The Role of History and Spatial Proximity in Cultural Integration: A Gravity Approach

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Abstract

Based on the idea that values diffuse spatially, over time, and more rapidly among similar socio-demographic groups, this paper estimates a 'cultural gravity model' that quantifies the respective contributions of spatial proximity, history and socio-demographic characteristics on cultural integration. I use localized micro-level data from a survey of 21,000 households and I exploit the variation in the extent of European dynastic Empires from 1300 to 2000 to shed light on the rate of cultural change. The results indicate that long history matters and illustrate that not only values but also economic occupations are very slow to change.

Keywords: culture, Europe, gravity model, history, spatial proximity.

JEL classification: F15 ; N00 ; O10 ; P30, Z1.

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1. Introduction

There has been a growing interest in recent years in the role of culture as a determinant of economic development. A number of studies have established the causal impact of socially transmitted norms of behavior on economic outcomes[2], and the economic impact of culture has been discussed as one explanation for the long term persistence of economic development (Guiso, Sapienza and Zingales 2007, 2008). Different determinants of culture have been discussed, such as institutions or events of the past (Tabellini 2008a, 2008b), geography and physical distance (Giuliano, Spilimbergo and Tonon 2006) or genetic distance (Spolaore and Wacziarg 2009). However, the empirical literature is short of a suitable methodology to quantify the respective contributions of these different elements, which are, to a large extent, correlated with one another. This has already been noted, namely by Giulano et al. (2006) who observe that geography explains genetic distance and by Nunn and Puga (2007) who argue that geographic conditions have both a direct and an indirect effect on development through their influence on institutional (Nunn and Puga 2007) and cultural development (Nunn and Wantchekon 2009). Similarly, one could argue that physical distance and history are correlated. For example, different historical experiences but also the relative geographic isolation of the South of Italy may contribute to explain its divergence from the North[3], whose location favored exposure to Enlightment values. This paper proposes a 'cultural gravity model' to measure the respective contributions of different determinants of cultural integration, which is defined as the similarity of opinions and outcomes.

[2] See, for example, Algan and Cahuc (*forth*), Benabou and Tirole (2006), Fernandez (2007), Fernandez and Fogli (2009), Guiso, Sapienza and Zingales (2008), Tabellini 2008a and 2008b . For a review, see Fernandez 2007)
[3] Guiso, Sapienza and Zingales (2008)

In the trade literature, the gravity model explains different intensities of trade integration as a function of the proximity of trading partners, respective and common characteristics of the economies. The 'cultural gravity model' explains different intensities of cultural integration as a function of spatial proximity, respective socio-demographic characteristics, and common characteristics, such as common institutions or a shared history. As in trade gravity models, a common metric (kilometers) quantifies the respective contributions to cultural distance of different determinants, such as spatial proximity, socio demographic characteristics or common history. The model can be applied to a wide variety of determinants and measures of culture, but for the clarity of the study, I choose to focus most particularly on history and spatial proximity as determinants and on two measures of cultural outcomes, which have been extensively used in the literature: general trust and economic occupations[4]. Tabellini (2008a, 2008) discusses how distant past history and local interaction act together to determine how much people trust one another[5]. Algan and Cahuc (*forth*) show that trust has a sizeable impact on economic development, namely by facilitating the accumulation of human and physical capital. Botticini and Eckstein (2006b) discuss how economic occupations are path dependent and influenced by changes in distant history, while many social network models since the pioneering work of Granovetter (1973) and economic geography models put forward the role of location in the determination of occupation patterns.

The data comes from the *Life in Transition Survey* (LITS), conducted by the World Bank and the EBRD in 2006 in 29 countries of Central, Eastern and South Eastern Europe[6]. I take advantage of three particularly appealing features of the data. First, LITS contains a very rich set of

[4] Previous versions of this paper looked at other outcomes such as preferences for redistribution, corruption or female labor force participation.
[5] See the theoretical model in Tabellini 2008b.
[6] LITS surveyed 1,000 households in each of 29 countries. Because I only have precise enough historical and geographic information on a subset of the countries included in the survey, I retain a subsample of 21 countries.

attitudinal questions and socio economic background information and, importantly, localization data of the households at the primary sampling unit[7] level. Second, the region covered by the survey is particularly well suited to a historical analysis in the sense that it was split for most of the historical time span that I consider (1300-2000) between a few Empires (the Ottoman Empire, the Austro Hungarian Empire, Prussia and the Russian Empire) with considerable variation in the geographical extent of such Empires. I exploit the variation in the length of integration of different localities into different Empires in order to shed light on the rate of cultural change. Third, most successor states borders do not coincide with former Empires' borders. This is key to distinguishing the legacy of history on culture from its legacy on current institutions.

One of the main messages of the paper is that history matters, even when spatial proximity, which is confirmed to be strongly correlated with history, is taken into account. Moreover, things move very slowly. For general trust, the significant effect of living under common institutions comes in effect after 400 years of Imperial Rule. For the pattern of economic occupations, things move faster: the effect of past empires is observed after "only" 200 years of common institutions. On the contrary, more recent history, such the former USSR or Yugoslavia, does not have any significant effect. Even more strikingly, current nation states do not matter, which may be explained by the fact that in this region, borders are not only recent (after the First World War for the oldest, after the collapse of the Soviet Union or the Yugoslavian war for others) but also in many cases arbitrary[8].

[7] There are 50 PSUs per country and 20 households per PSU.
[8] This is namely the case of borders inherited from the Saint Germain, Trianon or Versailles or treaties. The most striking example is Hungary, which, as a defeated power of the Axe, lost 72% of its territory, leaving a third of ethnic Hungarians outside of Hungary's new borders. For a more lengthy discussion of the arbitrary nature of many borders in the region, see Grosjean and Senik (*forth*)

The first set of contributions of this paper is methodological. This paper takes the point that culture matters and suggests a model and a measure of cultural distance, by means of one of the few applications of gravity models outside of the trade literature[9]. As in trade gravity models, a common metric (kilometers) quantifies the respective contributions of different determinants to cultural distance.

A second methodological contribution comes from the result that people who live close to one another are more similar to one another, and all the more so when they share a common history. This suggests a research design based, not on instrumental variables, but on precise geographic localization data in order to circumvent endogeneity biases. The idea is to get rid of cultural omitted variable biases by focusing on groups who are geographically close to one another and share a common history. This is the approach used namely in Miguel (2004) and Grosjean and Senik (*forth*), who use border zones as an identification strategy to identify the impact of distinct national policies on political preferences.

