to $[1 + 1 + max(0.9;0.3) + max(0.1;0)]/6 = 3/6 = 0.5$. The Jaccard index of the two sets will instead be equal to $2/6 = 0.33$.

The empirical motivation to use this index is that, in the folklore catalog, there is a non-negligible number of textually similar motifs, whose content is almost indistinguishable from the perspective of the LSA algorithm.[22] For instance, take the motif m29p described

[18] See (Tonta & Darvish, 2010) for a study on the diffusion of the use of LSA in different fields, including: psychology, linguistics, biology and computer science. LSA is also used in finance and economics, to extract information, for instance, from corporate social responsibility reports, from the FED open market committee statements.

[19] The computations have been implemented in Stata using the Lsemantica package. See Iaria et al. (2018) for details. The original folklore catalog is in Russian, so the actual translation in English might cause some biases in this text analysis exercise. However, text analysis algorithms perform much better in English, which motivates our choice. Note that MX report also an alternative motif description obtained by using Google API, with a different wording. We also implemented the analysis from this alternative, finding similar results (not reported). We obtained similar results in the case where 200 or 400 components were chosen. See the appendix for further details. In the benchmark computations, we did not exclude stop-words to reduce the elements of discretionary in the computations. We discuss the robustness in appendix.

[20] Cosine similarity between vectors is the cosine of the angle that they form, equal to the scalar product of the vectors divided by the product of their lengths.

[21] Since two ethnic groups can share, at most, the number of motifs of the group that has less of them, when computing maximal cosine similarities we search over the oral tradition of the group with less motifs ($N_k \leq N_l$ in the example), even though our results are robust in case of a search over the oral tradition of the group with more motifs.

[22] Although the mean cosine similarity of the motifs (over all 3 million motif pairs) is small, 0.059, if we compute, for each motif in the catalog, the highest cosine similarity with respect to all other motifs, we have a median maximum cosine similarity of 0.447, with a about 10% of the distribution (250 motifs) above 0.7 and 1% of the distribution (25 motifs) above 0.974. Repeating the exercise for the second and third most

as: “A man is tricked by a Spider” and m29o described as: “A man is tricked by a Monkey”. They clearly describe similar situations of deceptions, although with different characters, which grants them but they are classified as different.

As a less extreme example, take the motif k33g, whose description reads: “One who eats certain fruit (leave, etc.) gets horns (long nose, etc.) or turns into an animal. After eating another fruit (leave) person recovers his or her normal body”, and motif f97: “After eating certain fruit, berry, tuber, etc. people become sexually aware”. Their cosine similarity is equal to 0.583: while these stories, and some of their implications, are different, they both share a similar structure and iconography, which however has not been considered enough to be associated to the same motif. This feature cannot be ignored in measuring folklore similarity. Along the same lines, take the motifs k27s: “Contest: a race” and m187: “Snail is a participant to the race and wins”. Their cosine similarity equal to 0.789 because they both the depict the same situation, although the latter adds substantive content which clearly identifies the stories as different.

3.4 Folklore similarity: content measure

Our second approach to measuring folklore similarity involves assessing differences in the average importance assigned to various themes/concepts/topics within the oral tradition. The rationale for using textual analysis to measure folklore similarity also provides arguments for examining the content of the motifs, rather than just their text: indeed, not only textual variants but also themes can travel between oral traditions as replication units. An additional conceptual justification for this measure is that different stories can convey similar messages or cultural values, even if their structural elements differ. This means that two ethnic groups can share a deeply interconnected cultural heritage, even if they lack many stories with similar textual elements.

Operationally, rather than introducing a new repertoire of themes, we use the same one proposed by MX in their analysis, and we build on their content extraction procedure on the motifs in Berezkin catalog. The procedure itself starts with the association of the folklore motifs to a large number of themes, based on the presence of keywords or tags in the motifs text, identified with the help of ConceptNet.[23] Next, the relative importance, or intensity, of a theme in the oral tradition of an ethnic group is measured as the ratio of the number of motifs associated with the concept over the total number of motifs. We measure folklore similarity, for ethnic group pairs, as one minus the absolute value of the differences in relative concept intensity, averaging over a large set of concepts without weights (all themes are assumed to be equally important). Algebraically we construct the following index of content-based cultural similarity:

$$\Theta_{kl} = 1 - \frac{1}{S}\sum_{s=1}^{S}\left|\frac{|N_s^k|}{|M^k|} - \frac{|N_s^l|}{|M^l|}\right| \tag{3}$$

Footnote 22 (continued)

similar motifs, we have, respectively, 1% of the distribution above 0.926 and 1% of the distribution above 0.82.

[23] ConceptNet is a resource designed to make human language interpretable to computers and that can use to let machine learning algorithms understand text. It mainly consists in the creation of vectors of word meanings (word embeddings). For further details see: https://conceptnet.io.

where $|N_s^k|$ is the total number of motifs in the folklore catalog of the ethnic group k associated by MX with the theme s (i.e. that contain a specific keyword or a tag) and S is the total number of themes. We start from the full list of themes published by MX based on ConceptNet, and discard conjunctions, adverbs, prepositions, pronouns etc., plus generic verbs (”go”, ”come”, ”see”, etc.). We also consolidate similarities (e.g. ”thought”, ”think”, ”thinking”) and stem some words so that singular and plurals, for instance, are treated as the same word. We end up with a list of about 1500 themes, among which we have: God, war, altruism, chief, slave, home, husband, education, hunt, beauty, painting and patience (full list available in the appendix). As an example of different motifs sharing an underlying theme, consider the following ones, associated with “Greed”: A132 whose description reads: “A stone swallows people”; L58: “A man does not share food with his wife or kinsfolk. He or his food is transformed (turns into a bird, into worms, etc.) in punishment”; m67: “Imprudent trickster produces wind that carries him away”.

By construction $0 \leq \Theta_{kl} \leq 1$. Values of Θ_{kl} close to one (small average absolute value of the differences in concept intensity) indicate that the two oral traditions assign the same importance to the same topics, whereas small values of Θ_{kl} (big average absolute value of the differences in concept intensity) means that the selected topics are prominent only in the oral tradition of one of two groups in the pair. As an illustrative example, consider two ethnic groups, one in which 50% of the motifs are about deceptions and 30% about god and supernatural beings, while for another group 50% about deceptions, 80% about god, and 40% about chivalry (Notice that the shares must not add up to one because the same motif is associated with more than one theme). The relative concept intensity measure of folklore similarity, in this example, is $1 - [\,|0.5 - 0.5| + |0.3 - 0.8| + |0.4 - 0|\,]/3 = 0.7$

It is important to note that featuring similar relative prominence of a theme for two oral traditions does not necessarily reflect the absolute importance of that theme in each group’s oral tradition. Indeed, a negligible difference in the relative prominence of a theme could occur both in the case where equally high and in the case where equally low importance are assigned in the two traditions to the theme. Additionally, a single motif is often associated with multiple themes.

This measure, which evaluates the similarity of two oral traditions based on the relative importance of various themes, could theoretically overestimate folklore similarity. For instance, two motifs on the same broad theme might convey entirely different messages and thus have different impacts on present-day outcomes. To illustrate, consider a hypothetical example: in one story, a hero fights and defeats an evil spirit through courage and determination, while in another, the hero dies in the same circumstances.[24] Both stories address themes such as bravery, altruism, and courage but convey opposite messages-one promoting bold action despite risks, the other advocating acceptance and avoidance of danger.

Despite this concern, there are three reasons why we believe this is not a fundamental issue for our analysis: (1) As previously noted, small variations in the same underlying story still indicate a shared heritage. Even if parts of the narratives have diverged, the thematic connections remain significant. (2) The large number of motifs in our dataset helps mitigate this issue by increasing the precision of the information, since the likelihood of two different motifs being associated with exactly the same themes decreases as the number of themes grows. (3) As discussed in Sect. 6.1, this measure of folklore similarity

[24] Another example, borrowed from the literature, is the Ulysses tale described by Dante, with a completely different ending with respect to the original Odyssey by Homer.

is empirically linked to responses from the World Values Survey, reflecting present-day norms, beliefs, and customs.

3.5 Folklore similarity in ethnic groups: results

We were able to construct folklore-based cultural similarity measures for a total of 457446 ethnic group pairs, starting from the 957 groups listed in the folklore catalog and used by MX in their analysis. Table 1 reports the summary statistics of the three indices, together with geographic distance. Table 2 reports the (un-weighted) average folklore similarities for the largest ethnic groups by population for each continent, along with the total number of motifs in the catalog for the group.[25] Figure 3 reports histograms and kernel density plots of the distribution of the indices in our sample. As expected, the empirical distribution of the Jaccard measure of folklore similarity is very skewed: many ethnic groups do not have many motifs in common, and in fact many of them do not share their folklore at all, although some groups have oral traditions that overlap considerably. Example of ethnic group pairs that share many motifs include the French and the Spanish (Jaccard coefficient equal to 0.501), the Russians and the Ukrainians (0.601), and the Bongo and the Nyangi, two Sub-Saharan African groups (0.667). Examples of ethnic groups who do not share motifs are, among others: the Hadza, mostly located in Tanzania and the Brahui, mostly located in southern India; the Italians and the Bongo (Sudan); the Berbers of Tunisia and the Lao of South-East Asia; the Manchu of China and the Dogon in Mali.

Comparing the Cosine similarity measure with the Jaccard coefficient, we observe that the former is larger on average and in median, with differences that are relatively more important for ethnic groups pairs with fewer motifs in common (left tail of the distribution of the Jaccard coefficient). In fact even the ethnic groups without motives in common share some of the textual elements of them, and this evidence emerges clearly from the comparison of the histograms. Examples include: the Tunisian Berbers and the Hadza (mostly from Tanzania), with zero motifs in common and a cosine similarity of 0.115, and the Five Nations Iroquios and the Chinook, two native American ethnic groups, with a 0.146 Jaccard and a 0.305 cosine similarity. Overall, the sample mean (0.114), median (0.111) and interquartile range [0.066;0.155] of the cosine similarity measure are larger compared to the Jaccard, but the coefficient of variation is significantly smaller, 57%, as a consequence of the correction for textual variants. The Jaccard measure and the cosine measure, however, are highly correlated, with a correlation coefficient of 0.804.

As for content similarity, the evidence is that even different oral traditions tend to assign a similar importance to many relevant themes, although we still observe divergence for many pairs. Examples of ethnic group pairs with relatively smaller values of Θ similarity include the Germans and Mixtec (0.749), Russians and Manasi (0.683) and Ukranians and Wolof (0.608). As an example of the single differences in relative frequencies that determined such small overall cosine similarities (see Sect. 7 for further details on the themes discussed here), in the German oral tradition 12.7% of the motifs can be associated with the "Learning" theme and 7% with the "Rich/Greed" while, in the Mixtec oral tradition, only, respectively 6.25% and 1.5% of them. Moreover, 4% of the motifs in the German

[25] Total population is computed multiplying the country population shares by ethnicity in 2000 from MX by the total country population in the same year from the World Bank Development Indicators, and then summing by ethnic group.

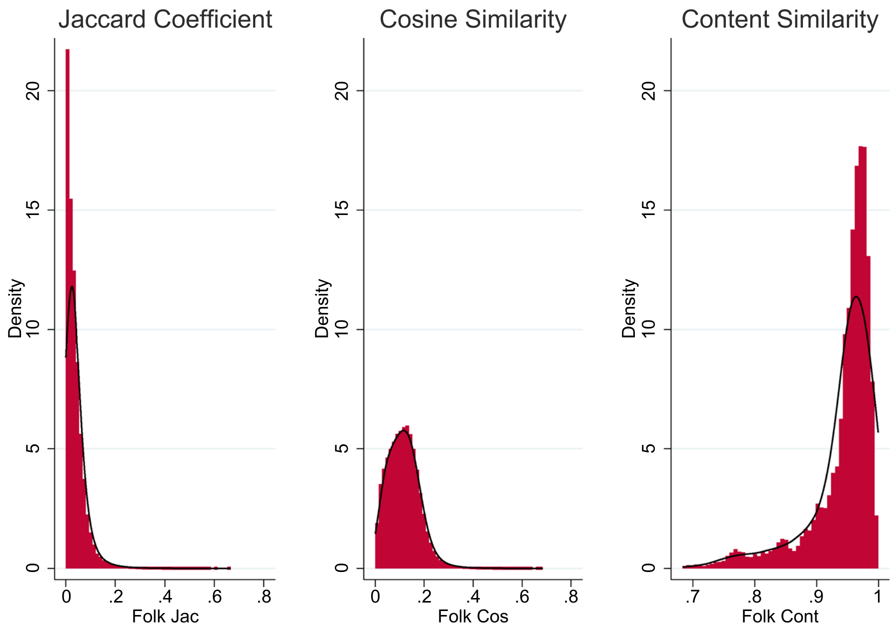

Fig. 3 Distribution of folklore similarity. Left Panel: distribution of the Jaccard coefficients of folklore catalog entries with kernel density estimate. Central panel:distribution of cosine-similarity based measure of folklore similarity over ethnic groups with kernel density estimate. Right panel:distribution of the average similarity in concept intensity of the oral traditions. 457446 observations (ethnic group pairs)

oral tradition are about competition, while these theme does not feature at all in the oral tradition of the Mixtec. However, both oral traditions feature a similar relative importance of the theme associated to "Trade". Similarly, the Manasi oral tradition does not feature motifs associated with competition and with richness/greed, while, in the Russian tradition, 2.3% of the motifs are about competition and 7.3% about richness, although both traditions assign a similar relative importance to the theme learning.

Figure 4 shows the relationship between the cosine and the content measures of folklore similarity (457446 ethnic group pairs). As expected, the two are positively correlated, highlighting that ethnic groups with higher cosine similarity tend to have, on average, smaller differences in the folklore content, although the correlation is small, 0.149. This small correlation is mainly determined by the high variability of folklore content similarity at small levels of folklore cosine similarity, mainly because of the presence of many ethnic group pairs with different motifs that feature similar themes. Examples include: the Brahui and the Sepik-Ramu Papuans, the Efik and the Nyangi, and the Mapuche and the Serer. Conversely, ethnic group pairs with high cosine similarity have a much lower variance of content similarity. This evidence emphasizes how looking at motifs only might not capture the full extent of oral tradition similarities.