This paper also contributes to the trade literature and to the interpretation of distance and border effects in trade gravity models. Geographic distance is found to be a determinant of cultural distance, both in its own right but also as a proxy for other determinants of cultural distance, namely history. Because trade is positively correlated with cultural proximity (Giuliano, Spilimbergo and Tonon 2006; Toubal and Felbermayr 2006), this may explain why the coefficients on physical distance are so large in trade gravity models. Also, border effects may be overestimated for two reasons: not only because they proxy other breaks in cultural diffusion (i.e. language, current institutions, etc) but also because they suffer from an aggregation bias that

[9] Gravitational models have almost exclusively been applied to trade models, with two notable exceptions. Kelejian, Murrell and Shepotyloe (2007) develop a spatial analysis of spillover between countries in the development of institutions, but use a spatial lag model instead of a gravity model. Head Mayer (2008) use a gravity model to detect local interactions from the spatial pattern of first names in France.

ignores the continuous spatial cultural diffusion process[10][11]. For similar (and even stronger) reasons, this paper cautions against the use of national averages of cultural variables, which can introduce a large bias in cross country comparisons. For example, ignoring the spatial continuous process of cultural diffusion will overestimate the cultural distance between contiguous countries or countries that are physically close to one another[12]. Any attempt to control for this using, for example, physical distances between capital cities, is also biased, as it depends on the arbitrary relative location of capitals and still ioverlooks the continuous nature of the spatial diffusion process. [13]

The rest of the paper is organized as follows. Section 2 presents the econometric specification and introduces the data. Section 3 presents the results. In Section 4, the cultural gravity model is applied to investigate the impact of more recent history, such as the USSR or Yugoslavia and EU membership on cultural and economic integration. Section 5 discusses the main results, the potential applications of this approach and concludes. The appendix presents a theoretical model that extends traditional models of cultural transmission a la Bisin and Verdier (2001) in order to incorporate the spatial diffusion among *geographical* peer groups.

[10] In other words, two randomly picked individuals in a 10km radius of the border will be much closer culturally than two individuals picked within a 1000km radius, and this is ignored by taking country averages, what leads to an overestimation of the border effect.
[11] Gorodnichenko and Tesar (2009) provide another explanation why border effects are overestimated, which relies on cross country heterogeneity in the distribution of within-country prices.
[12] In other words, countries are not independent observations. Although this has been acknowledged in the literature before, it is a particular problem for culture studies, since the role of physical distance is found to be so important here.
[13] Take the example of two contiguous countries. If capital cities happen to be relatively far from each other (e.g. Vienna-Bern), the impact of distance will be underestimated. If they happen to be relatively close (Vienna-Bratislava), the impact of distance will be overestimated.

2. Econometric Specification and Data

2.1.Econometric Specification

The model in Appendix presents a continuous spatial diffusion process where the share of a cultural trait in a locality depends on the share of this trait in all localities that are connected with one another, discounted by a factor that increases in the physical distance between localities. To avoid Manski's reflection bias (Manski, 1993), I estimate a model in which the dependent variable is not the share of a cultural trait in a given locality but rather the dissimilarity in the prevalence of cultural traits between pairs of localities (Head and Mayer 2007) and adjust standard errors for dependence between observations. Following the trade gravity literature, I posit a concave relationship between cultural distance and physical distance and estimate the following dyadic model, which accounts for the properties of the model in Appendix:

$$MDC_{ln} = \alpha_1 MDS_{ln} + \alpha_2 MDE_{ln} + \alpha_3 MDO_{ln} + \alpha_4 MDR_{ln} + \alpha_5 \ln(\mathrm{DIST}_{\ln}) + \alpha_6 I + \alpha_7 C + \alpha_8 E + \delta_i + \delta_j + \epsilon_{ln} \quad (1)$$

where the MD variables are metrics of dissimilarity between pairs of locations *l* and *n*. In each case, I use the Manhattan Distance which sums over the absolute differences in shares of responses for multinomial variables (Head and Mayer, 2007). For example, MDC in the case of general trust is defined as: $MDC_{ln} = \sum_{i=1}^{I} |s_{il} - s_{in}|$ where s_{il} (respectively s_{in}) is the share, in location *l* (respectively *n*) of responses allocated to each modality *i* of the *I* modalities of the following *World Values Survey* question on general trust, which was replicated in the *Life in Transition Survey*: *"Generally Speaking, would you say that most people can be trusted, or that you can't be too careful in dealing with people?"* Responses modalities are on a scale of 1 to 5, with 1 corresponding to "Complete Distrust" and 5 to "Complete Trust". Dissimilarities across

localities for each of the variables of interest (see Subsection 2.3.) are defined in a similar way. For a dummy variable, the Manhattan Distance is just the absolute value of the difference between two locations.

The covariates in (1): social class dissimilarity *MDS*, education dissimilarity *MDE*, occupation dissimilarity *MDO* and religious affiliation dissimilarity *MDR* are defined in a similar way.

The next covariate in (1) examines the role of geographic distance between two locations. α_5 is expected to be positive. As usual in the gravity trade models, *I* is a dummy variable indicating whether the two districts are located in the same country and *C* is a dummy variable to indicate whether two locations belong to different but adjacent countries. The role of history is investigated through the dummy variable *E,* which indicates whether two locations belonged to the same Empire in the past. Subsection 2.4. describes in more details the different Empires the role of which is examined. Finally, the regression specification includes an error term and a set of intercepts δ_i, δ_j for each location (Primary Sampling Unit). The fixed effects are designed to capture third-location effects on the pairwise differences (Head and Mayer 2007). Also, to account for the fact that standard errors are correlated among every pair that contains a specific observation, standard errors are adjusted for clustering on any observation that contains either member of a pair, following the multi-way clustering method by Cameron et al. (2006).

2.2.Data

The data comes from the *Life in Transition Survey* (LITS), a survey conducted by the European Bank for Reconstruction and Development and the World Bank in 2006, in 28 post-transition

countries and Turkey[14]. Respondents to the survey were drawn randomly, using a two stage sampling method, with census enumeration areas as Primary Sampling Units (PSUs), and households as secondary sampling units. The definition of locations in this paper corresponds to the PSUs. The data set contains 50 PSUs in each of the 21 countries retained for analysis (see footnote 6). The list of countries used in this paper is displayed in Table A1 in Appendix. There are thus 1050 PSUs, and 550200 PSU pairs[15] for the analysis.

2.3.Dependent Variables

I consider two dependent variables, which measure the Manhattan Distance between locations in the following dimensions:

General trust:

The widely used World Value Survey question was included in the LITS survey:

Generally speaking, would you say that most people can be trusted, or that you can't be too careful in dealing with people? Please answer on a scale from 1 to 5, where 1 means that you have complete distrust in people, and 5 means that most people can be trusted. What would it be today? (Scale: Complete distrust=1, Some distrust=2, Neither trust nor distrust=3, Some trust=4, Complete trust=5)

Occupation:

The categories used in the construction of the Occupation Manhattan distance are the following: unemployed; pensioner; student; housewife; or employed, with this last category broken up in

[14] Turkmenistan was not included in the survey, neither was Kosovo. I exclude from the analysis countries from Central Asia and the Caucasus, for which I could not find detailed enough historical information. I am left with a data set of 21 countries, comprising 1050 PSUs and 21,000 households.
[15] $1050^2/2-1050$, since the relationship is undirectional

different subcategories of: white collar, blue collar, service worker and farmer or farm-worker. The different categories of employment were constructed from the responses about the respondent's first job, using the ISCO classification[16].

Table A3 in Appendix B presents descriptive statistics of all the variables.

2.4. History

The main historical variable is the integration of localities in the former Empires of Central, Eastern and South Eastern Europe: the Ottoman Empire, the Habsburg Empire, Prussia (and the Teutonic Order) and the Russian Empire, which occupied all the localities in the sample (with the notable exception of Upper Zeta, the central region of Montenegro). These events are quite distant in the region's past. The Ottoman Empire's territorial extension in South-Eastern Europe occurred mainly in the XIVth Century (Bulgaria, South Serbia, FYROM) and the XVth century (Albania, Bosnia and Herzegovina, Crimea, Moldavia, Wallachia and Montenegro). Territorial losses of the Ottoman Empire occurred chiefly in two waves: at the end of the XIXth century, namely after the Russian-Turkish War of 1877-1878, and at the eve of the first World War, after the Balkan Wars of 1911-1912. I designate by 'Habsburg Empire' what was the Kingdom of Hungary and the Austrian Empire and became the Austria-Hungarian Empire after the 1867 Ausgleich. Successor states, which became independent after the Saint-Germain and Sevres treaties of 1918, include territories that now belong to Croatia, Hungary, the Czech Republic, Poland, Romania, the Slovak Republic, Slovenia, Serbia and Ukraine. 'Prussia' designate Prussia per se (1525-1947) as well as Old Prussia (the Teutonic Order). Prussia encompassed territories

[16] The ISCO categories corresponding to our white collar category are: 1: Legislator, Senior Official and Manager, 2: Professionals, and 3: Technicians and Associated Professionals. Our service workers category consists of: 4: Clerks and 5: Service workers and shop and market sales workers. 6: Skilled agricultural and fishery workers are in our "farmer and farm worker category" together with independent farmers. All the remaining ISCO categories are considered as blue collar workers.

that are today part of Poland, Lithuania and Czech Republic, as well as Germany, Denmark, Belgium and the Netherlands (not included in our sample). Most territories outside of today's Germany were lost at the Treaty of Versailles in 1919. The Russian Empire's territorial expansion in Europe occurred mainly under Peter the Great in the XVIIth century and Catherine the Great in the XVIIIth century. Bessarabia was gained from the Ottomans in 1812. The Russian Empire encompassed more or less the Soviet Union, with the addition of Polish territories, Turkish territories, but a much smaller Ukraine, not all territories of the Baltic states and without Kaliningrad. I use the Periodical Atlas of Europe in order to reconstruct Empire delimitations and their evolution across time, from 1300, the start date of empire consolidation in Medieval Europe, to 2000. Table A2 presents some descriptive statistics on the length and geographical delimitation of these empires. The dummy variable "*Same Empire"* takes value 1 if two locations belonged to the same former Empire for more than 100 years. Figure A1 maps each Empire used in the empirical estimation.

2.5. Geography

The geographical distance between each pair of PSU is computed from longitudinal and latitudinal coordinates of the geographical center of the PSU using the great circle formula.

2.6.Other controls

The richness of the LITS data set makes it possible to control for many variables that could have an impact on the dependent variables, such as: differences in the age, gender, education, income levels and religious composition at the PSU level, but also the characteristics of the local

economy. I use the index developed by Grosjean and Senik (*forth*) that captures the development of the modern sector of the economy and the advancement towards a market economy.[17]

3. Results of the Gravity Model

3.1.Spatial Proximity and the Long Term Effects of History

Tables 1a and 1b present estimation results of the baseline gravity equation described in (1). Five different specifications for each dependent variable are presented. All specifications control for the full set of socio demographic distances. The first specification in each table investigates the effect of Same Country and Contiguity dummies, when the role of history and spatial proximity are ignored. The proxies for spatial proximity and history are then introduced, firstly individually, then together. The last specification in Tables 1a and in Table 1b is the one described in (1).

The results show that both spatial proximity and history play an important role in explaining dissimilarities in general trust and economic occupations. Physical distance increases dissimilarities, while having belonged to the same former empire tones them down. The effect of physical distance remains important, even once past and modern geopolitical considerations are taken into account. However, the coefficient drops significantly in magnitude (by 36% for general trust and by 47% for occupations) once the role of history is taken into account (columns (3) and (7)). There are two lessons from this first set of result. The first is that physical distance is a proxy for other determinants of cultural similarity. This explains why the coefficient on distance drops in magnitude when other factors of cultural distance, such as the influence of

[17] This index ("*industrial index*") measures the proportion of respondents in the active labor force who are self-employed with more than five employees, or have a formal labor contract and either: work in a small enterprise, work in a medium enterprise, work in a private firm, work in a newly created enterprise (since 1989).

historical events, are included. The second is that distance also plays a role in its own right as a determinant of cultural distance. This may capture the role of local social interactions, or as stated by Grossman (1986) the role of "familiarity [that] declines rapidly with distance". Grossman (1986) concludes that freight costs cannot explain the large distance effects estimated in trade gravity equations. This paper brings two explanations: (i) distance is a proxy for other determinants of "familiarity", for example a common past history, which, when not included in trade gravity models, lead to an overestimation of the effect of distance, (ii) distance itself plays a role as a direct determinant of "familiarity", which also contributes (directly) to the overestimation of distance effects.