3.6 The determinants of folklore similarity

In this section we propose a detailed analysis of the potential determinants of folklore similarities in ethnic group pairs. The scope is to illustrate some important conceptual

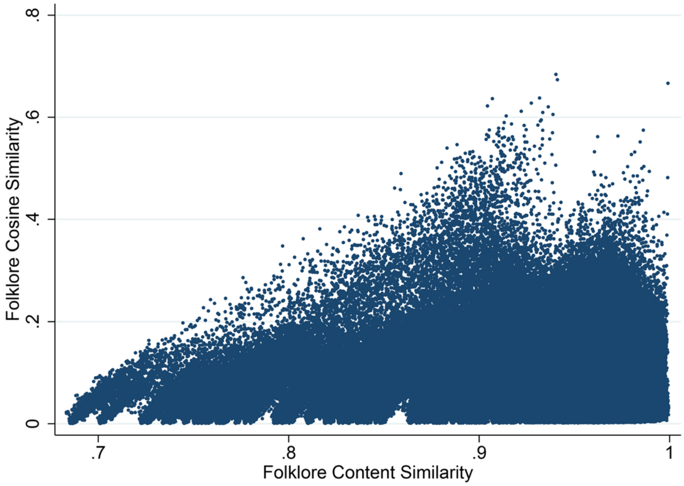

Fig. 4 Folklore similarity measures. Folklore cosine and Content similarity for 457446 ethnic group pairs

underpinning of the indices that we propose and to provide a brief illustration of their relation with existing measures of relatedness between populations.

Folklore Similarity, Genetic Distance and Geographic Distance. Folklore similarity, broadly speaking, is a measure of relatedness between populations, so it is important to compare it with other existing proxy measures. Genetic distance is perhaps the most prominent of such measures in the economic literature, after the seminal contribution of SW and following the literature that applies phylogenetic methodologies to the study of vertical transmission in mythologies (Tehrani, 2013; d'Huy, 2016; Thuillard et al., 2018) (among others). We use the microsatellite measure of genetic distance in Pemberton et al. (2013), which is based on neutral genes not affected by evolution, allowing us to abstract from fitness and natural selection forces as a random source of bilateral distances. to the extent that it is not affected by genetic admixture (Pemberton et al., 2013), genetic distance can therefore be considered as a proxy for the separation time between ethnic groups, that is for the time since they were part of the same population, like a "molecular clock", as in SW.

The left panel of Fig. 5 shows the relationship between the cosine measure of folklore similarity and genetic distance.[26] We find, as expected, a negative correlation, meaning that populations that have been separated for a longer time tend to have less folklore in common, in the sense of a lower cosine similarity measure of folklore (pictured), but also of a lower Jaccard similarity of the motifs and a lower content similarity (not reported, details available upon request). This is indeed an important evidence in favor of the importance of the demic channel in cultural diffusion: stories do travel with people. However, we also find that there a large amount of variability of folklore similarity can be observed among genetically close ethnic groups. In greater detail, at small levels of genetic distance, that is looking at groups with more recent separation and/or more intense genetic admixture, we see both ethnic groups with a lot of folklore in common and ethnic groups with very little

[26] The Pemberton et al. (2013) sample of genetic distances covers only a subset of the ethnic groups in the folklore catalog.

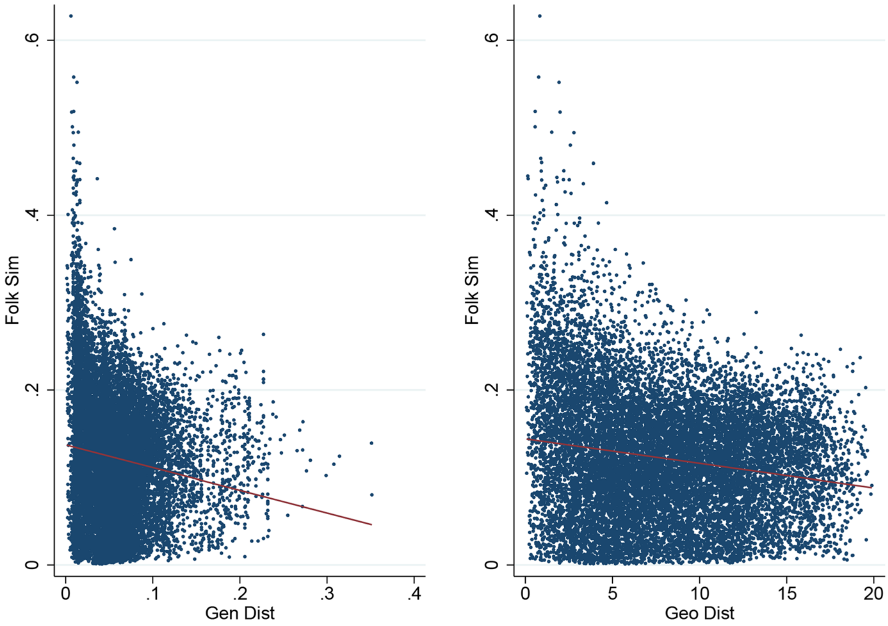

Fig. 5 Average folklore-based cultural similarity, cosine. Left panel: relationship between the cosine-similarity based measure of folklore similarity and (microsatellite) geneticdistance. Right Panel: relationship between the cosine-similarity based measure of folklore similarity and geodesic distance (inthousand km) between the ethnic groups centroids. OLS linear fit. 15071 observations (ethnic group pairs)

oral tradition shared. Moreover, for groups characterized by longer genetic separations, it is less likely to see a lot of shared folklore, although we do observe significant oral tradition overlap. Borrowing the metaphor used by SW to explain the content of genetic distance measures based on family relationships, we find a lot of brothers (small genetic distance) that exhibit few cultural traits in common, and rarely talk to each other, whereas there are instances of some fairly distant cousins (higher genetic distance) featuring large similarity in oral traditions. This evidence is also in line with recent phylogenetic studies that show how vertical transmission is not the only driver of mythology similarity (Thuillard et al., 2018).

As shown in the right panel of Fig. 5, a very similar pattern is found for geographic distance between the ethnic group centroids (ancestral locations), namely we do observe geographically close ethnic groups with few motifs in common, and geographically distant groups with a significant oral tradition overlap, even though the overall correlation between geodesic distance and folklore similarity is negative.

Folklore Similarity, Language and Religion. Since oral tradition is related to language, which also facilitates cultural exchanges (d'Huy, 2013) and since many motifs are religious in nature, we also consider two measures of linguistic and religious relatedness. For linguistic distance, we use the lexical similarity measure is from the Automated Similarity Judgment Program - ASJP- (Wichmann et al., 2022), it is equal to the average Levenshtein distance (number of replacements needed to convert one word into another) between

40 basic words/meanings[27] (hand, one, eye, drink, person, etc.). For religious distance, we use, following the literature, a standard cladistic measure equal to the complement to one of the relative number of common nodes in the World Christian Database religious tree[28] (covering all religious denominations). Overall, the empirical evidence turned out to be in line with what we just described about genetic and geodesic distance: a negative overall correlation, but a high amount of variability of folklore similarity for pairs with similar levels of linguistic and religious distance.

Regression Evidence. In Tables 3 and 4 we report, respectively, the raw correlations between the measures of folklore similarity and genetic, linguistic and religious distance at the ethnic group pair level, and the results from a ethnic-group pair level regression of folklore similarity on other phylogenetic distances. Note that geodesic distance is a general measure of proximity that might influence contacts between populations (d'Huy, 2013) due, for instance, to their cooperation (trade) or competition (violent conflict), among other mechanisms. In all regressions, we also control for the absolute value of the difference in the number of publications used to code the folklore catalog, for the absolute value of the difference in the year of first publication of the sources used (Michalopoulos & Xue, 2021), to capture the extent to which an ethnic group has been studied by folklorists and for how specialized they were (missionaries versus university-trained anthropologists). We also control for a dummy equal to one in case the two groups have centroids within the same modern-day country, which is indeed a generic control for closeness, capturing several possible determinants of exchanges between cultures which are not recorded in religious, linguistic and genetic distances. Finally we control for two-way ethnic group fixed effects to soak up any unobserved, ethnic-group level, heterogeneity. Overall, the table shows how folklore similarity is correlated with other measures of relatedness, but, importantly, the R^2 of the regressions are below 0.4, even after the inclusion of several additional controls (see the notes to Table 4 for details). We conclude that there is a significant amount of unexplained variability in folklore similarity or, putting it differently, some new information that we can exploit.

To give a couple of examples of this unexplained variability,[29] take the Brahui and the Tamil, two Dravidian-speaking groups of South-East Asia, which are very close genetically (genetic distance in the lowest 5% of the distribution over all ethnic groups) and geographically (geodesic distance in the lowest 10% of its empirical distribution) but yet have very

[27] One alternative measure of linguistic distance is based on the Cladistic approach, which consists in constructing language trees based on the perceived similarities between language, and than computing the (normalized) number of common branches in those trees. We think that the measure we chose, which falls into the Lexicostatistics family, is more suited to our analysis for a few main reasons: because, being based on the similarity of words used to convey basic concepts, it is more suited for our aim in this study, i.e. to measure how well people speaking different languages understand each other; and also because it provides a continuous and, therefore, finer measurement of linguistic distance; because it is based on text analysis like our measures of folklore similarity. Moreover, the cladistic approach minimize the role of horizontal exchanges, i.e. presumes that, upon separation, there is no further merge. See Desmet and Ortuno-Ortin and Romain Wacziarg. (2012); Desmet et al. (2015) and Ginsburgh and Weber (2015) for further references.

[28] See Bentley (1993) for a discussion of cross cultural contacts induced by the spread of religions in pre-modern times. Berezkin (2023) is very meticulous in distinguishing the exchange of motifs selected from folktales from those selected from mythology and sacred texts. "Motifs that are selected not from folktales but from mythological texts strictu sensu do not cross language and cultural borders so easily".

[29] Note that, as suggested by the regressions results in Table 4, there are indeed many ethnic groups which are genetically, linguistically and geographically close with many similarities in the oral traditions such as, among others: Hindi and Bengali in India; Igbo and Ewe in western Africa;Italians and French in Europe; Miao and Lao in South-East Asia; Kechua and Aymara in South America.

few folklore elements in common (folklore cosine similarity in the lowest 10% of its empirical distribution). Similarly, the Hausa and the Maba, two Islamic groups speaking Chadian languages, mostly located, respectively, in Nigeria and Chad, are genetically close (lowest 1% of the distribution of distances) and geographically (lowest 5%) but turn out to feature few common traits in their oral traditions (lowest 10% of the folklore cosine similarity). In contrast, Maori and Sepik-Ramu Papuans, spread between South-East Asia and Oceania, are not closely related genetically (genetic distance is in the top 10%), but they are geographically close and speak languages that are partially mutually intelligible, also they have a significant overlap of oral traditions (folklore cosine similarity in the top quartile).

The key question, then, is what determines this variability of folklore similarity that is unexplained by the other measures of relatedness between populations. We tackle this question in what follows.

Diffusion of Folklore. Cultural similarities, such as those recorded in Berezkin's catalog of oral traditions, are shaped by four major historical dynamics: (1) Common exogenous shocks, including processes of convergent evolution, where similar motifs emerge as responses to shared geo-climatic conditions or significant events like earthquakes and eclipses. (2) A common past, which involves cultural traits preserved within groups due to a shared ancestry, with similarities diminishing as time since separation increases. (3) Demic processes such as migrations, interbreeding, and demographic mixing, that introduce motifs into a group's oral tradition through individuals who carry their cultural traits. (4) Cultural diffusion or horizontal transmission, which involves the exchange of cultural elements between groups, as emphasized in diffusionist theories (Newell, 1895), also supported by recent empirical evidence such as Tehrani (2013). Recently separated ethnic groups- those with high genetic similarity due to recent demic processes- speaking similar languages, practicing the same religion, or living in comparable environments, may share more or less folklore elements based on the intensity of their interactions post-separation. Therefore folklore similarity, conditional on other measures of separation, geographic characteristics, and exogenous shocks, provides insights into the historical episodes of cultural contact between ethnic groups.[30] In the appendix, we propose a simple model to illustrate this conceptual framework.

Horizontal transmission of motifs between populations after separation results from both random episodes, as noted by Berezkin, and non-random processes like ancient trade patterns and trade diasporas, conflicts, and migrations. Although some of these are partially controlled by other measures of relatedness, our goal is not to isolate the effect of specific sources of cultural exchange. Instead, we estimate the impact of shared oral traditions-irrespective of origin - on income differentials, under the assumption that these historical cultural exchanges are exogenous to current outcomes.

In summary, our folklore-based measure provides valuable information beyond geographic distance, demic processes, or linguistic common origins, that can be relevant for shedding light on the importance of cultural diffusion for economic development.

Diffusion of Folklore: Examples. There are several studies of folklore diffusion in the ethno-anthropology literature. Among others, an example of demic diffusion is proposed by d'Huy (2013), who focuses on the so-called "Big Dipper - Cosmic Hunt and the Pleiadis" (Motif b42k in the Berezkin Catalog), a story that features the dipper interpreted as

[30] In Berezkin's words: "The replication of forms that can be borrowed from culture to culture [...] reveals the particular and, to some degree, random peculiarities of [...] cultural contacts and interactions" (Berezkin 2015, p. 34-35)

an animal such as a bear or a deer, and the three stars of its handle interpreted as hunters. Using phylogenetic (statistical) methods he finds that this motif originated in Central Asia/Siberia, then spread to North America with early human migrations through the Bering strait. Conversely, Berezkin (2014), shows that many widespread motifs among African populations, such as the "Muddled Message", featuring "a person sent by god to bring instructions or objects but that distorts, forgets or replaces them", originated in Eurasia, so their diffusion path was opposite compared to the early out-of-Africa human migrations, and therefore not directly related to early demic movements. An example of diffusion through several related channels is "The Mouse and the Lion" tale (m130c in the catalog), featuring a strong lion in trouble that is helped by a little and weak mouse, widely known in the familiar Aesop version in Ancient Greece. Since a similar tale was found in a papyrus in ancient Egypt, it is likely that migrations from Egypt brought the story to Greece and then to Rome because of the influence of Greek Philosophers and writers in the ancient Roman societies, but also because of trading relationships in the Magna Grecia colonies. Later, through Roman wars of conquest, the story arrived in Central and Northern Europe and throughout the Mediterranean. Some examples of cultural diffusion primarily through trade include the myths associated with the god Baal, such as those about thunder gods (I35a1 and I4 in the catalog, respectively: "Person pretends to be the sky-god imitating rain and thunderstorm" and "Thunder rides in the sky") and "The God and the cow" (F98 in the catalog: "Anthropomorphic god descends from the sky and copulates with a cow"), which were brought to ancient Greece by Phoenician traders; the Jataka tales, that spread from India to China following the Silk Road, and diffusing motifs such as, among other, the widely known "Moon Rabbit" (A32a in the catalog: "Rabbit or hare seen in the moon").

Convergent Evolution. As a final remark notice that it is in principle possible for two groups to share motifs simply because of a convergent evolution determined by an underlying similarity in what we can loosely refer to as the "human nature": most of us have kids, think about death, and take comfort from friendship, to name a few. We are not concerned about this possibility, for several reasons. First, because of Berezkin himself has shown in several studies that: "A multiple emergence of specific motifs is rare, and the formation of whole sets of similar motifs in areas that do not exchange information regularly looks practically impossible." (Berezkin, 2023, p. 305). Second, because universal motifs, shared by a very large set of ethnic groups, simply do not exist in the folklore catalog. In particular, a motif is shared, on average, by only 19 out of about 1000 total cultures, and 95% of the motifs are shared by less than 100 cultures. In addition, the most diffused motifs, K27n (difficult tasks of the in-laws) and M29b (tricksters fox, jackal or coyote) are shared by only 355 ethnic groups, that is 37% of the total number of groups. Third, even admitting the possibility of convergent evolution, this should be an issue mostly for the content similarity measure.