History matters. Having belonged to the same former Empire for more than 100 years has the consistent and robust effect of diminishing dissimilarities between pairs of PSUs both for general trust and occupations. The persistent effect of past historical events, which are quite distant in time, even when geography and today's geopolitical conditions are included, is notable and sizeable. In fact, it far outweighs the influence of current geopolitical factors, such as nation states' borders. Indeed, the *Same Country* dummy, although significant when included on its own, loses significance when spatial proximity between locations and history are taken into account[18]. This may be explained by the fact that in this region, borders are quite recent (after the first World War for the oldest, after the collapse of the Soviet Union or the Yugoslavian war for others) and, in many cases, arbitrary. Still, this is a striking result in light of the strong country fixed effects that come out of cross country comparisons, which generally ignore the role of history and the spatial processes of cultural diffusion.

[18] Similarly for the *Contiguity* dummy.

To refine on the analysis, I investigate the effect of different time spans spent under common institutions; and the individual effects of the different Empires under consideration. I separate the *Same Empire* dummy into three different dummies indicating whether two locations spent 100 to 200 years, 200 to 400 years, or more than 400 years in the same Empire. Results are displayed in Table 2. The results concerning the time different time spans spent under Imperial rule stress the very slow nature of cultural change. The effect increases both in significance and in level the longest the time spent under the same Empire. There is however a difference between the impact of different time spans on general trust and on occupations. For general trust, the effect of history is not significant for less than 400 years of common Imperial rule. For economic occupations, the effect kicks in earlier, after "only" 200 years. Among the different Empires, the most influential Empires on general trust are the Ottoman Empire and, to a much lesser extent, Prussia. Similarly, the Ottoman Empire has left the biggest imprint on the pattern of economic occupations. In another paper, I provide an illustration of the potential channel for the long term persistence of Ottoman rule on the pattern of economic occupations, by documenting a strong and negative influence of former Ottoman occupancy on the development of formal financial institutions and on firm size.

Another implication of these results is that capturing cultural differences by history or geography alone may not be adequate. The impact of physical distance for example is not homogeneous, and depends on whether regions have lived under common institutions in the past. Physical distance is hence an imperfect proxy of cultural differences and this paper proposes a new measure of cultural distance that combines the influences of both history and physical distance and, possibly, of socio demographic determinants. Indeed, one of the advantage of using a gravity model to explore cultural differences is that it is possible to express the impact of each

variable in terms of a common metric. For example, having been integrated in a common empire for more than 100 years 'reduces' the cultural distance between two PSUs, in terms of general trust, by the equivalent of 1394 km.[19] The average physical distance between two locations in the sample is 1029km. At the sample average, the effect of having belonged to the same Empire is to reduce this distance by 349km. By contrast, differences in religions increase the distance by 499km, at the sample average (in terms of differences in general trust). The effect of former history is even stronger for the pattern of economic occupations: around 2778km, or 695km at the sample average.

As displayed in Tables 1a and 1b, most other covariates included in (1) have expected positive signs: dissimilarities in terms of social class composition, education, gender composition, religion or differences in industrial development contribute positively to cultural distance in general trust and dissimilarity in economic occupations.[20]

[19] Computed as: 10.29*(-0.042/(0.031/100)). 10.29 is equivalent to a one percent change in average distance.
[20] I check that the results obtained here are robust to alternative specifications such as using a log log specifications or dropping observations which are further than 3000 km apart.

4. Applications of the Cultural Gravity Model to more recent history: the Effects of USSR, Yugoslavia and the European Union

4.1.USSR and Yugoslavia

I add to the specification in (1) two dummy variables investigating further the role of more recent history: USSR and Yugoslavia, which take value 1 if both PSUS in the pair used to belong to, respectively, the former USSR and former Yugoslavia. Results are displayed in Table 3.

The former USSR appears to have no significant lasting effect on the differences in general trust. Considering that it takes at least 400 years of Imperial rule to have a sizeable impact, this is not too surprising, but is still notable. In the case of the former Yugoslavia, the coefficient on general trust is even positive, indicating greater dissimilarity. One reason could be the influence of war, a shocking enough event to have had such an impact, even in a short time span.

On the contrary, the former USSR and Yugoslavia have a lasting impact on the pattern of economic occupations, which, we have already found, change faster. The impact of former dynastic empires' influence remain significant (and is not affected in magnitude) when more recent history is included.

4.2.EU integration

This cultural gravity model can also be used in order to investigate the cultural and economic proximity of European Union members. Many countries in our sample are either member states of the European Union or candidate countries. The Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, the Slovak Republic and Slovenia are member states of the EU since 2004; Bulgaria and Romania since 2007. Other countries, such as Croatia, the Former Yugoslav

Republic of Macedonia and Turkey are candidate countries. I construct several dummy variables that reflect the status of each country in our sample relative to the EU, and I evaluate the impact of EU status on cultural dissimilarity and the measures of economic outcomes heterogeneity. The variables takes value one if each member of the PSU pair belongs to countries that are both EU members (*EU*), or are both candidate countries (*EU candidates*). Another variable takes value one if one PSU belongs to a member states and the other to a candidate country (*EU-candidate EU*). The purpose of this variable is to reflect whether countries that are not yet in the EU but are candidate countries are culturally and economically more similar to EU member states rather than countries which do not have any perspective of adhesion yet. Results are displayed in Table 4.

There is no relationship between EU integration and similarity in terms of general trust. Again, this is hardly surprising, as we have discussed above that the effect of common institutions kicks in after 400 years. The results however indicate that EU members are significantly more similar to one another in the pattern of economic occupations, again consistent with the result that economic occupations move much faster than general trust. There is no way to conclude from this analysis whether these results are due to a convergence effect, caused by EU adhesion, or to a selection effect: the EU only selected members that were closer in these dimensions. Still, EU members in this sample are similar only in the more "economic" of the two dimensions under consideration. Whether a causal or selection effect, these results still indicate that EU integration is economic rather than cultural, at least in the very short term of EU adhesion for the countries in this sample. An argument against the selection effect is that EU candidates are more dissimilar to EU members than to the rest of the sample in both dimensions, including occupations.

Again, the influence of former Empires remain significant and negative.

5. Discussion and Conclusion

The cultural gravity model presented here provides a new tool to investigate the determinants of cultural integration and can be applied to many dimensions of cultural integration. In this paper, I chose to focus on general trust and the pattern of economic occupations, but the model could be applied to, for instance: preferences for redistribution, corruption, or female labor force participation. Similarly, I focus only on the respective contributions of two widely discussed determinants of cultural proximity: spatial proximity and history. My aim here is not to provide an exhaustive list of determinants of cultural integration but to provide a framework for analysis. One could investigate the influence of, for example, migration, modern telecommunication tools, or genetic distance.

This paper confirms empirically not only that both history spatial proximity play a role in cultural transmission but that they are also correlated. This implies that proxying cultural distance by history alone and ignoring the impact of physical proximity will result in overestimating the impact of history, and vice versa. Similarly, ignoring physical proximity and history altogether, for example by treating country averages as independent observations will result in a large bias in cultural studies. In particular, country fixed effects will be largely overestimated. Attempts to account for physical distance by controlling for the distance between capital cities for example still leave an important bias and introduce a new one, related to the specific localization of national capitals. This paper, by stressing the continuous nature of spatial cultural diffusion cautions against the use of national averages for cross country comparisons in cultural studies. The finding in this paper that people who live close to one another are more similar to one another, and all the more so if they have a common past history points to a sounder approach, which consists in focusing on groups of respondents physically close to one another

and who share a common history. This is the idea behind using frontier-zones as an identification strategy, used namely by Miguel (2004), Grosjean and Senik (*forth*) or Bruegger et al (2009).

In a similar vein, this paper contributes to the interpretation of border and distance effects in trade gravity models. Ignoring other determinants of cultural distance, most notably the influence of the past, leads to biased estimation of the impact of distance, since distance is correlated with other determinants of cultural distance and trade is correlated with cultural proximity (Giuliano, Spilimbergo and Tonon 2006; Toubal and Felbermayr 2006). As explained above, ignoring the continuous process of cultural diffusion also results in an overestimation of border effects.

One of the main messages of the paper is that history matters, even when spatial proximity is taken into account, and that things are very slow to change. For the more "cultural" variable investigated here: general trust, the significant effect of living under common institutions appears after 400 years of common history. Shorter, albeit more recent events, such as the USSR or EU membership are not significantly correlated with the pattern of general trust. For economic occupations, things move faster: the effect of past empires is observed after "only" 200 years of common institutions, and the USSR, Yugoslavia or EU membership are significantly correlated with the pattern of economic occupations. Even more strikingly, current nation states do not matter any longer when history and spatial proximity are taken into account. This may nevertheless be explained by the fact that in the particular region considered in this paper, borders not only are recent (after the first World War for the oldest, after the collapse of the Soviet Union or the Yugoslavian war for others) but also to a large extent arbitrary (Grosjean and Senik, *forth*).

An interesting feature of the trade gravity model is to provide a new measure of cultural distance: physical distance discounted by the influence of past historical events or socio demographic characteristics. An appealing outcome of this research would be to draw a cultural map, where cultural distances, taking into account the role of history would be plotted instead of physical distances. Another immediate application of this paper would be to estimate a trade gravity model, where, instead of physical distance, the measure of cultural distance proposed in this paper is included. Looking at differentiated effects of such a measure of cultural distance on trade of differentiated versus undifferentiated goods would provide an interesting validation, as one would expect preferences to be more similar in regions that have shared a common past history.

More work is also needed to model not only absolute differences but the direction of these differences (i.e., in a directional gravity model) and their dynamic evolution in repeated cross section or panel data. This is the object of future research.

The analysis in this paper is subject to a number of caveats. These include in particular the issue of migration and other population movements since the historic events under consideration, as well as the influence of modern transportation and telecommunication means. Also, geodesic distance is a crude approximation of the ability to meet and exchange with others and more refined measures could be developed and incorporated to improve upon the precision of this work.

6. Tables and Figures

Table 1a: Baseline Gravity Equation for General Trust

	1	2	3	4	5
	General trust	General trust	General trust	General trust	General trust
Distance		**0.038*** **		**0.028*** **	**0.031*** **
		[0.004]		[0.003]	[0.004]
Same Empire			**-0.061*** **	**-0.041*** **	**-0.042*** **
			[0.008]	[0.007]	[0.007]
MD religion	0.024***	0.022***	0.022***	0.019***	0.019***
	[0.005]	[0.005]	[0.005]	[0.005]	[0.004]
MD occupation	0.032***	0.028***	0.028***	0.026***	0.026***
	[0.007]	[0.007]	[0.007]	[0.007]	[0.007]
MD social class	-0.0002	-0.0001	0.0002	0.0001	0.0001
	[0.003]	[0.003]	[0.003]	[0.003]	[0.003]
MD education	0.020**	0.019**	0.020***	0.019**	0.019**
	[0.006]	[0.006]	[0.006]	[0.006]	[0.006]
Diff. Age	-0.001**	-0.001**	-0.0001**	-0.001**	-0.001**
	[0.0002]	[0.0002]	[0.0002]	[0.0002]	[0.0002]
MD industrial index	0.004	0.004	0.004	0.004	0.004
	[0.004]	[0.003]	[0.003]	[0.003]	[0.003]
Diff. gender	0.003	0.002	0.003	0.002	0.002
	[0.005]	[0.005]	[0.005]	[0.005]	[0.005]
Same Country	**-0.066*** **				**0.008**
	[0.008]				**[0.009]**
Contiguous	**-0.026*** **				**0.009**
	[0.006]				**[0.006]**
Observations	535095	535095	535095	535095	535095
R-squared	0.444	0.446	0.445	0.447	0.447

Table 1b: Baseline Gravity Equation for Occupations

	1	2	3	4	5
	Occupations	Occupations	Occupations	Occupations	Occupations
Distance		**0.015*** **		**0.008*** **	**0.010*** **
		[0.002]		[0.002]	[0.003]
Same Empire			**-0.033*** **	**-0.027*** **	**-0.027*** **
			[0.005]	[0.005]	[0.005]
MD religion	0.036***	0.035***	0.034***	0.033***	0.034***
	[0.004]	[0.004]	[0.004]	[0.004]	[0.004]
MD social class	0.074***	0.074***	0.074***	0.074***	0.074***
	[0.007]	[0.007]	[0.007]	[0.007]	[0.007]
MD education	0.151***	0.150***	0.150***	0.150***	0.150***
	[0.008]	[0.008]	[0.008]	[0.008]	[0.008]
Diff. Age	0.015***	0.015***	0.015***	0.015***	0.015***
	[0.0006]	[0.0006]	[0.0006]	[0.0006]	[0.0006]
MD industrial index	0.007**	0.007**	0.007**	0.007**	0.007**
	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]
Diff. gender	0.049***	0.049***	0.049***	0.049***	0.049***
	[0.010]	[0.010]	[0.010]	[0.010]	[0.010]
Same Country	**-0.018*** **				**0.009**
	[0.005]				**[0.006]**
Contiguous	**-0.017*** **				**-0.002**
	[0.003]				**[0.003]**
Observations	535095	535095	547581	547581	547581
R-squared	0.586	0.587	0.587	0.588	0.588