However, to further inquire on this issue, we conducted three additional empirical tests. The logic behind the first two exercises consists in focusing attention on the geographically isolated ethnic groups that, presumably, exchanged information with other groups to a lesser extent, so that eventual folklore similarities are more likely to be determined by convergent evolution. First, we computed, for each ethnic group, the average folklore similarity with all other groups in the sample, and regressed it on a measure of geographical isolation equal to the distance between the ethnic group centroid and the closest centroid of another group. The result is a negative and strongly significant coefficient (conditioning on the number of publications and of the year of the first publication - which is essential given that those groups are typically less studied). This we take as evidence for how more geographically isolated ethnic groups tend to be less culturally similar to others, further pointing towards the importance of contacts in the spread of folklore. Second, we computed our cosine measure of folklore similarity among the geographically isolated ethnic groups only, and, more specifically, among the groups in the lowest 10% of the distribution of the minimum distance between their centroid and the centroid of all other groups. The result is a median value of the cosine measure of folklore similarity equal to 0.027, which is about 25% of the average in the full sample of ethnic group pairs. The third exercise is based on a different logic, and it consists in computing the cosine measure of folklore similarity excluding the most widely shared motifs in the catalog, which are more likely to be influenced by convergent evolution processes. We use, as threshold, the 90^{th} percentile of the distribution of motifs by number of ethnic groups that share them, that is motifs shared by more than 73 ethnic groups. Regressing folklore similarity on other measures of relatedness, we found the same results as those in columns 3 and 4 of Table 4, with regression coefficients that are numerically close. All in all, convergent evolution does not seem to be an issue (all results available upon request).

3.7 Folklore similarity: country-level aggregation

In what follows, we will mostly use a folklore-based measure of cultural similarity for country pairs, with countries whose population is potentially composed by several ethnic groups with different oral traditions. To this aim, following the literature, we aggregate the ethnic group level information that we have from the Folklore Catalog according to the ethnic group shares (weights) in the current population of each country:

$$D_{ab} = \sum_{k \in K} \sum_{l \in L} \omega_k^a \, \omega_l^b \, D_{kl} \tag{4}$$

where D_{kl} is the measure of folklore similarity at the ethnic group pair level - either J, χ or Θ - and ω_k^x is the population share of the ethnic group k in country x, ω_l^y is the population share of the ethnic group l in country y, and where K and L are, respectively, the sets of all ethnic groups in country x and y, with $\sum_{k \in K} \omega_k^a = 1 = \sum_{l \in L} \omega_l^b$. In practice, we follow the same logic used to construct, among others, genetic distances for country pairs starting from genetic distances in ethnic groups pairs ((Cavalli-Sforza et al., 1994; Pemberton et al., 2013) SW). We use the same population shares by ethnic groups in 2000 used by MX, and we refer to their work for the details of their construction and of the sources used.

To visualize the country-level information, in Fig. 6 we provide a world map of the country average cosine folklore similarities (the equivalent map for the Jaccard measure and for the concept intensity measure are not reported and available upon request), computed as an unweighted average of the bilateral cosine similarity between a country and all other countries in the World. Countries in Sub-Saharan Africa and in South-East Asia, together with some Latin American countries, appear to be the more culturally isolated, that is the ones with the least similarities with the rest of the World. European countries, together with Canada, Brazil, Argentina, on the other hand, are characterized by large similarity. More generally, a visual look at the map synthetically suggests important variation driven by ancient cultural contacts (Europe, Near East, Egypt) and by modern migration patterns that affect the composition of the population at the country level (America and Australia). This latter consideration will require a specific empirical strategy to deal with the impact of post 1500 migrations (see Sect. 4.1), which we borrow from SW.

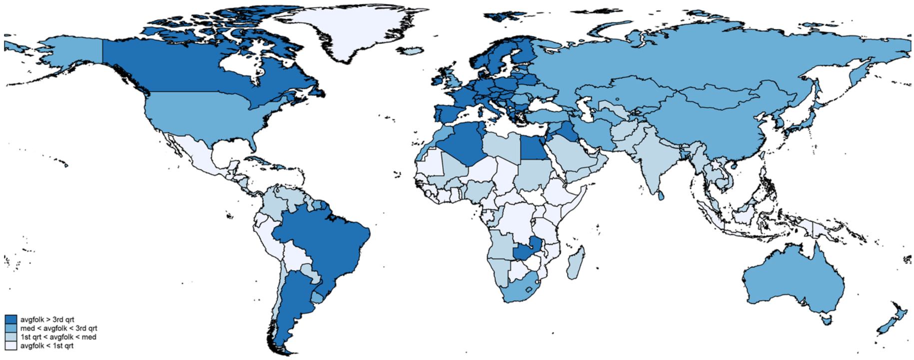

Fig. 6 Average folklore-based cultural similarity, cosine. Average cosine folklore similarity between each country and all other countries in the World (Avgfolk). Different colorsrefer to the quartiles (qrt) of the distribution. 191 observations/countries.

Table 1 Folktales similarity and geodesic distances, summary statistics

	Mean	Median	STD	1^{st} Qrt	3^{3d} Qrt	Min	Max	Obs	Groups
Folk Jac	0.0364	0.0270	0.0390	0.0108	0.0500	0	0.6667	457446	957
Folk Cosine	0.1146	0.1115	0.0635	0.0662	0.1547	0.0005	0.6841	457446	957
Folk Cont	0.9418	0.9599	0.0533	0.9329	0.0671	0.6832	0.9995	457446	957
Geo	8.9391	9.0407	4.4961	5.4240	12.2263	0.0141	19.9928	457446	957

Observations are for ethnic group pairs. Folk Jac is folklore similarity computed with the Jaccard coefficient of the folklore catalog entries. Folk Cosine is folklore similarity based on the cosine similarity of the motifs. Folk Cont is the folklore similarity measure based on content. Geo is the geodesic distance (in thousand km) between the ancestral locations (centroids) of the ethnic groups. Obs is the number of ethnic group pairs and Groups is the number of ethnic groups

4 Cultural doorways and economic distances: evidence

The central part of our analysis is the study of the empirical relationship between the folklore-based measures of cultural similarity and differences in the level of income per capita. In Sect. 4.1 we describe the empirical model. In Sect. 4.2 we present the main empirical results. In Sect. 4.3, we discuss the results obtained in a similar empirical setting where the unit of observation is given by ethnic groups pairs. The regression reported and commented are those obtained by using the measures of cultural similarity based on text analysis and content analysis (χ and Θ indices) that we developed. All the results we report also hold if we use the Jaccard coefficient, not reported for brevity. They are available upon request.

4.1 The empirical model and identification

Model and Estimation. Following SW, our baseline empirical specification is:

Table 2 Average Folktales Similarity, Selected Groups

Continent	Group	Lang Family	Motifs	Avg Folk Jac	Avg Folk Cosine	Avg Folk Content
Asia	Chinese	Sino-Tibetan	208	0.0602	0.1321	0.9083
	Hindi	Indoeuropean	248	0.0603	0.1241	0.8874
	Bengali	Indoeuropean	164	0.0472	0.1288	0.9129
	Russians	Indoeuropean	598	0.0591	0.0887	0.7173
	Japanese	Altaic	211	0.0538	0.1258	0.9059
	Yava	Austronesian	102	0.0428	0.1396	0.9414
	Punjabi	Indoeuropean	170	0.0419	0.1220	0.9038
	Marathi	Indoeuropean	119	0.0454	0.1346	0.9389
	Telugu	Dravidian	56	0.0313	0.1215	0.9423
	Koreans	Altaic	212	0.0633	0.1313	0.9026
	Tamil	Dravidian	116	0.0447	0.1333	0.9233
	Viets	Austroasiatic	165	0.0609	0.1413	0.9172
Africa	Arabs of Egypt	Afrasian	292	0.0526	0.1116	0.8296
	Yoruba	Niger-Kongo	89	0.0412	0.1363	0.9500
	Hausa	Niger-Kongo	160	0.0470	0.1304	0.9154
	Sidamo	Afrasian	42	0.0293	0.1147	0.9562
	Mbundu	Niger-Kongo	73	0.0443	0.1363	0.9505
	Arabs of Algeria	Afrasian	233	0.0505	0.1183	0.8868
	Tiv	Niger-Kongo	110	0.0491	0.1426	0.9418
	Amhara	Afrasian	72	0.0320	0.1255	0.9335
	Akan	Niger-Kongo	80	0.0416	0.1383	0.9474
	Rwanda	Niger-Kongo	54	0.0374	0.1303	0.9505
Europe	Germans	Indoeuropean	458	0.0565	0.0983	0.7720
	English	Indoeuropean	174	0.0432	0.1238	0.9110
	Spanish	Indoeuropean	388	0.0555	0.1030	0.7967
	Italians	Indoeuropean	411	0.0547	0.1007	0.7802
	Portuguese	Indoeuropean	368	0.0541	0.1041	0.8016
	French	Indoeuropean	433	0.0573	0.1012	0.7902
	Poles	Indoeuropean	362	0.0563	0.1073	0.8157
	Ukrainians	Indoeuropean	588	0.0579	0.0891	0.7162
America	Pipil	Uto-Aztecan	16	0.0155	0.0749	0.9599
	Aztec	Uto-Aztecan	68	0.0396	0.1345	0.9543
	Cuban	Indoeuropean	6	0.0109	0.0408	0.9607
	Totonac	Isolate	104	0.0495	0.1439	0.9374
	Tseltal	Mayan	48	0.0307	0.1252	0.9525
	Ixil	Mayan	26	0.0267	0.1004	0.9581
	Tarascan	Isolate	16	0.0156	0.0737	0.9581
	Yaqui	Uto-Aztecan	30	0.0420	0.1149	0.9585
	Chol	Mayan	46	0.0397	0.1321	0.9583
Oceania	Torricelli Papuans	Torricelli	79	0.0411	0.1329	0.9541
	Sepik-Ramu Papuans	Sepik-Ramu	52	0.0330	0.1229	0.9562
	Fijian	Austronesian	21	0.0228	0.0871	0.9600
	Maori	Austronesian	66	0.0500	0.1408	0.9551

Table 2 (continued)

Observations are for ethnic groups. Motifs is the total number of motifs in the catalog. Lang Family is the linguistic family to which the language spoken by the ethnic group belongs. Avg Folk Jac is the average folklore similarity computed with the Jaccard coefficient between the group and all others in the catalog. Folk Cosine is the average folklore similarity based on the cosine similarity of the motifs. Folk Cont is the average folklore similarity based on content.

Table 3 Folktales similarity, and phylogenetic distances. correlations

	Folk Jac	Folk Cosine	Folk Cont	Gen	Geo	Lang	Relig
Folk Jac	1						
Folk Cosine	0.8403	1					
Folk Cont	−0.0222	0.1570	1				
Gen	−0.2613	−0.1207	0.1496	1			
Geo	−0.3441	−0.1660	0.0593	0.4450	1		
Lang	−-0.2660	−0.1714	−0.0342	0.1743	0.2150	1	
Relig	−0.1702	−0.0608	0.1410	0.1634	0.1863	0.1128	1

Observations are for ethnic group pairs. Folk Jac is folklore similarity computed with the Jaccard coefficient of the folklore catalog entries. Folk Cosine is folklore similarity based on the cosine similarity of the motifs. Folk Cont is the folklore similarity measure based on content. Geo is the geodesic distance (in thousand km) between the ancestral locations (centroids) of the ethnic groups. Geo is geodesic distance between the ethnic group centroids; Lang is linguistic distance from the ASJP; Relig is religious distance. 11776 observations (ethnic group pairs)

$$|Y_i - Y_j| = \beta_0 + \beta_1 D_{ij} + \Gamma X_{ij} + \eta_i + \eta_j + \varepsilon_{ij} \tag{5}$$

where Y_i is the logarithm of the average GDP per capita of country i from the Maddison project over the period[31] 2000-2020, D_{ij} is one the measures of folklore-based cultural similarity between country i and j, X_{ij} are controls specific to the country pair, η_i and η_j are country fixed effects, and where ε_{ij} an error term. The baseline set of control variables is briefly described below. Given a potential problem of spatial correlation (see also SW for a discussion), we use two-way clustered standard errors, at the level of country i and of country j (in an undirected sample of country pairs,[32]) following Cameron et al. (2011).

The empirical challenge that we face is that, in the aggregation of ethnic group level information at the country level, we need to use population shares by ethnicity that can be endogenous to income per capita because of, among others, selective modern and contemporary migration induced by factor endowments and other determinants of income distances. To overcome this issue, we borrow the logic of the IV strategy by SW, adapting it to our analysis. In particular, we assign a dominant, ancestral, ethnicity to each country, that is the most prominent ethnic groups before the massive modern migrations that took

[31] Since the population shares on the basis of which we aggregate our ethnic group level measures refer to 2000, we take the average per-capita GDP after 2000

[32] This choice is dictated by the very nature of the database, since Berezkin's catalog only records shared motifs, not the direction of diffusion.

Table 4 Folktales similarity and distances in phylogenetic traits, ethnic groups

	Folk jaccard similarity		Folk cosine similarity		Folk content similarity	
	(1)	(2)	(3)	(4)	(5)	(6)
Gen	−0.6803*** (0.0606)	−0.3528*** (0.0490)	−0.4553*** (0.0470)	−0.2293*** (0.0356)	−0.1314*** (0.0277)	−0.0632*** (0.0189)
Geo		−0.1456*** (0.0232)		−0.0877*** (0.0167)		−0.0089 (0.0074)
Lang		−0.1138*** (0.0211)		−0.0570*** (0.0160)		−0.0186* (0.0105)
Relig		−0.0962*** (0.0207)		−0.0580*** (0.0159)		−0.0224** (0.0118)
R^2	0.226	0.367	0.244 15225	0.351	0.203	0.301
Obs	15225	11776		11776	15225	11776
Groups	175	154	175	154	175	154
Controls	no	yes	no	yes	no	yes

Observations are for ethnic group pairs. Dependent variable is in column. Folk Jaccard similarity is the Jaccard coefficient of the folklore catalog entries. Folk Cosine Similarity is the folklore cosine similarity measure. Folk Content Similarity is one minus the weighted average difference in the relative importance assigned to different concepts. Gen is genetic distance between the ethnic groups from Pemberton et al. (2013). Geo is the geodesic distance between the ancestral locations (centroids) of the ethnic groups. Lang is linguistic distance from the ASJP. Relig is religious distance based on the religion tree from the World Christian Database. All regression includes: the absolute value of the difference between the number of publications used to code the motifs; the absolute value of the difference of the year of publication of the first source; two- way ethnic groups fixed effects. Controls is yes in case of additional control variables added to the regression: a dummy equal to one in case of ancestral homelands in the same climatic zone; a dummy equal to one in case of ancestral homelands within the same present-day country borders; the absolute value of the difference between the ancestral homelands latitudes. Standardized beta coefficients. Two-way clustered standard errors (ethnic groups) in bracket. Groups is the number of ethnic groups for which distances are computed. *** significant at the 1% level. ** significant at the 5% level. * significant at the 10% level

place after 1500, and then use folklore similarity between those ancestral ethnic groups as instrument.[33]

Identification. Our identification strategy relies on the exogeneity of folklore similarities, rooted in the distant past, to current income differentials. However, some of the elementary components of the shared oral traditions (Berezkin's motifs) may have entered or persisted in a pair of oral traditions due to ethnic group characteristics that were themselves influenced by past income differences. For example, similarities in production modes (e.g., agriculture versus pastoralism, or nomadic versus sedentary lifestyles) or governance structures (e.g., matrilineal versus patriarchal systems) between ethnic groups might explain shared motifs, confounding these traits with cultural contact as the true determinant. Similarly, motif sharing could result from ancient trading relationships, with stories exchanged during commercial trips or shared by sailors and traders. Conflicts and colonization are additional examples of such mechanisms.

[33] In the few instances where we were not able to match a single ethnic group to a country, we simply computed weighted averages distances with equal weights.

To address these issues, we made an effort to control for as many ethnic group characteristics as possible, including fixed effects. However, it is important to emphasize that our aim is not to pinpoint the impact of a specific historical determinant of folklore similarity on current income differences. Instead, our objective is to estimate the overall effect of ancestral folklore similarities, shaped by the myriad of historical episodes of cultural contact. These episodes were driven by diverse remote causes, such as the rise and fall of ancient trade routes, invasions, and colonizations-factors, that can reasonably be considered exogenous to contemporary income similarities.

In this respect, our empirical approach is akin to that of SW and Ashraf and Galor (2013), among others: although there is no comprehensive information on the factors driving population separations or their migrations from Africa, it is still both informative and meaningful to evaluate the long-term consequences of these separations under the assumption that such events and their causes are exogenous to present-day outcomes. Similarly, our research design does not rely on detailed information about the reasons behind the development of shared oral traditions. Instead, we evaluate the long-term consequences of these similarities, operating under a comparable identification assumption: that ancient dynamics influencing motif exchange at the ethnic group level are exogenous to current income levels.

With respect to the content of the folklore catalog, we do not think that there is an endogeneity problem because we work with folklore motifs which, according to Thompson (1946) quoted in MX, are “the smallest element in a tale having the power to persist in tradition”, meaning that they are sheltered from the influence of socio-economic outcomes relevant at the time when the stories are recorded. In other words, even if it is in principle possible for some of the elements of the folktale to change over time, it is unlikely that its main elements, recorded in a motif, will.[34]

Control Variables. In our regression analysis we consider a wide range of control variables *X*, some of which are induced by the adopted conceptual framework, and some are borrowed from the literature, in particular from the analysis in SW and Ashraf and Galor (2013).

To isolate the effect of cultural doorways from demic processes and, more generally, from the effect of a shared past (distance from separation as in SW), we include in the regression the country-pair measures of genetic, linguistic and religious distance described in Sect. 3.6, obtained using population shares by ethnicity as in equation (4). To capture the effect of geographic barriers on cultural exchanges, which also affect ancient trading relationships and violent conflicts, we consider both the geodesic distances between the major cities of the country-pair, and a dummy for contiguous countries. Furthermore, we include a dummy in case one country is an island, a dummy in case one country is landlocked, a dummy for a common sea or ocean, and the transportation costs from Giuliano et al. (2014), to capture geographical isolation. We include the latitude difference, because, according to Diamond (1997), it proxies for the importance of geographical barrier to the diffusion and adaptation of technological innovation, especially in agriculture.

We include several indicators of climatic similarity between countries in order to control for the direct effect of climate on growth: countries with similar climates can adopt similar innovations, and climate has a direct effect on productivity[35] ((Sachs, 2001; Dell et al.,

[34] See also Toelken (1996) on the “Conservative force of tradition”.

[35] We also considered, as additional controls, the absolute value of the difference in average, country-level, temperature and the absolute value of the difference in precipitation from Dell et al. (2012), obtaining similar results.

2012); and 2014). Following the literature, our main control for climate is the average difference in the percentages of the total country surface in each of the 12 Koeppen-Geiger climate zones. Furthermore, to capture the effect of an early transition to agriculture on growth (Diamond, 1997), which is also a consequence of climatic conditions, we include the difference in the neolithic transition timing from Putterman (2008) and a dummy for the "Diamond effect", equal to one in case only one of the countries in a pair is from Eurasia (because of its documented advantages in farming).

To capture the effect of democracy on growth, we included the absolute value of the difference in the POLITY2 scores (Marshall et al., 2017), averaging over the same period for which we take GDP data. Since colonialism determined, among other things, a transfer of institutional features and technologies, we include a dummy equal to one in case the two countries in the pair were in a colonial relationship, and a dummy equal to one in case the two countries have ever been within the same country in the past.

Finally, we include three additional control variables to account for common ethnicity in country pairs: the share of ethnic groups the countries in the pair have in common, obtained dividing the number of ethnic groups that are present in both countries by the total number of ethnic groups in both countries, which is the Jaccard coefficient of the set of ethnic groups; the total population share of the common ethnic groups; an index of joint ethnic fractionalization computed in a fictional country made up of the sum of the populations in the two countries composing the pair. These three variables are important as a further control for the demic origin of cultural exchange.

Notice that the inclusion of two-way country fixed effects controls for country-specific factors, such as, among others, the extent of ethnic fractionalization (Alesina et al., 2003) or polarization, that can have an effect on growth, as well as for other barriers to development that are not captured by geographic variables. An additional argument for considering two-way country fixed effects is that the country aggregation of folklore similarities hinders the peculiarity of the within-country ethnic compositions that might lead to the emergence of conflicts that could affect income per capita. In short, fixed effects allow us to control for the role of, broadly speaking, within-country diversity.

4.2 Main results

The results of our baseline regression are summarized in Tables 5 and 6. All variables in the regression are standardized. The main evidence we find is a statistically significant effect of folklore similarities on current income differentials: country pairs with larger textual and content folklore similarities have smaller differences in the level of income per capita. The result holds after controlling for a large set of potential confounders and upon the inclusion of country fixed-effects.

Quantitatively, looking at the IV estimates in the regression with all controls (column 6 of Table 5), a 1 std change in textual folklore similarity, equivalent to 0.118 which is about the switch from the similarity between France and Bulgaria (or Italy and Poland), to the similarity between Italy and France, is a associated with a -1.31 change in the absolute value of the log of income per capita differences (the std deviation of log income per capita difference is 0.979), which is about the switch from the rather big difference between France and Iraq (1.36) to the relatively smaller difference between France and Italy (0.051). Given that the median log income per capita difference, in our sample, is 1.2, with an interquartile range [0.56, 2.02], the effect is therefore quite sizeable.

Table 5 Folklore and income differences, cosine

	Differences in Log Income per Capita					
	OLS			IV		
	(1)	(2)	(3)	(4)	(5)	(6)
Folk Cosine	−0.3691*** (0.0363)	−0.3057*** (0.0453)	−0.2944*** (0.0714)	−0.6909*** (0.1445)	−0.6701*** (0.1601)	−1.3478*** (0.4554)
Geo Dist	−0.0848*** (0.0252)	−0.3176*** (0.1242)	−0.2091** (0.1010)	−0.1504*** (0.0364)	−0.3575*** (0.1228)	−0.1553 (0.1170)
Gen Dist		0.0774*** (0.0655)	0.3241*** (0.0791)		−0.0583 (0.1181)	−0.1772 (0.2268)
Lang Dist		−0.0558*** (0.0227)	−0.0539** (0.0225)		−0.1387*** (0.0454)	−0.2754*** (0.1024)
Relig Dist		−0.1308** (0.0589)	−0.0056 (0.0636)		−0.1615*** (0.0625)	−0.0754 (0.0776)
R^2	0.139	0.226	0.257	0.053	0.176	
Obs	11941	9316	9316	11941	9316	9316
Countries	158	137	137	158	137	137
F				75	31	
Contr	no	yes	yes	no	yes	yes
FE	no	no	yes	no	no	yes

Observations are for country pairs. Dependent variable is the absolute value of the differences in the logs of income per capita. Folk Cosine is folklore-based cultural similarity measure based on the cosine similarity of the motifs. In columns (4), (5) and (6), folklore-based cultural similarity is instrumented with ancestral folklore-based cultural similarity. Geo Dist is geodesic distance between the countries capitals. Gen Dist is weighted average genetic distance. Lang Dist is weighted average linguistic distance based on the ASJP. Relig Dist is weighted average religious distance based on the World Christian Database. All regressions include a dummy for contiguous countries, the percentage of common ethnic groups, the share of the joint population in the common ethnic groups and the index of joint fractionalization. Contr indicates the presence of additional controls: a dummy in case one country is an island, a dummy in case one country is landlocked, a dummy for a common sea or ocean, the transportation cost from Giuliano et al. (2014), the latitude difference, the average difference in the percentages of the total surface in each of the 12 Koeppen-Geiger climate zones), a dummy equal to one in case only one of the countries in a pair is from Eurasia (Diamond effect), the difference in the agricultural transition timing, the difference in the Polity2 scores, a dummy equal to one in case of a past colonial relationship, a dummy in case the two countries have ever been in the same country. F is the first stage F statistic for folklore similarity. Two-way clustered standard errors in brackets. FE is yes in case of two-way country fixed effects are included. Standardized Beta coefficients. Negative R^2 omitted. *** significant at the 1% level. ** significant at the 5% level.

As argued in Sect. 3.6, the inclusion of vertical distances in our regressions, especially genetic distances, allows us to control for vertical transmission mechanisms of inheritance and persistence, and for the role of demic movements. Since convergent evolution, according to Berezkin, is rather implausible (see the Introduction), this allows us to interpret the coefficient on folklore similarity as capturing specific information about the intensity of horizontal cultural exchanges in the history of the ethnic group pairs. This result, we believe, offers a new perspective to the "Very interesting question of what other vertical traits and characteristics are behind the large effects of genetic distance on income differences, besides language and religion" (SW, p.513). It suggests a robust, and larger than previously established, empirical relevance of cultural diffusion, horizontal exchange and

Table 6 Folklore and income differences, content

	Differences in Log Income per Capita					
	OLS			IV		
	(1)	(2)	(3)	(4)	(5)	(6)
Folk Cont	−0.1372*** (0.0442)	−0.0591 (0.0381)	−0.1667*** (0.0513)	−0.2971*** (0.0878)	0.2217** (0.0932)	−0.6143*** (0.2093)
Geo Dist	−0.0121 (0.0262)	−0.2477* (0.1349)	−0.2073** (0.1012)	−0.0151 (0.0263)	−0.1477 (0.1528)	−0.1618 (0.1097)
Gen Dist		0.3489*** (0.0667)	0.3743*** (0.0778)		0.3309*** (0.0553)	0.1329 (0.1267)
Lang Dist		0.0103 (0.0277)	−0.0004 (0.0251)		−0.0002 (0.0289)	−0.0231 (0.0273)
Relig Dist		−0.1044* (0.0570)	0.0151 (0.0677)		−0.1028** (0.0535)	0.0183 (0.0640)
R^2	0.044	0.194	0.248	0.019	0.173	0.142
Obs	11935	9316	9316	11935	9316	9316
Countries	155	137	137	155	137	137
F				77	70	32
Contr	no	yes	yes	no	yes	yes
FE	no	no	yes	no	no	yes

Observations are for country pairs. Dependent variable is the absolute value of the differences in the logs of income per capita. Folk Cont is folklore-based cultural similarity measure based on the average difference in concept intensity. In columns (4), (5) and (6), average concept intensity differences are instrumented with ancestral average concept intensity differences. Geo Dist is geodesic distance between the countries capitals. Gen Dist is weighted average genetic distance. Lang Dist is weighted average linguistic distance based on the ASJP. Relig Dist is weighted average religious distance based on the World Christian Database. All regression include a dummy for contiguous countries, the percentage of common ethnic groups, the share of the joint population in the common ethnic groups and the index of joint fractionalization. Contr indicates the presence of additional controls: linguistic distance, religious distance, a dummy in case one country is an island, a dummy in case one country is landlocked, a dummy for a common sea or ocean, the transportation cost from Giuliano et al. (2014), the latitude difference, the average difference in the percentages of the total surface in each of the 12 Koeppen-Geiger climate zones), a dummy equal to one in case only one of the countries in a pair is from Eurasia (Diamond effect), the difference in the agricultural transition timing, the difference in the Polity2 scores, a dummy equal to one in case of a past colonial relationship, a dummy in case the two countries have ever been in the same country. F is the first stage F statistic for folklore similarity. Two-way clustered standard errors in brackets. FE is yes in case of two-way country fixed effects are included. Standardized Beta coefficients. Negative R^2 omitted. *** significant at the 1% level. * significant at the 5% level. * significant at the 10% level.

learning, for comparative development. However, we cannot provide further information on the potential determinants of cultural diffusion itself.

4.3 Cultural doorways and economic distances: ethnic-group level evidence

An important piece of evidence to support the interpretation of our main empirical results is whether a similar relation between folklore similarities and income differentials holds also at the ethnic-group level. The empirical specification is the same as that at equation (5), although - due to the different unit of observation - some of the included variables are to be defined differently. In particular: GDP per capita is proxied with the average night

Table 7 Folklore and income differences, ethnic groups

	Differences in Light Intensity					
	(1)	(2)	(3)	(4)	(5)	(6)
Folk Cosine	−0.0651***	−0.1564***	−0.1662***			
	(0.0131)	(0.0423)	(0.0415)			
Folk Cont				−0.0423***	−0.3308***	−0.3498***
				(0.0147)	(0.0938)	(0.0932)
Geo	−0.0299*	−0.0496	−0.0348	−0.0177	−0.0342	−0.0170
	(0.0169)	(0.0860)	(0.0823)	(0.0164)	(0.0858)	(0.0818)
Gen		0.2953***	0.2863***		0.3127***	0.3049***
		(0.0939)	(0.0945)		(0.0949)	(0.0955)
Mig			0.0389			0.0291
			(0.0396)			(0.0393)
R^2	0.041	0.048	0.050	0.015	0.050	0.052
Obs	294726	8892	8890	294726	8892	8890
Groups	804	147	147	803	147	147
FE	No	Yes	Yes	No	Yes	Yes
Contr	no	No	Yes	No	No	Yes

Observations are for ethnic group pairs. OLS regression results. Dependent variable is the absolute value of the differences in the logs of average night-time light intensity per capita within a 200-km radius from the ethnic group centroid. Folk Cosine is folklore-based cultural similarity measure based on the cosine similarity of the motifs. Folk Cont is folklore-based cultural similarity measure based on the average difference in concept intensity. Geo is geodesic distance between the ethnic group centroids. Gen Dist is microsatellite genetic distance. Mig Dist is the area of the migratory triangle defined by the distances from the closest migratory midpoints and geodesic distance. All regression include: linguistic distance, a dummy in case one of the ethnic groups is on an island, a dummy in case one ethnic groups is landlocked, a dummy for a common sea or ocean, the transportation cost from Giuliano et al. (2014) (imputed with the present-day country border of where the ethnic group centroid is located), the difference in latitudes, a dummy in case the ethnic groups are in the same Koeppen-Geiger climate zones, a dummy equal to one in case only one of the countries in a pair is from Eurasia (Diamond effect), a dummy equal to one in case the ethnic groups centroid is in the same present-day country. Contr is yes in case of additional control variables: the exposure to solar and lunar eclipses, the proximity to meteorite findings, the proximity to volcanoes and to seismic zones, the difference in average temperature around the group centroid, the difference in the intensity of lighting strikes and the difference in the caloric potential from agriculture. Two-way clustered standard errors (ethnic group level) in brackets. FE is yes in case two-way ethnic group fixed effects are included. Standardized Beta coefficients. *** significant at the 1% level

light intensity per square km within a 200 km radius from the ethnic group centroid; climatic similarity is defined as a dummy equal to one in case the two ethnic groups are in the same Koeppen-Geiger climate zone; freight costs are imputed by matching ethnic groups to countries based on their centroid and on the present-day country borders; the contiguity dummy is replaced with a dummy equal to one in case the ethnic groups centroids are in the same present-day country; the two-way fixed effects are coded at the ethnic group level, and they account for all unobserved idiosyncratic shocks faced by the ethnic groups in history. Since there is no aggregation problem, we focus on the OLS regression results only.