Notes to Table 1a and 1b: All dependent variables are Manhattan Distance measures of dissimilarity between PSU pairs. "*Distance*" is expressed as the logarithm of the physical distance between PSUs in km. "*Same Empire"* takes value 1 if both PSUs have belonged to the same Empire (as defined in section 4) for more than a 100 years. All regressions control for location fixed effects. Robust standard errors are adjusted for clustering on any observation which contains either member of a pair (multi-way clustering by each member of the pair following the Cameron et al. (2006) method). *** indicates significance at 1%, * significance at 10%.

Source: Life in Transition Survey 2009; Periodical Atlas of Europe 1300-2000.

Table 2: Different time spans under Imperial Rule

	1	2	3	4
	General trust	Occupations	General trust	Occupations
Distance	0.032***	0.009***	0.022***	0.011***
	[0.004]	[0.003]	[0.004]	[0.003]
Same Empire for 100 to 200 years	-0.011	-0.009		
	[0.010]	[0.005]		
Same Empire for 200 to 400 years	-0.003	-0.037***		
	[0.011]	[0.010]		
Same Empire for more than 400 years	-0.090***	-0.037***		
	[0.018]	[0.008]		
Habsburg Empire			-0.004	0.004
			[0.008]	[0.005]
Ottoman Empire			-0.118***	-0.053***
			[0.015]	[0.008]
Prussia			-0.031*	0.038***
			[0.017]	[0.008]
Russian Empire			-0.019	-0.004
			[0.012]	[0.007]
Observations	535095	535095	447843	447843
R-squared	0.472	0.604	0.450	0.588

Notes to Table 2: All dependent variables are Manhattan Distance measures of dissimilarity between PSU pairs. "*Distance*" is expressed as the logarithm of the physical distance between PSUs in km. The "*Same Empire…*" dummies takes value 1 if both PSUs have belonged to the same Empire for the number of years indicated. All regressions control for dissimilarity between pairs of PSUs in terms of religious affiliation, social class composition, education, age, industrial index, same country dummy and contiguity dummy as well as location fixed effects. In addition, regressions in columns 1 and 3 control for occupational differences between PSUs. Robust standard errors are adjusted for clustering on any observation which contains either member of a pair (multi-way clustering by each member of the pair following the Cameron et al. (2006)) method. *** indicates significance at 1%, * significance at 10%.

Source: Life in Transition Survey 2009; Periodical Atlas of Europe 1300-2000.

Table 3: The Effect of the former USSR and Yugoslavia

	1	2	3	4
	General trust	General trust	Occupation	Occupation
Distance	**0.042*** **	**0.031*** **	**0.014*** **	**0.006** **
	[0.005]	[0.005]	[0.003]	[0.003]
Same empire		**-0.041*** **		**-0.030*** **
		[0.007]		[0.005]
USSR	**-0.006**	**-0.016**	**-0.012**	**-0.018** **
	[0.013]	[0.013]	[0.009]	[0.002]
Yugoslavia	**0.028*** **	**0.016** **	**-0.007** **	**-0.015** **
	[0.007]	[0.007]	[0.006]	[0.006]
Observations	535095	535095	535095	535095
R-squared	0.446	0.4467	0.587	0.588

Notes to Table 3: All dependent variables are Manhattan Distance measures of dissimilarity between PSU pairs. "*Distance"* is expressed as the logarithm of the physical distance between PSUs in km. All regressions control for dissimilarity between pairs of PSUs in terms of religious affiliation, social class composition, education, age, industrial index, same country dummy and contiguity dummy as well as location fixed effects. In addition, regressions in columns 1 and 2 control for occupational differences between PSUs. "*USSR"* comprises Belarus, Estonia, Latvia, Lithuania, Moldova, the Russian Federation and Ukraine. "*Yugoslavia"* consists of Bosnia and Herzegovina, Croatia, FYR Macedonia, Montenegro, Serbia and Slovenia. Robust standard errors adjusted for clustering on any observation which contains either member of a pair (multi-way clustering by each member of the pair following the Cameron et al. (2006) method). *** indicates significance at 1%, * significance at 10%.

Source: Life in Transition Survey 2009; Periodical Atlas of Europe 1300-2000.

Table 4: Actual and Future EU Integration. Results of the Gravity Model.

	1	2	3	4
	General trust	General trust	Occupations	Occupations
Distance	0.035***	0.027***	0.013***	0.008***
	[0.004]	[0.004]	[0.002]	[0.003]
Same Empire		-0.041***		-0.025***
		[0.007]		[0.005]
EU	**-0.013**	**-0.004**	**-0.020****	**-0.015****
	[0.009]	[0.009]	[0.006]	[0.006]
EU candidates	-0.024	-0.036	0.006	-0.002**
	[0.030]	[0.029]	[0.014]	[0.014]
EU-EUcandidates	0.050***	0.050***	0.026***	0.026***
	[0.010]	[0.010]	[0.006]	[0.006]
Observations	535095	535095	535095	535095
R-squared	0.447	0.449	0.587	0.588

Notes to Table 4: All dependent variables are Manhattan Distance measures of dissimilarity between PSU pairs. "*Distance"* is expressed as the logarithm of the physical distance between PSUs in km. All regressions control for dissimilarity between pairs of PSUs in terms of religious affiliation, social class composition, education, age, industrial index, same country dummy and contiguity dummy as well as location fixed effects. In addition, regressions in columns 1 and 2 control for occupational differences between PSUs. Robust standard errors are adjusted for clustering on any observation which contains either member of a pair (multi-way clustering by each member of the pair following the Cameron et al. (2006) method). *** indicates significance at 1%, * significance at 10%.

Source: Life in Transition Survey 2009; Periodical Atlas of Europe 1300-2000.