They are summarized in Table 7.[36] We find that folklore similarities explain income differences also at the ethnic group level, over and above genetic and linguistic distances.

The reason why we believe that these results are important is because the potential confounding factors and unobserved characteristics that may affect the country level regressions are quite different from those that may affect the ethnic-group-level regressions. For instance, conflicts and invasions, if studied at the ethnic group level, are spurred by different causes, and trade is carried out for different reasons than at the country level. Moreover, the very notion of border is much more blurred in the case it is referred to an ethnic group rather than to a country, contacts are much easier as they are not intermediated by a formal authority. Furthermore, in an ethnic-group level regression there is virtually no concern about migrations. Therefore, the finding of robust results at the ethnic group level also lends credibility to the identification of the country-level model.

5 Folklore and income differences: robustness

In this section we examine the robustness of our baseline empirical results. First, we explore the role of exogenous shocks (Sect. 5.1) and the role of out-of-Africa Migrations (Sect. 5.2). Then we report other robustness checks (Sect. 5.3), including the use of historical income differentials as dependent variables. Overall, the main results are remarkably robust across different model specifications. The uninterested reader can skip to Sect. 6 where we discuss the mechanisms behind our main empirical results.

5.1 Robustness: exogenous shocks

First, we tried including in the regression a set of variables to control for a wide range of exogenous shocks faced by the ethnic groups currently living in the country, to further clean the regression from potential convergent evolution dynamics. In particular, we considered the following additional controls: the exposure to astrological phenomena like solar and lunar eclipses, the proximity to meteorite findings, the proximity to volcanoes and to seismic zones, the climatic conditions around the ethnic group centroids, and a generic measure of ethnic group pairs proximity to capture effects for which we do not have data.

Recent work by Litina et al. (2020) shows that the exposure to eclipses, by triggering intellectual curiosity (Boerner et al., 2021), fostered knowledge and human capital accumulation, ultimately leading to economic growth, while ethnic groups that experienced or eclipses might have developed a similar folklore with a prominent presence of sun and moon in their motifs. We computed eclipse exposure using historical data from NASA, and defining exposure in case the coordinates of the point of maximum eclipse visibility was within 50 km from the ethnic group centroid (although the results do not change much considering a range from 20 to 200 km). We consider full eclipses only, both solar and lunar, but only the relatively more ancient ones, using 0 CE as the threshold year for inclusion in the sample (astrology-related motifs are likely to be old). We

[36] Notice that there is a much bigger number of data-points in this empirical specification, although not all control variables are available for all ethnic group pairs. The drop in the number of observations across specifications is due to available observations of control variables, mainly due to the reduction of units of observations induced by the measure of genetic distances.

then coded a dummy, for each ethnic group pair, equal to one if they both experienced at least one eclipse before the common era.

We also use data on meteorite landings and meteorite finding from the NASA to compute the potential exposure to an arguably major event in the history of an ethnic group that might have also stimulated intellectual curiosity. We exclude the landings after 1500 to account for the more ancient formation of folklore, but we keep all meteorite findings for which exact landing dates were not available. We code a dummy, for ethnic group pairs, equal to one in case of a centroid within 100 km of a meteorite landing or finding site (all the results turned out to be robust to rays of 50 and 200 km).

Along the same lines, we used data on proximity to volcanoes, following the same strategy that we used for meteorites and eclipses, namely coding a dummy equal to one if both of the ethnic group centroids lie within 100 km from a volcano (but the results turned out to be robust in case of 50 and 200 km radiuses). The raw data on volcano locations come from the Smithsonian Institute. In addition, we also consider the distance from nearest high-intensity earthquake zones from MX, to complement the information that we have on volcanoes, coding a dummy equal to one if both ethnic groups centroids are within a 300 km radius (sample median distance over ethnic groups) from zone 3 and zone 4 earthquake areas (Bentzen, 2019).

For climatic conditions, we consider the dummy equal to one in case of ethnic group centroids are in the same Koppen-Geiger climate zone, and the difference in the intensity of lighting strikes near the ethnic group centroids (Cecil et al., 2014). As further control for the geo-climatic conditions, we include the difference in the caloric potential from agriculture of crops available before 1500 from Galor and Ozak (2015). Finally, we consider a generic control equal to the geodesic distance between the ethnic group centroids, to account for other potentially unobserved shocks, both climatic and not.

For all variables, we aggregate the measures at the country-pair level using current population shares by ethnicity. As shown in columns 1 and 3 of Table 8, the empirical benchmark IV results obtained using folklore similarity of the ancestral groups as instruments are robust to the inclusion of these additional controls. Quantitatively, the coefficients are of comparable size with our baseline estimates. We conclude that the baseline results do not appear to be the byproduct of the exposure to similar exogenous shocks, and that the dynamics related to convergent evolution of cultural traits are unlikely to be behind our empirical results.

5.2 Robustness: the role of out-of-africa migrations

As a further set of controls, we constructed an additional bilateral measure of the separation time between ethnic groups due to ancient, out-of-Africa, migrations. According to the Out-of-Africa Hypothesis, modern humans originated in East Africa, near Addis-Ababa in Ethiopia (the so-called "Cradle of Humankind") and then spread throughout the world in a process fundamentally shaped the characteristics of the ethnic groups that gradually emerged in different areas. Ashraf and Galor (2013) show that these ancient migrations, through their effect on genetic diversity (the serial founder hypothesis), had long-lasting effects on economic growth, while Galor et al. (2023) show that larger migratory distances are associated with a lower number of motifs in the folklore catalog. So there is indeed the possibility that the similarity in the oral traditions results from the similarity of the out-of-Africa migration paths, that is from an ancient separation shock, over and above the geographic and genetic distances.

Table 8 Folklore and income differences, robustness

	Differences in Log Income per Capita			
	(1)	(2)	(3)	(4)
Folk Cosine	−1.0884***	−1.0885***		
	(0.3324)	(0.3378)		
Folk Cont			−0.5603***	−0.5608***
			(0.1917)	(0.1903)
Geo Dist	−0.0128	−0.0128	−0.0917	−0.0849
	(0.1381)	(0.1356)	(0.1258)	(0.1229)
Gen Dist	0.0325	0.0324	0.1893*	0.1893*
	(0.1365)	(0.1385)	(0.1027)	(0.1026)
Lang Dist	−0.1807***	−0.1809***	0.0065	0.0067
	(0.0654)	(0.0665)	(0.0231)	(0.0230)
Relig Dist	−0.0349	−0.0348	0.0452	0.0385
	(0.0697)	(0.0665)	(0.0647)	(0.0631)
Mig Dist		−0.0005		0.0367
		(0.0410)		(0.0335)
R^2	0.101	0.102	0.172	0.173
F	24	23	40	40

OLS regression results. Observations are for country pairs. Dependent variable is the absolute value of the differences in the logs of income per capita. Folk Cosine is folklore-based cultural similarity measure between countries based on the cosine similarity of the motifs, instrumented with folklore similarity of the dominant ancestral ethnic groups. Folk Cont is folklore-based cultural similarity measure based on the average similarity in concept intensity, instrumented with the average content similarity of the folklore of the dominant ancestral ethnic groups. Geo Dist is geodesic distance between the countries capitals. Gen Dist is weighted average genetic distance. Mig Dist is the area of the migratory triangle defined by the distances from the closest migratory midpoints and geodesic distance. Lang Dist is weighted average linguistic distance based on the ASJP. Relig Dist is weighted average religious distance based on the World Christian Database. All regressions include: a dummy for contiguous countries, the percentage of common ethnic groups, the share of the joint population in the common ethnic groups, the index of joint fractionalization, a dummy in case one country is an island, a dummy in case one country is landlocked, a dummy for a common sea or ocean, the transportation cost from Giuliano et al. (2014), the latitude difference, the average difference in the percentages of the total surface in each of the 12 Koeppen-Geiger climate zones), a dummy equal to one in case only one of the countries in a pair is from Eurasia (Diamond effect), the difference in the agricultural transition timing, the difference in the Polity2 scores, a dummy equal to one in case of a past colonial relationship, a dummy in case the two countries have ever been in the same country. Moreover the regression include the following weighted average measures at the ethnic group level: the exposure to solar and lunar eclipses, the proximity to meteorite findings, the proximity to volcanoes and to seismic zones, the difference in average temperature around the group centroid, a dummy for the same KG climatic zone, the difference in the intensity of lighting strikes, the difference in the caloric potential from agriculture, and the geodesic distance between the ethnic group centroids. Standardized Beta coefficients. F is the first stage F statistics. 9316 observations and 137 countries. *** significant at the 1% level. * significant at the 10% level

We propose a new measure of common out-of-Africa migration paths, that is of a common ancient migratory history, equal to the area of the triangle defined, for an ethnic group pair, by the distance of the groups' centroids and by the distances of the centroids from the closest migration midpoint (Ramachandran et al., 2005; Ashraf & Galor, 2013). The smaller the area, the less recent is the separation between groups, meaning that they shared most of their migratory path. Once again, we aggregate these measures at the country-pair level using contemporary population shares by ethnic group. Notice that this distance is also well suited to capture the probability of gene flows within the group pairs, over and above the genetic distance measure by SW. This may be important for our identification, as it further controls for the demic channel of cultural transmission.

When adding this additional control for common migratory histories, we found empirical evidence similar to that emerging from our baseline model specification. The results are reported in columns 2 and 4 of Table 8 for the baseline IV specification with ancestral folklore similarity used as instrument of cultural similarity in the pair.

For further robustness, we computed an additional measure for the commonality of out-of-Africa migration paths given by the sum of the distances between the centroid of each ethnic group in the pair and the closest common out-of-Africa migratory midpoint, obtaining similar results.

In conclusion, the relationship between folklore similarities and income differences does not seem to be driven by the separation shocks determined by out-of-Africa migrations. This is consistent with the idea that the results in our baseline regression capture the effect of cultural similarities determined independently from genetic separation and gene flows between groups.

5.3 Robustness: empires, ethnicity, production modes, historical income differentials and further evidence

Empires. Cultural transmission between groups and cultures can be easier when they live within the same political and institutional environment.[37] Recent work shows examples of the cultural traits persistence determined by the affiliation to historical empires (Grosfeld & Zhuravskaya, 2015; Becker et al., 2016). Notice that, in our regressions, we always control for the geographic contiguity dummy, and for the colonial links, that partially account for such effect. However, colonial links do not take into account, among others, the fact that, say, Australia, India, and the US have been closely linked because they were both part of the British Commonwealth. To further check our main results for robustness, we constructed a novel variable that accounts for empire affiliation. First, we coded a dummy, for each ethnic group pair, equal to one in case they were ever (in history) part of the same ancient empire, using the ethnic group centroids to locate the cultures within the empire borders. We then aggregated these dummies at the country-pair level using present-day population shares. We included the following empires considered at the maximum of their expansion: Ancient Egypt (3150 BC - 30 BC), Roman (I sec.BC-V sec. CE), Ottoman (1299 CE-1922 CE), Russian (1721 CE-1917 CE), Holy Roman/Habsburg (800-1802), British (1707 CE- 1914 CE), French First and Second (1804 CE-1870 CE), Spanish (1492 CE-1976 CE), Dutch Colonial (1590 CE-1661 CE), and Japanese (1868 CE- 1947 CE). Although we do not have an exhaustive coverage of all ancient chiefdoms and kingdoms, our selection covers most of the institutional links between countries. For instance, we do not have, in the data, the Kush kingdom, located in almost the same area of the ancient Egypt, or the Mayan empire, already covered by the Spanish colonial empire. Notice that, since the empires we considered flourished in different historical periods, there is some

[37] As it is well known, a distinguishing element of the administrative and political organization denoted empire is that a single sovereign authority exercises control over territory of great extent involving different ethnicities or a number of distant territories populated by different ethnic groups.

overlap. The empirical results (available upon request) turned out to be robust to the inclusion of this additional empire dummy.

Ethnicity. We report here checks for the possibility that our bilateral, country-level measures of folklore similarity may reflect similarities in ethnic composition rather than true cultural similarities. Specifically, we considered a set of dummy variables, each equal to one for a country pair when the population share of a given ethnic group exceeds a certain threshold in both countries. The empirical exercise involves estimating the following equation:

$$|Y_i - Y_j| = \beta_0 + \beta_1 D_{ij} + \Gamma X_{ij} + \sum_{k=1}^{K} W_k^{ij} + \eta_i + \eta_j + \varepsilon_{ij}$$

where $W_k^{ij} = 1$ if $\omega_k^i > \alpha$ and $\omega_k^j > \alpha$, with ω_k^i being the population share of ethnic group k in country i. As a benchmark threshold, we pick $\alpha = 0.05$, that excludes about on third of all ethnic groups in the sample which happen to be present in more than one country, ending up with 121 additional dummies. All the regression results turned out to be robust. For further robustness, we also considered an additional, smaller, threshold level of $\alpha = 0.015$ that excludes only about 5% of the groups, ending up with 159 dummies and robust empirical results (all results available upon request).

Production Modes. We considered several additional control variables designed to account for specific societal organizational differences that might have influenced folklore. First, the subsistence economy measures from the Ethnographic Atlas, namely the dependence, in relative terms, on specific economic sector of activity such as agriculture, animal husbandry, hunting, fishing and wild plant gathering. For each ethnic group pair, we computed the absolute value of the difference of the scores (1 to 9) assigned in the Atlas. The reason why we included this additional control is that the subsistence mode influences (functionally) the emergence, selection, fixation and exchanges of the cultural traits recorded in the oral tradition. As an example of this functional basis of the emergence of a specific set of cultural traits consider that hunting societies tend to focus on and value different aspects of human behavior, skills and psychological traits (bravery, strength, patience, coordination etc.) than agricultural societies (thrift, hard work, etc.). Moreover, recent evidence by Cao et al. (2021) shows how a particular form of pastoralism is associated to a culture of honor with strong emphasis on revenge and violence, and a higher prominence of motives featuring those themes in the oral tradition. Next, we considered the type of agriculture practiced, since it is related to the type of environment in which the groups are embedded, because -for instance- of the need of irrigation. Once again, we computed the absolute value of the difference in the scores in the Atlas. Lastly, we included a dummy equal to one if the groups domesticated the same animals (cows, sheep, etc.), both because it is a further indicator of a common environment (e.g. camels vs cows) and because this is likely to have influenced the exchange of traits/motifs in the oral traditions. Following Cao et al. 2021) and Becker (forthcoming), we also computed an additional variable for the dependence on pastoralism, equal to the product on the dependence on animal husbandry and on an indicator equal to one in case the main animal in a society is a herding animal (sheep, cattle, horses, reindeer, alpacas, or camels). In all cases, we computed country-level weighted average and, upon their inclusion in the baseline regression, we found robust results (not reported, available upon request).

Historical Income Differentials. A natural question is whether folklore similarities are more or less important in more recent period compared to the past. To explore this hypothesis, we collected historical income data from the Maddison Project database,

Table 9 Folklore and income differences, historical

	Differences in GDP per capita							
	(1800-50)	(1850-1900)	(1900-45)	(1945-70)	(1970-90)	(1990-2000)	(2000-10)	(2010-20)
Folk Cosine	−0.2002**	−0.3031***	−0.2189***	−0.2417***	−0.2960***	−0.2454***	−0.2829***	−0.2722***
	(0.0981)	(0.0829)	(0.0701)	(0.0634)	(0.0651)	(0.0528)	(0.0527)	(0.0543)
Geo	0.1704	0.1626	−0.0165	−0.1314	−0.0719	−0.1617*	−0.1167	−0.1237
	(0.2735)	(0.4045)	(0.3988)	(0.1872)	(0.1088)	(0.0986)	(0.0921)	(0.0918)
Gen	0.2175**	0.0758	0.0791	0.2119***	0.3285***	0.2653***	0.2418***	0.2637***
	(0.1085)	(0.0794)	(0.0601)	(0.0622)	(0.0635)	(0.0548)	(0.0582)	(0.0583)
R^2	0.128	0.134	0.120	0.118	0.169	0.122	0.122	0.133
Obs	1596	2415	3321	9045	11325	11325	11325	11325
Countries	57	70	82	135	151	151	151	151

Observations are for country pairs. Dependent variable is the average of the absolute value of the differences in the logs of GDP per capita in the period specified in column. Folk Cosine is folklore-based cultural similarity measure based on the cosine similarity of the motifs. Geo is geodesic distance between the ethnic group centroids. Gen Dist is microsatellite genetic distance. All regression include: linguistic distance, religious distance, a dummy for contiguous countries, the percentage of common ethnic groups, the share of the joint population in the common ethnic groups, the index of joint fractionalization, a dummy in case one country is an island, a dummy in case one country is landlocked, a dummy for a common sea or ocean, the transportation cost from Giuliano et al. (2014). Two-way clustered standard errors (ethnic group level) in brackets. *** significant at the 1% level. * significant at the 5% level computed average income differentials over several historical periods, and then ran regressions of income differences in specific sub-periods on our indices of folklore similarity and controls. We chose the following time periods, with more extended time windows for past periods because of the smaller number of available historical observations: 1800-1850; 1850-1900; 1900-1945; 1945-1970; 1970-1990; 1990-2000; 2000-2010; 2010-2020. The empirical results are reported in Table 9. The evidence shows that, regardless of the different periods, the main empirical results are stable over time. These results support a large persistence of the effect of the cultural heritage in explaining income dispersion at the country level.[38] An important caveat is that, in all of those regressions, because of the absence of systematic historical population composition data, we use the same explanatory variables that assume a fixed population structure by ethnicity, which means that the results must be interpreted with caution.

Various Robustness Checks. The denominator of the cosine measure of folklore similarity is the same as the denominator of the Jaccard coefficient, to normalize the measure in between 0 and 1. This normalization is potentially problematic due to the absence of idiosyncratic motifs in the folklore catalog, possibly inducing an upward bias in the index of folklore similarity (the denominator does not include motifs that are idiosyncratic to oral traditions). For this reason we also tried using an alternative, non-normalized, measure of folklore similarity, equal to the numerator in Eq. (1), which is the raw number of shared motifs between ethnic groups corrected for text similarity, obtaining similar results (not reported, detailed results available upon request). The problem with this alternative measure is its difficult interpretation, given that it might be artificially high for countries with more extensive oral tradition (i.e. more motifs in the catalog). We also tried using the numerator of the Jaccard coefficient (not corrected for text similarities), for further robustness, obtaining similar results.

Another concern could be that the cosine measure potentially overestimates folklore similarity because the textual similarities are determined by word choices in the motifs descriptions. We do not think that this is problematic because the max operator in equation (2) limits the extent of the problem (small similarities between motifs text strings are seldom included in the index computation). Nevertheless, we also considered a regression specification based on indices computed by including only the cosine similarities between motifs above a certain threshold, finding similar results also in case of relatively high thresholds above 0.5[39] (results available upon request).

6 Cultural doorways and the diffusion of development: mechanisms

In this section we explore few mechanisms through which a shared folklore can affect current economic disparities in country pairs. First, we follow MX and study a purely cultural channel, according to which ancient cultural traits affect current cultural traits (Sect. 6.1) by direct fixation of specific traits. Second, we explore the possibility that cultural distances act as a barrier to the diffusion of innovations (Sect. 6.2), in line with the analysis by SW. Next, we study the relationship between folklore similarities and management

[38] This result we consider as an extremely interesting preliminary evidence that deserve further investigation of its own.

[39] Note that Jaccard coefficient is equivalent to our measure with a threshold text similarity of 1.

Table 10 Folklore and world values survey (WVS)

	Cultural Distance based on WVS			
	(1)	(2)	(3)	(4)
Folk Cosine	−0.3954***	−0.2261***		
	(0.0713)	(0.0659)		
Folk Cont			−0.1632***	−0.0864**
			(0.0441)	(0.0438)
Gen Dist		0.0947		0.1607**
		(0.0677)		(0.0718)
R^2	0.157	0.236	0.095	0.224
Contr	No	Yes	No	Yes

Observations are for country pairs. Dependent variable is current cultural distance measured as the fixation index of WVS answers (average 2005–2014). Folk Cosine is folklore-based cultural similarity measure based on the cosine similarity of the motifs. Folk Cont is folklore-based cultural similarity measure based on concept intensity. Gen Dist is microsatellite genetic distance. All regression include geodesic distance, a dummy for contiguous countries, the percentage of common ethnic groups, the share of the joint population in the common ethnic groups, the index of joint fractionalization, a dummy in case one country is an island, a dummy in case one country is landlocked, a dummy for a common sea or ocean, the transportation cost from Giuliano et al. (2014), and two-way country fixed effects. Regressions in columns (2) and (4) include also linguistic and religious distance. Two-way clustered standard errors in brackets. Standardized Beta coefficients. 2628 observations and 73 countries. *** significant at the 1% level. *** significant at the 1% level. ** significant at the 5% level

practices (Sect. 6.3), a very specific technology, influenced by cultural factors, that is crucial for long-run growth (Bloom et al., 2016).

6.1 Ancient cultural similarities and current cultural distances

World Values Survey. The first mechanism that we consider entails the persistence of cultural traits (Bisin & Verdier, 2000, 2023), which also emerges from the analysis of MX. The main empirical exercise consists in a simple regression of currently observed cultural differences, as recorded in the World Values Survey, on folklore based measures of cultural similarity. For similarity of currently observed traits we use the synthetic measure of cultural distance developed by Muthukrishna et al. (2020), averaged over the period 2005-2014. The logic behind the construction of this measure is the same used to compute genetic distance measures with fixation indices (Cavalli-Sforza et al., 1994), but applied to surveys designed to elicit individual cultural traits.[40] We chose this measure for three main reasons: because it leverages a vast amount of information[41] because it overcomes many of the issues that emerge in other measures of cultural distance based on survey answers, related in particular to within-group variability; because, as showed by Desmet

[40] In synthesis, Muthukrishna et al. (2020) treat survey questions as DNA loci (location of the genes responsible for a particular trait such as eye color), and survey answers as alleles (gene variations for blue, green, brown eyes etc.) and then they compute the fixation index as the ratio of the between and within groups variance of answers (alleles) for a particular question (or locus) in the WVS answers by individuals in two populations.

[41] The full set of used answers is available at the URL: http://www.culturaldistance.com

Table 11 Folklore and fertility

	Differences in Fertility Rates			
	(1)	(2)	(3)	(4)
Folk Cosine	−0.3257*** (0.0493)	−0.2945*** (0.0624)		
Folk Cont			−0.2492*** (0.0399)	−0.2033** (0.0439)
Gen Dist	0.3986*** (0.0714)	0.4691*** (0.0768)	0.4233*** (0.0713)	0.4998*** (0.0739)
R^2	0.357	0.448	0.351	0.446
Obs	11325	9453	11325	9453
Countries	150	138	150	138
Contr	No	Yes	No	Yes

Observations are for country pairs. Dependent variable is the difference in the fertility rate from the WB development indicators (average 2000–2020). Folk Cosine is folklore-based cultural similarity measure based on the cosine similarity of the motifs. Folk Cont is folklore-based cultural similarity based on concept intensity. Gen Dist is microsatellite genetic distance. All regression include geodesic distance, a dummy for contiguous countries, the percentage of common ethnic groups, the share of the joint population in the common ethnic groups, the index of joint fractionalization and (two-way) country fixed effects. Contr indicates the presence of additional controls: Linguistic distance, religious distance, a dummy in case one country is an island, a dummy in case one country is landlocked, a dummy for a common sea or ocean, the transportation cost from Giuliano et al. (2014), the latitude difference, the average difference in the percentages of the total surface in each of the 12 Koeppen-Geiger climate zones), a dummy equal to one in case only one of the countries in a pair is from Eurasia (Diamond effect), the difference in the agricultural transition timing, the difference in the Polity2 scores, a dummy equal to one in case of a past colonial relationship, a dummy in case the two countries have ever been in the same country. Two-way clustered standard errors in brackets. Standardized Beta coefficients. 2628 observations. *** significant at the 1% level. ** significant at the 5% level

and Ortuno-Ortin and Romain Wacziarg. (2017), it is highly correlated with alternative measures of cultural distance that account for the overlap between culture and ethnicity. Table 10 reports the results. It shows that, conditioning on controls and fixed effects, folklore similarity predicts smaller current cultural distances.

Fertility. The second empirical exercise that we conduct to study cultural persistence as a transmission mechanism involves the cultural basis of fertility choices. The idea is that preferences over the number of children could be similar among individuals that share a common culture, and there is literature linking fertility choices to income per capita (Becker et al., 1990; Ahituv, 2001; Hazan & Berdugo, 2002). We use the fertility data, that is the country-level average number of births per woman, from the World Bank Development Indicators, and compute the absolute value of the difference in average fertility. We then regress the average difference in fertility from 2000 to 2020 on folklore similarity and controls. The results are summarized in Table 11. It shows that folklore similarities are also associated with similar fertility choices.

6.2 Cultural doorways and technology

Another important mechanism linking folklore similarity to income differences is through the barrier effect to the diffusion of innovations. Here we report four sets of empirical results in support for this hypothesis. The first test, in line with the analysis by SW, is based

Table 12 Folklore and income differences, relative to frontier

	Differences in Log Income per Capita					
	(1)	(2)	(3)	(4)	(5)	(6)
RelFolk Cosine	0.3931*** (0.0467)	0.2534*** (0.0532)	0.3029*** (0.0761)			
RelFolk Cont				0.3819*** (0.0448)	0.2419*** (0.0514)	0.2256*** (0.0617)
RelGen		0.2421*** (0.0575)	0.1556** (0.0744)		0.2416*** (0.0565)	0.1982*** (0.0678)
R^2	0.177	0.209	0.235	0.169	0.203	0.219
Obs	12403	11175	9316	12403	11175	9316
Countries	158	150	137	158	150	137
Contr	No	No	Yes	No	No	Yes
FE	No	No	Yes	No	No	Yes

Observations are for country pairs. Dependent variable is the absolute value of the differences in the logs of income per capita. RelFolk Cosine is the absolute value of the difference of folklore-based cosine cultural similarity from the technological frontier (US). RelFolk Cont is the absolute value of the difference of folklore-based cultural similarity measured with average concept intensity from the technological frontier (US). RelGen is the relative genetic distance from the US. All regression include geodesic distance, a dummy for contiguous countries, the percentage of common ethnic groups, the share of the joint population in the common ethnic groups and the index of joint fractionalization. Contr indicates the presence of additional controls: Linguistic distance, religious distance, a dummy in case one country is an island, a dummy in case one country is landlocked, a dummy for a common sea or ocean, the transportation cost from Giuliano et al. (2014), the latitude difference, the average difference in the percentages of the total surface in each of the 12 Koeppen-Geiger climate zones), a dummy equal to one in case only one of the countries in a pair is from Eurasia (Diamond effect), the difference in the agricultural transition timing, the difference in the Polity2 scores, a dummy equal to one in case of a past colonial relationship, a dummy in case the two countries have ever been in the same country. Two-way clustered standard errors in brackets. FE is yes in case of two-way country fixed effects are included. Standardized Beta Coefficients. *** significant at the 1% level. ** significant at the 5% level

on the idea that learning from the technological leaders/innovators is more difficult in case of cultural differences. So we explore a regression of income differences on the folklore based measure of relative cultural distance from the technological frontier. The second, more direct, test, entails the use of the technology adoption data in Comin et al. (2010), which refer to 5 broad sectors: agriculture, transportation, communication, industry and military; the third test involves patent cooperation data, to investigate whether patents are more likely to be shared among culturally similar countries. The last test is focused on the role of foreign direct investments (FDI) as a tool for international transfers of embodied technologies. All in all, the evidence highlights how folklore similarities facilitate technological transfers.