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8. Appendix

Appendix A: Theoretical Model

This model builds on Bisin Verdier (2001) and Hauk Saez-Marti (2001). Preferences of children are acquired through an adaptation process which depends on the parents' socialization actions, *and* on the social environment in which children live. Instead, because social interactions are constrained by space, I consider that the relevant social environment to which parents refer to is their peer group, which, as in Glaeser, Sacerdote and Sheinkman (1996), consists of their geographical neighbors.

Suppose there are two possible cultural traits $\{a, b\}$. Such cultural trait can reflect for example the inclination to trust others. Individuals live in different locations, or neighborhoods, indexed by l. There are L possible locations. Localities neighboring to locality l are demoted by $C(l)$. Individuals in each locality are heterogeneous in two different ways. Firstly, as described above, they may differ in their cultural trait. Secondly, they are member of larger groups with different mean preferences (as in Head and Mayer 2007). In each locality, there are *G* groups, indexed by subscript g. The share of each group in each location is given by: x_{lg} with $\sum_{g=1}^{G} x_{lg} = 1$. The portion of each group with cultural trait a is denoted by s_{lga}. The prevalence of cultural trait a in neighborhood l is then: $s_{la} = \sum_{g=1}^{G} s_{lga} x_{lg}$. The prevalence of cultural trait b is: $s_{lb} = 1 - s_{la}$.

Following Hauk and Saez-Marti (2001), I consider an overlapping generation model, with a Poisson birth and death process. With probability γ, an active agent is active the next period. With probability $(1 - \gamma)$, an active agent in *t* has a child, which becomes active in *t+1*. Children are born without predetermined preferences or cultural trait. As in Bisin and Verdier (2001) and Hauk and Saez-Marti (2001), parents' education effort τ corresponds to the probability of

successful "vertical" transmission of cultural traits, that is to say the probability that the child ends up with identical preferences as his parent. If vertical socialization is unsuccessful, the child remains naïve and gets randomly matched with somebody else, whose cultural trait he adopts. The innovation in this model is that this match depends on the geographical localization of agents. As in Tabellini (2008a), I consider that the probability of a match decreases with the distance that separates two agents. More precisely, I consider that agents are either matched with an individual within their neighborhood or with an individual from an adjacent location *n* with a probability ϑ_{tln} that decreases with distance. ϑ_{tln} is assumed to vary between zero[21] (localized interactions) and $1/(L-1)$ (globalized interactions) (Head and Mayer, 2007). Each household in each of the *G* groups socializes its children according to this socialization process, but each child only interacts with people of her parents' group.

Let p^{ij} denote the probability that a child from a family with trait *i* is of type *j* and τ^i the education effort by the parent of type i. The socialization mechanism described above implies that:

$$p_t^{aa} = \tau_t^a + (1-\tau_t^a)\left(s_{lgat} + \sum_{n\neq l}\vartheta_{tln}s_{ngat}\right) \quad (1)$$

$$p_t^{ab} = (1-\tau_t^a)\left[1-\left(s_{lgat} + \sum_{n\neq l}\vartheta_{tln}s_{ngat}\right)\right] \quad (2)$$

Where s_{kgat} , $k \in \{l,n\}$is the proportion of active agents of type a in locality *k*.. Similarly, we get:

$$p_t^{bb} = \tau_t^b + \left(1-\tau_t^b\right)\left[1-\left(s_{lgat} + \sum_{n\neq l}\vartheta_{tln}s_{ngat}\right)\right] \quad (3)$$

$$p_t^{ba} = \left(1-\tau_t^b\right)\left(s_{lgat} + \sum_{n\neq l}\vartheta_{tln}s_{ngat}\right) \quad (4)$$

[21] This brings us back to the models in Bisin and Verdier (2001) and Hauk and Saez-Marti (2001).

As in Bisin and Verdier (2001), parents display imperfect empathy. When taking the decision to socialize their children, they maximize their children's utility, but they evaluate such welfare through their own preferences. In addition, let us assume that the utility of a child depends on what group g he belongs to[22]. Let V_g^{ij} denote the utility to a type i parent belonging to group g of a type j child, $i, j \in \{a, b\}$. In order to determine the optimal socialization effort τ_g, which costs $C(\tau_g)$, parents maximize:

$$p_t^{ii} V_g^{ii} + p_t^{ij} V_g^{ij} - C(\tau_{gt})$$

The following optimal education efforts are obtained:

$$C'(\tau_g^a) = (V_g^{aa} - V_g^{ab})[1 - (s_{lgat} + \textstyle\sum_{n \neq l} \vartheta_{tln} s_{ngat})] \quad (5)$$

$$C'(\tau_g^b) = (V_g^{bb} - V_g^{ba})(s_{lgat} + \textstyle\sum_{n \neq l} \vartheta_{tln} s_{ngat}) \quad (6)$$

We can now characterize the dynamic behavior of s_{la}:

$$s_{lgat+1} = \gamma s_{lgat} + (1 - \gamma)[s_{lgat} p_t^{aa} + (1 - s_{lgat}) p_t^{ba}]$$

Substituting (1)-(4) and rearranging, we obtain:

$s_{lgat+1} =$

$$s_{lgat} + (1 - \gamma)\{s_{lgat}(\tau_g^a - \tau_g^b)(1 - s_{lgat} - \textstyle\sum_{n \neq l} \vartheta_{tln} s_{ngat}) + (1 - \tau_g^b) \textstyle\sum_{n \neq l} \vartheta_{tln} s_{ngat}\} \quad (7)$$

Under stationary expectations ($V_{gt}^{aa} - V_{gt}^{ab} = V_g^{aa} - V_g^{ab}$ and $V_t^{bb} - V_t^{ba} = V^{bb} - V^{ba}$ for all t),

Hauk and Saez-Marti (2001) show that (5) has three rest points, (i) $s_{lgat} = 0$, (ii) $s_{lgat} = 1$, and an interior rest point. In this modified model, the interior rest point is given by:

[22] We can think of these groups as socio economic groups, or religious groups.

$$s^*_{lga} = \frac{V_g^{aa} - V_g^{ab}}{V_g^{bb} - V_g^{ba} + V_g^{aa} - V_g^{ab}} - \sum_{n \neq l} \vartheta_{ln} s^*_{nga} \quad (8)$$

with $\tau_g^a(s_{lga}, V_g^{aa} - V_g^{ab}) = \tau_g^b(s_{lga}, V_g^{bb} - V_g^{ba})$

We can see from (5) and (6) that vertical cultural transmission (parents' effort) and transmission from geographical peer groups are substitutes. Under this condition, the interior rest point is globally stable, while the other rest points are unstable (Bisin and Verdier 2001).