Technological Frontiers and Maladaptation. Table 12 reports the results from a regression similar to equation 5 where the differences between log income per capita in the pair is regressed not on folklore similarity but rather on the relative folklore similarity from the technological frontier: our variable of interest is then equal to $|D_{i,US} - D_{j,US}|$, where D is either of our two measures of folklore similarity. Note that, since we take the absolute value of the difference in similarities with the technological frontier, we are in fact measuring the relative distance of country pairs, therefore the sign of the coefficient is expected to be positive for both our indices of cultural similarity. Indeed, we find that a relatively

Table 13 Folklore and income differences, alternative frontiers

	Differences in Log Income per Capita				
	China	Japan	France	Burundi	Malawi
RelFolk Cosine	0.4015***	0.2347***	0.2006***	0.2913**	0.1954**
	(0.1134)	(0.0621)	(0.0702)	(0.1379)	(0.0962)
RelGen	0.2653***	0.2515**	0.2391***	0.2089***	0.2098**
	(0.0772)	(0.0747)	(0.0714)	(0.0805)	(0.0881)
R^2	0.169	0.169	0.216	0.166	0.175

Observations are for country pairs. Dependent variable is the absolute value of the differences in the logs of income per capita. RelFolk Cosine is the difference of folklore-based cultural similarity from the country indicated in column, computed using cosine similarity. RelGen is the relative genetic distance from the country indicated in column. Rel is religious distance. Lang is linguistic similarity. All regression include: geodesic distance, a dummy for contiguous countries, the percentage of common ethnic groups, the share of the joint population in the common ethnic groups, the index of joint fractionalization, a dummy in case one country is an island, a dummy in case one country is landlocked, a dummy for a common sea or ocean, the transportation cost from Giuliano et al. (2014), the latitude difference, the average difference in the percentages of the total surface in each of the 12 Koeppen-Geiger climate zones), a dummy equal to one in case only one of the countries in a pair is from Eurasia (Diamond effect), the difference in the agricultural transition timing, the difference in the Polity2 scores, a dummy equal to one in case of a past colonial relationship, a dummy in case the two countries have ever been in the same country, two-way country fixed effects. Two-way clustered standard errors in brackets. Standardized Beta Coefficients. 9316 observations and 137 countries. *** significant at the 1% level. ** significant at the 5% level

bigger difference in the folklore-based cultural similarity relative to the technological frontier predicts higher differences in income per capita in country pairs.

Since the US, although technologically advanced, is not the only country from which innovations originate, and since innovations could be interpreted in a less restrictive sense than in a purely technological way - broadly speaking also as institutional distances - we extended the analysis allowing for different frontiers. The results for the cosine similarity measure are reported in Table 13. First, we considered two technological advanced, Asian countries, China and Japan, who are both geographically and culturally quite distant from the US. The results turned out to be in line with the US benchmark, also in terms of point estimates. We then considered France, an advanced European country, obtaining again analogous results. However, it is interesting to notice that similar empirical results hold also in cases where poor and developing countries are used as benchmark to compute the relative distance. In Table 13, we report the results for the two poorest countries in the sample, Burundi and Malawi. Thus, being culturally similar to countries which are far from the technological frontier predicts a similar (small) level of income per capita.

We interpret these results as evidence that cultural channels are not necessarily a way to technological advancement. Rather, they can actually reinforce the persistence of traits that prevent the diffusion of development[42]: a strong cultural link to a country which is far from the technological frontier tends to increase the distance from the frontier, coeteris paribus. In practice, the data show a lock-in effect, or development trap. This we consider as evidence in favor of the persistence of "maladaptive" ideas: in the process of the cultural evolution through social learning, it is impossible for each individual to evaluate all

[42] The underlying mechanisms are conceivably similar to those considered in the literature on social segregation.

Table 14 Folklore and technology adoption

	Agriculture	Communication	Transportation	Industry	Military
Folk Cosine	−0.1665***	−0.4801***	−0.3626***	−0.2185***	−0.4167***
	(0.0391)	(0.0603)	(0.0492)	(0.0408)	(0.0681)
Gen dist	0.1567**	−0.0068	0.0271	0.0625	0.0099
	(0.0706)	(0.0598)	(0.0511)	(0.0447)	(0.0526)
Dist	0.1374	0.2124	0.4570*	0.3533***	0.1720
	(0.1483)	(0.1782)	(0.2569)	(0.1413)	(0.1510)
R^2	0.181	0.290	0.304	0.440	0.259

Observations are for country pairs. Dependent variable is the absolute value of the difference in the level of technological adoption in 1500 from Comin et al. (2010) in the sector indicated in column. Folk Cosine 1500 is folklore-based cultural similarity measure based on the cosine similarity of the motifs, between dominant ancestral ethnic groups. Gen Dist is microsatellite genetic distance. Dist is geodesic distance between the country capitals. All regression include: linguistic and religious distance, a dummy for contiguous countries, the percentage of common ethnic groups, the share of the joint population in the common ethnic groups, the index of joint fractionalization, a dummy for past colonial relationships, a dummy in case in the two countries have ever been the same country, a dummy for a common sea or ocean, freight costs and two-way country fixed effects. Clustered standard errors at the country pair in brackets. Standardized coefficients. 5565 observations and 106 countries. *** significant at the 1% level. ** significant at the 5% level

beliefs made available by culture, with the consequence that some of them persist even if they affect outcomes negatively, something that is impossible in biological evolution (Boyd & Richerson, 2005). Importantly, the estimates that we obtain change with the choice of the ”frontier” country. For instance, the regression coefficient on relative folklore similarity is not statistically significant when taking Russia (a middle income country in Europe with medium technology level) or Mozambique (in the bottom decile of income per capita) as benchmark. These differences deserve further investigation, which we leave to future research.

Technology Adoption The second test is based on the technology adoption data by Comin et al. (2010). The dataset consists of a set of binary indicators which register the presence or absence of a specific technology in a given time period, then aggregated at the level of macro-sectors: agriculture, communication, transportation, industry and the military.[43] We focus on the data at 1500 AD because they are based on more detailed information compared to that available for earlier periods (0 AD and 1000 BC), and because they are not influenced by the technological transfer and the migration/colonization processes that took place after the great geographic discoveries.[44] Consistently with the methodology adopted so far, we computed, for each country-pair, the absolute level of the difference in the level of technological adoption, and regressed it on folklore similarity and controls. We use the folklore similarity measures between dominant, ancestral, ethnic group pairs for consistency with the historical period we chose. The baseline results for the cosine similarity measure are summarized in Table 14. Overall, the results highlight that more folklore

[43] Examples of such technologies include, among others: plough agriculture, firearms, ships capable of trans-oceanic journeys, magnetic compass, books, iron, and steel. See Comin et al. (2010) for a complete list and for details on the sectorial aggregation.

[44] Going further back in time, namely using data for O AD and 1000 BC is problematic because technological differences tend to lump at zero and one.

Table 15 Folklore and patents

	Patent cooperation					
	Foreign	Domestic	Coinv	Foreign	Domestic	Coinv
	(1)	(2)	(3)	(4)	(5)	(6)
Folk Cosine	0.7880* (0.0430)	0.9308*** (0.3477)	0.8109** (0.4286)			
Folk Cont				2.0262** (0.9730)	1.8035** (0.7884)	2.0589** (0.9635)
Gen Dist	2.8319 (4.9431)	5.1394 (5.2011)	2.8121 (4.9336)	2.1861 (4.7852)	3.7219 (5.1573)	2.1765 (4.7969)
Pseudo R^2	0.970	0.978	0.971	0.971	0.978	0.971
Obs	7565	7654	7569	7565	7654	7569
Countries	96	96	96	96	96	96

Observations are for country pairs. Dependent variable is indicated in column. Foreign is the number of patents invented by residents that are owned by foreigners; Domestic is the number of patents owned by residents that have been invented by foreigners. Coinv is the number of patents invented by residents with at least one foreign co-inventor. All patent data are from the PATSTAT database and summed over the period 2013-2023. Folk Cosine is folklore-based cultural similarity measure based on the cosine similarity of the motifs. Folk Cont is folklore-based cultural similarity based on concept intensity. Gen Dist is microsatellite genetic distance. All regression includes: geodesic, linguistic and religious distance, a dummy for contiguous countries, the percentage of common ethnic groups, the share of the joint population in the common ethnic groups, the index of joint fractionalization, a dummy for past colonial relationships, a dummy in case the two countries have ever been the same country, a dummy for a common sea or ocean, freight costs and two-way country fixed effects. Table entries are coefficients from a Pseudo Maximum Likelihood Poisson regression. Standard errors clustered at the level of the country pair in brackets. *** significant at the 1% level. ** significant at the 5% level. * significant at the 10% level

similarity is associated with a smaller difference in the level of technological adoption. We find similar results when using the technology adoption data from Comin et al. (2008) that refer to 2000 AD, using actual folklore similarity instrumented with ancestral, pre-1500 folklore similarity (the only difference is that the coefficient on transportation technology is significant only at the 10% level, and there is no military technology adoption data available).

Patents. The next empirical tests provide more direct evidence on the effect of folklore similarity on technological transfers. We start from data on patent cooperation from the PATSTAT database, to check whether folklore similarity facilitates the sharing of innovation. We focus on three indicators: a measure of foreign ownership of domestic inventions (number of patents invented by residents that are owned by foreigners), a measure of domestic ownership of inventions made abroad (number of patents owned by residents that have been invented by foreigners), and patents with foreign co-investors (patents invented by residents with at least one foreign co-inventor). For all three indicators we compute the total number of patents over the available data period, from 1999 to 2022, and we build a directed dataset of country pairs. We then regress our bilateral patent cooperation indicators on folklore similarity and on the set of controls used in our main empirical specifications, including two-way country fixed effects. Since there are many zeros in the sample, that indicate the absence of patent cooperation, we use the pseudo-maximum likelihood Poisson estimator proposed in Correia et al. (2020). Given that the dataset is directed, we cluster the standard errors at the country-pair level. The results are reported in Table 15 for

Table 16 Folklore and FDI

	Foreign direct investment			
	(1)	(2)	(3)	(4)
Folk Cosine	0.1027*** (0.0411)	0.1453*** (0.0437)		
Folk Cont			0.0364** (0.0186)	0.0531*** (0.0190)
Gen Dist	−0.0203 (0.0743)	0.0431 (0.0799)	−0.0307 (0.0753)	0.0269 (0.0810)
R^2	0.075	0.129	0.074	0.221
Obs	8599	7718	8599	7718
Countries	167	151	167	151
GDP dif	no	yes	no	yes

Observations are for country pairs. Dependent variable is the average flow of FDI over the period 2005-2014 from the OECD database. Folk Cosine is folklore-based cultural similarity measure based on the cosine similarity of the motifs. Folk Cont is folklore-based cultural similarity based on concept intensity. Gen Dist is microsatellite genetic distance. All regression include: geodesic, linguistic and religious distance, a dummy for contiguous countries, the percentage of common ethnic groups, the share of the joint population in the common ethnic groups, the index of joint fractionalization, a dummy for past colonial relationships, a dummy in case in the two countries have ever been the same country, a dummy for a common sea or ocean, freight costs and two-way country fixed effects. Regressions in columns (2) and (4) also include differences in log gdp per capita. Clustered standard errors at the country pair in brackets. Standardized Beta coefficients. *** significant at the 1% level. ** significant at the 5% level

both of our main indices of folklore similarity, and show that indeed patent cooperation increases with folklore similarity.

FDI. Our last test consists in looking at foreign direct investments (FDI) as an indicator of technological transfer. We start from the bilateral FDI flow database from the OECD, and build a directed dataset of country-pairs taking averages over the period 2000-2013. The empirical test entails regressing the FDI flow from country i to country j on their folklore similarity conditioning on the same set of control variables as in our baseline empirical specification and on two-ways country fixed effects, clustering the standard errors at the country pair level. The results are reported in Table 16. Overall, we find that FDI is facilitated by folklore similarity. It is important to notice that the results are robust in case we include the difference in log GDP per capita among the controls, regardless of the fact that it is a “bad” control.

6.3 Cultural doorways and management practices

We study the relationship between folklore similarity and management practices, using the World Management Survey data (see (Bloom et al., 2014) and references therein). We explore this relationship for two main reasons. First, management is indeed a form of know-how (Bloom et al., 2016), with an empirically established impact on growth: better management practices are positively and significantly associated with higher productivity,

Table 17 Folklore and management practices

	Difference in management practices scores			
	(1)	(2)	(3)	(4)
Folk cosine	−0.4293*** (0.1207)	−0.2941** (0.1413)		
Folk cont			−0.3541*** (0.0973)	−0.1717* (0.0916)
Gen dist		0.2183* (0.1241)		0.2853** (0.1179)
R^2	0.213	0.204	0.170	0.195
Obs	561	528	561	528
Countries	34	33	34	33
Controls	no	yes	no	yes

Observations are for country pairs. Dependent variable is the difference in the management practices score from the World Management Survey. Folk Cosine is folklore-based cultural similarity measure based on the cosine similarity of the motifs. Folk Cont is folklore-based cultural similarity based on concept intensity. Gen Dist is micro-satellite genetic distance. All regression include: geodesic distance, a dummy for contiguous countries, the percentage of common ethnic groups, the share of the joint population in the common ethnic groups, the index of joint fractionalization and two-way country fixed effect. Controls is yes in case of additional control variables included in the regression: linguistic distance, religious distance, a dummy for past colonial relationships, a dummy in case in the two countries have ever been the same country. Clustered standard errors at the country pair in brackets. Standardized Beta coefficients. *** significant at the 1% level. ** significant at the 5% level. * significant at the 10% level

firm size, profitability, sales growth, market value and survival probability, with a positive overall effect on country-level Total Factor Productivity (TFP). Second, management is a technology that depends on social interactions, so that it is potentially influenced by cultural diversity and our folklore based measure should be able to account for such differences. We average the firm level management scores assigned on the basis of all questions at the country level, and then regress the absolute value of the difference of the management scores on folklore similarity and control variables. Empirical results are summarized in Table 17, and they show that more similar practices are associated with more folklore in common. This result confirms that culture-specific traits are relevant for management practices, although there is still a high within-country variability (std) of the management practices scores that deserves further inquiry. The effect of folklore similarities on management practices highlights another transmission channel.

7 Folklore similarity: disaggregated measures

The aggregate measures of folklore-based cultural similarity that we used so far rely on a unitary notion of shared cultural identity. In this last part of the analysis, we partially change this conceptual framework. We adopt a different notion of cultural identity made of many component traits, and propose several disaggregations of our indices of folklore similarity, by types of motifs. The aim of the analysis is both to further shed light on the mechanism that links folklore similarities to income differences and, in addition, to check for the robustness of our baseline results. In what follows, we discuss three disaggregations of the cosine similarity measures, based on, respectively, geographic diffusion, expert's classification and relevance for growth. We also propose one disaggregation of the content similarity measure by homogeneous themes. In appendix, we discuss an alternative, data-driven disaggregation of the cosine similarity measure based on a topic modeling algorithm.

Spatial Diffusion. The first motifs disaggregation that we propose is according to their spatial diffusion. A casual look at the data reveals that some of the motifs in the folklore catalog are part of the oral tradition of ethnic groups located in quite distant areas, while others are just shared among geographically close groups. To measure geographic diffusion, we draw, on the World map, the smallest rectangle that contains all centroids of the ethnic groups whose catalog entries include the motif, and then compute its area.[45] The data confirm that there is a quite high variability of the geographical diffusion of the motifs, with a coefficient of variation of 80%.

We then split the folklore catalog according to the deciles of the empirical distribution of the geographic diffusion, and then compute our χ measure of folklore similarity on these subsets. Then we feed the disaggregated measures of folklore similarity into a LASSO to highlight the most significant predictors of income per capita differences. The result is that, conditional on all control variables, including country fixed effects, the most significant predictors are the 5^{th}, 8^{th}, and 10^{th} deciles.[46] In other words, the motifs that matter the most to explain income differences are the more geographically diffused. We also considered a disaggregation according to the number of groups with the motifs, regardless of the geographic area of diffusion (i.e. the numerator of the density measure). The Lasso selects only the 8^{th} percentile, still evidence that the communality of rare motifs does not matter. This is actually not surprising, given that it is difficult for two ethnic groups to share rare motifs (many zeros are recorded in the folklore similarity measure computed on rare motifs by construction).

Combining the results, we conclude that the folklore similarities that matter more to explain differences in income per capita are those about geographically more diffused motifs and about those held by a sufficiently large number of ethnic groups and cultures. The most likely reason is that motifs that are specific to few cultures are unlikely to foster communications and technological transfer on such a scale to be relevant to explain long-run growth. Moreover, the motifs that are less geographically diffused are shared between groups that share the same environment, and the effect of the latter on Gdp differences, for which we control in all regressions, trumps the one of folklore similarities.

Expert Classification. In a second exercise, we explore the classification of the motifs in the Berezkin catalog into 14 homogeneous groups:[47] sun and moon (group A), origins of the characteristics of the environment (group B), disasters (group C), fire and laughter (group D), origins of people and culture (group E), gender and sex (group F), fertility and

[45] Each rectangle is drawn using the minimum and maximum of the longitudes and latitudes of the groups centroids, and the geodesic distances between those point are computed using the Haversine formula

[46] Notice that the disaggregated measures at high deciles are very correlated with each other. For instance, the correlation between the disaggregated measures at the 9^{th} and 10^{th} deciles is 0.95, so it is not surprising that the 9^{th} decile is excluded from the selected regressors by Lasso.

[47] As noted by Berezkin, some of the motifs should actually belong to more than one group, and are classified according to the best match. This potentially induces some bias in the computations, although small given that this potential double-classification is not pervasive.

Table 18 Folklore and income, cosine, expert classification

Group of motifs	Coefficient	Number of motifs
Sun and moon (A)	−0.1076***	101
Origins of the environment (B)	−0.1632***	250
Disasters (C)	−0.1180***	69
Fire and laughter (D)	−0.0121	48
Origins of people (E)	−0.1330***	76
Gender and sex (F)	−0.1333***	159
Fertility and agriculture (G)	−0.0278	44
Paradise lost (H)	−0.1489***	121
Supernatural objects and creatures (I)	−0.0679*	235
Avenger heroes (J)	−0.0782**	114
Adventures: act of heroes (K)	−0.3276***	519
Adventures: monsters and evil spirits (L)	−0.2035***	265
Adventures: tricks (M)	−0.3026***	530
Fabulous and epic formulas (N)	−0.0998***	33

Coefficients of an OLS regression of the absolute value of the differences in the logs of income per capita on the disaggregated cosine similarity of folklore computed over the group of folklore motifs indicted in row. Number of motifs in the group in the last column. Included controls in all regressions: geodesic distance, a dummy for contiguous countries, the percentage of common ethnic groups, the share of the joint population in the common ethnic groups, the index of joint fractionalization, genetic distance linguistic distance, religious distance, a dummy in case one country is an island, a dummy in case one country is landlocked, a dummy for a common sea or ocean, the transportation cost from Giuliano et al. (2014), the latitude difference, the average difference in the percentages of the total surface in each of the 12 Koeppen-Geiger climate zones), a dummy equal to one in case only one of the countries in a pair is from Eurasia (Diamond effect), the difference in the agricultural transition timing, the difference in the Polity2 scores, a dummy equal to one in case of a past colonial relationship, a dummy in case the two countries have ever been in the same country. F is the first stage F statistic for folklore similarity. Two-way clustered standard errors in brackets. FE is yes in case of two-way country fixed effects are included. Standardized Beta coefficients. 9453 observations and 138 countries. *** significant at the 1% level. * significant at the 10% level

agriculture (group G), paradise lost (group H), supernatural objects and creatures (group I), avenger heroes (group J), adventures-act of heroes (group K), adventures-monsters and evil spirits (group L), adventures-tricks and episodes (group M), fabulous and epic formulas (group N). Our simple exercise consists of computing the χ measures of folklore similarity for each subset of the catalog, as defined by this classification. We then run our baseline regression model on each of the disaggregated χ measures conditional on the full set of control variables including country fixed effects.

The results are summarized in Table 18. We find that the largest and most significant regression coefficients, are those for motifs belonging to groups K, M and L (in descending order of importance), so for those classified as "Adventures". We then fit the model with all disaggregated measures of folklore similarity and use a LASSO for model selection (allowing for clustering). The result is the selection of the groups K and M, so the "Act of heroes" and the “Tricks”, those that relate to social interactions, moral values, and to decision making under risk and uncertainty. However, we also find significant coefficients, albeit of a smaller magnitude, for nearly all groups, except for the D and G.

We also tried to understand what groups of motifs have the biggest predictive power for differences in WVS answers, to further validate one of the transmission mechanisms based on the cultural channel as explored above. We found indeed that the folklore similarities relative to the K (coefficient -0.2068) and M (coefficient -0.2418) groups are strongly statistically associated (p-value <0.01) with the synthetic index of cultural similarity based on WVS. We conclude that in our sample there is strong evidence that motifs related to adventures influence current beliefs and norms as they emerge from the WVS and hence current income differences. However, we also found that cosmological motifs in the A group are also strong predictors of similarities in WVS answers (coefficient -0.3064), and in fact a LASSO selects this group only, but this is not surprising giving that many WVS questions are related to religious beliefs. Since the folklore similarities related to cosmological motives in the A group are also robust predictors of income differences (first row of Table 18), this we consider as additional evidence that the transmission channel of folklore through current beliefs is at work. For what concerns the management practices, we find the strongest coefficients for the A, K and M groups, consistently with the results for the WVS answers, but also in the I group. Most likely, the motifs that drive preferences and beliefs as they emerge from the WVS also shape the preferences for management practices. In the appendix, we explore an alternative, data-driven motif classification based on topic modeling.

Similarities in Growth-Related Motifs. We also implemented a further, narrower disaggregation of the folklore cosine similarity measure. We select specific motifs associated with concepts that might be relevant for economic growth.

The first concept we considered is “Trust” (tags: cheat, deceive, trick), following the literature linking trust to growth (Zak & Knack, 2001; Algan & Cahuc, 2010, 2013), and the empirical result in MX, who find a cross-country association between trust motifs and contemporary measures of ”trust in others”. To identify the motifs associated with trust, we use the data in in MX. They asked a group of individuals hired trough MTURKS (Amazon marketplace for job outsourcing) in several countries, to read the stories that involve tricksters and to state if, in their opinion, tricksters in a plot are punished or not. Starting from their data we classify motifs as trust-related if more than 50% of the hired individuals identified a punishment. We also consider the complementary “No Trust” concept (tricksters not punished, identified by more than 50% of the individuals hired through MTURKS), because similarities in the lack of trust might predict low levels of the income per capita in both countries. Since risk-taking is a fundamental part of any entrepreneurial activity, we also considered the concept “Risk”, again following the analysis by MX and the MTURKS-based procedure, using the motifs with challenges that turn out to be successful (as identified by the hired individuals). To capture differences in individual motivations to engage in economic activity, we considered the concept “Rich”. To identify the motifs associated with this concept, consistently with procedure used throughout the paper, and also with MX, we looked for tags in the motifs descriptions (tags: rich, richness, wealth, greed). Given our previous results on innovation and technological adoption, and given the importance of education (see (Krueger & Lindhal, 2001)) and human capital for long-run growth, we also considered the concept “Learn” (tags: learn, knowledge). Next, we considered the concept “Competition” following the literature on the relationship between competition and growth (Aghion & Griffith, 2005). Finally, since international trade is related to long-run growth (Dollar & Kraay, 2004) and (Alesina et al., 2005), (among others),

Table 19 Folklore and income, cosine, disaggregation by concept

Group of motifs	Coefficient	Number of motifs
Trade	−0.3004***	89
Trust	−0.1425***	40
No Trust	−0.1410***	57
Risk	−0.1859***	24
Richness	−0.4385***	119
Knowledge	−0.4144***	90
Competition	−0.1314***	41

Coefficients of an OLS regression of the absolute value of the differences in the logs of income per capita on the disaggregated cosine similarity of folklore computed over the group of folklore motifs associated with the concept in row. Number of motifs in the group in the last column. Included controls in all regressions: geodesic distance, a dummy for contiguous countries, the percentage of common ethnic groups, the share of the joint population in the common ethnic groups, the index of joint fractionalization, genetic distance linguistic distance, religious distance, a dummy in case one country is an island, a dummy in case one country is landlocked, a dummy for a common sea or ocean, the transportation cost from Giuliano et al. (2014), the latitude difference, the average difference in the percentages of the total surface in each of the 12 Koeppen-Geiger climate zones), a dummy equal to one in case only one of the countries in a pair is from Eurasia (Diamond effect), the difference in the agricultural transition timing, the difference in the Polity2 scores, a dummy equal to one in case of a past colonial relationship, a dummy in case the two countries have ever been in the same country. F is the first stage F statistic for folklore similarity. Two-way clustered standard errors in brackets. FE is yes in case of two-way country fixed effects are included. Standardized Beta coefficients. 9453 observations and 138 countries. *** significant at the 1% level

we considered the concept "Trade". In all cases, we restricted the folklore catalog to the motifs subset specific to a concept, and computed motif-specific folklore cosine similarity measures.

The results are reported in Table 19, and show that the oral tradition textual similarities specific to the above selected motifs are all significantly associated with differences in income per capita. This evidence also reinforces the results highlighted in Sect. 6.1, namely the relationship between similarities in oral traditions and similarities in contemporary values and norms, specifically for what concerns trust, risk-taking and the importance of knowledge and wealth accumulation. Note that the number of motifs on which cosine similarities are computed is much smaller for this disaggregation, resulting in a sparser folklore similarity matrix (i.e. many ethnic groups have zero similarity according to these concept-specific similarity measures). These results, however, must be interpreted with caution because folklore similarities are not fully independent from each other, since motifs can be typically shared together. This means that there is a high chance to find disaggregated folklore similarity measures that are very correlated with each other, which will not allow for a proper identification of the empirical models, as well as for model selection algorithms that might potentially be used to select the most relevant folklore similarities in the data (see infra for more detailed discussions and examples on these correlations).

Themes/Concepts Disaggregation. Finally, we propose to explore a disaggregation of the Θ measure of folklore similarity based on content. We implemented a theory-based classification of the concepts into 21 homogeneous groups, borrowing from the Ethnographic Atlas classification: kinship, population, settlement patterns, ecology and geography, labor, community organization, rituals and religion, gender, family and marriage, leadership, games, economy and trade, property, wealth transactions, class/social differentiation, politics, housing, moral values, abstract thinking, script vs oral vertical transmission. Importantly, we allow for each concept to be included in more than one group. For instance, the concept "Authoritarian" is classified as part of community organization, leadership, politics and labor. The complete classification is not reported and it is available upon request. We then computed the average difference in concept intensity, for all ethnic group pairs, over the concepts in each group. The resulting disaggregated measures turn out to be highly correlated with each other, in excess of 0.95 in all pairs, which is partially due to the overlap in the concepts classification, and partially to the fact that the motifs have many underlying themes. Given this pattern, feeding the disaggregated measures into a regression, or using Lasso for model selection, will not produce interpretable results. In appendix, we discuss further results obtained with a more extensive disaggregation by single themes, which still produces correlated measures. We conclude that the relative concept intensity measure is meaningful when computed on the full set of concepts, but not much helpful to disentangle the effects of specific cultural traits as associated to groups of motifs in the folklore catalog.

8 Conclusion

We introduced new indices of oral tradition similarity and, following Berezkin (2015, 2023), we demonstrated that, if conditioned on other measures of population relatedness- such as genetic, linguistic, religious, and geodesic distances- these indices provide significant quantitative insights into horizontal cultural exchanges between ethnic groups and cultures in history. Our findings show that countries and ethnic groups with greater similarities in their oral traditions tend to have similar levels of income per capita. This relationship holds robust even after accounting for various potential confounding factors, including the effects of out-of-Africa migrations, geo-climatic shocks (such as earthquakes and eclipses), and differing production modes. We also proposed evidence supporting the possible mechanisms that link our folklore based measures of cultural similarity to income differences. These include relationships between oral tradition similarities and technological transfers via patents and foreign direct investment (FDI), technology adoption, contemporary values and beliefs, management practices and fertility choices. This evidence underscores the idea that the intensity of historical horizontal cultural exchanges shaped the barriers to development, contributing to present-day income disparities.

An important caveat is that horizontal cultural exchanges are often the result of deeper demic and non-demic processes, such as the historical dynamics of trade patterns, migrations, and conflicts. Due to limitations in historical data, it was not possible to quantify the specific roles of these fundamental drivers of cultural exchanges, nor fully identify the ultimate determinants of folklore similarity on income differences. On this matter, we adhere to a "hypothesis non fingo" stance, leaving this inquiry to future research.

Nonetheless, we deem our findings as significant for two main reasons. First, they highlight the empirical importance of historical cultural interactions, as measured by folklore similarities, in explaining current income disparities. Spolaore and Wacziarg (2013), in their survey on the deep roots of comparative development, argue that while long-term historical factors matter, their persistence should not be overstated. They emphasize the role of contingencies shaped by human actions, noting that "The diffusion of knowledge takes place not only vertically (from one generation to the next within populations) but also horizontally (across populations)." Our analysis provides evidence that horizontally transmitted cultural traits -as markers of historical encounters between groups- is a powerful force in shaping economic and cultural distances between groups and nations. Second, to the extent that horizontal cultural transmission is shaped by historical processes, our analysis identifies oral traditions as a mechanism of persistence. Once embedded in the cultural identities of ethnic groups, these traditions influence contemporary income differentials.

Looking ahead, our measures of shared cultural heritage can serve as tools for studying the proximate causes and mechanisms through which historical cultural exchanges operate on a global scale. Future research could explore how folklore similarities impact trade patterns and agreements, regional integration, bilateral migration and financial flows, conflicts, and diplomatic relationships. These analyses, particularly in a pairwise context, could shed further lights on the enduring influence of cultural heritage in shaping modern socio-economic and geopolitical dynamics.-

Supplementary Information The online version contains supplementary material available at https://doi.org/10.1007/s10887-025-09253-7.

Funding Open access funding provided by Università degli Studi di Napoli Federico II within the CRUI-CARE Agreement.

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