Let us denote $c_g = \frac{V_g^{aa} - V_g^{ab}}{V_g^{bb} - V_g^{ba} + V_g^{aa} - V_g^{ab}}$ and drop the subscript a in what follows.

The total share of type a in locality l is given by $s_l = \sum_{g=1}^{G} s_{lg} x_{lg}$, which, using (8) can be rewritten as:

$$s^*_l = \sum_{g=1}^{G} c_g x_{lg} - \sum_{g=1}^{G} x_{lg} \sum_{n \neq l} \vartheta_{ln} s^*_{ng} \quad (9)$$

Replacing by the value of s^*_{ng}, which can be obtained in a similar way as (8), we obtain:

$$s^*_l = \sum_{g=1}^{G} c_g x_{lg} - \sum_{g=1}^{G} c_g x_{lg} \sum_{n \neq l} \vartheta_{ln} + A_l \quad (10)$$

With $A_l = \sum_g x_{lg} \sum_{n \neq l} \vartheta_{ln} \sum_{m \neq n} \vartheta_{nm} s_{mga}$ and $m \in C(n)$.

This expression shows how the share of cultural trait in one locality depends on the share of the trait in the adjacent localities, as well as in all the localities adjacent to it, and so on. The share of cultural trait in one neighborhood depends hence on the share of the trait in all neighborhoods that are connected with one another.

Estimating equation of type (10) would run into severe complications. One would need to specify each neighbor of each localities and so on. Although possible and done in the literature

before (see Case, 1992), this would be a daunting task given the size of the sample we have at hand. Furthermore, as described by Manski (1993) the OLS estimates of this equation would be biased. The prevalence of the cultural trait a in the adjacent location *n* depends in part on the share of the cultural trait in location *l*. This is what Manski labels the "reflection" problem.

Instead, we are more interested in the dissimilarity in prevalence of cultural traits between any pair of locations: $|s_l - s_n|$. As explained in Head and Mayer (2007), incorporating s_n in the left hand side variable and correcting standard errors for dependence between observations addresses the reflection problem. Let us drop the subscript *a* to make things more tractable.

Following steps (8) and (9), we can define the total share of type *a* in locality *n:*

$$s_n^* = \sum_{g=1}^{G} c_g x_{ng} - \sum_{g=1}^{G} x_{ng} \sum_{m \neq n} \vartheta_{mn} s_{mg}^*$$

Adopting vector notations: $\sum_{g=1}^{G} c_g x_{lg} = \beta . x_l$, and denoting $A_n = \sum_{g=1}^{G} x_{ng} \sum_{m \neq n} \vartheta_{mn} s_{mg}^*$ we obtain the following expression for the dissimilarity in the prevalence of cultural trait a among a pair of locations:

$$|s_l - s_n| = |\beta . (x_l - x_n) - \beta . x_l \sum_{n \neq l} \vartheta_{ln} + A_l - A_n| \qquad (11)$$

This equation has three main implications that we can investigate empirically.

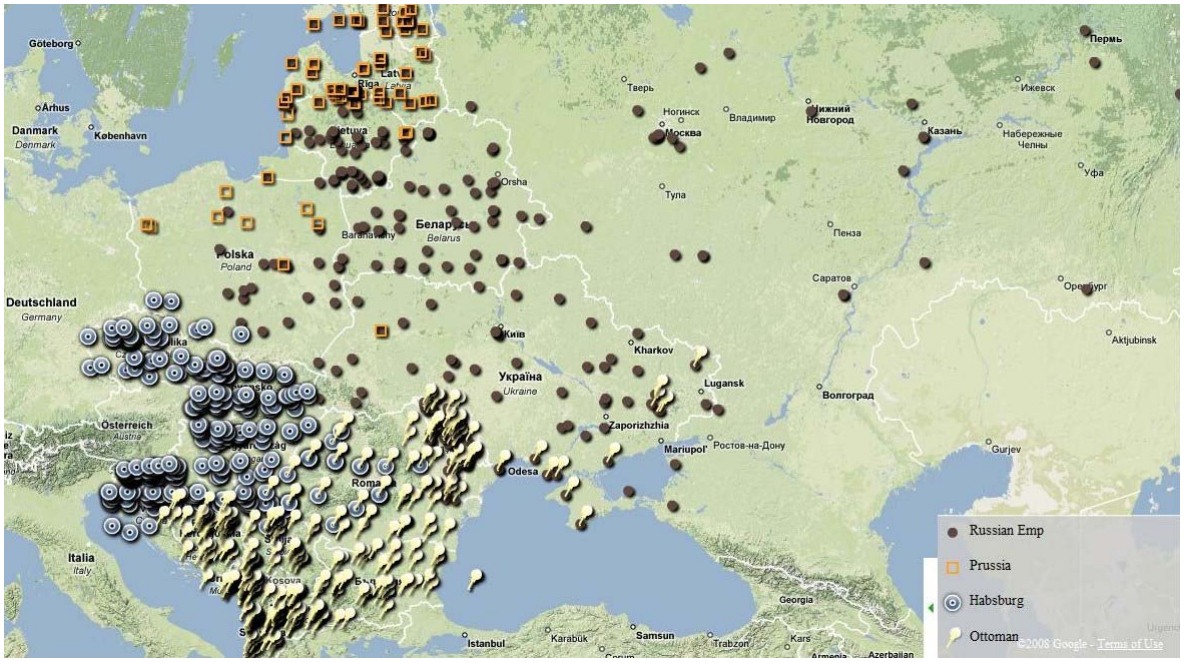
Firstly, similar group composition entails more similarity in the prevalence of cultural trait between two locations.

Secondly, distance increases cultural dissimilarity between locations. Indeed, $|s_l - s_n|$ decreases in ϑ_{ln}, which decreases with distance.

Prevalence of cultural traits in third locations $(A_l - A_n)$ influence bilateral dissimilarity. The empirical estimation attempts to control these by using fixed effects.

Appendix B: Tables and Figures

Figure A1. Map of Dynastic Empires in Central and Eastern Europe



Notes to Figure A1: The figure indicates PSUs that belonged to the Russian, Prussian, Habsburg and Ottoman Empires for more than 200 years only in Central, Eastern and South Eastern Europe. Source: Periodical Atlas of Europe 1300-2000.

Table A1: List of countries included in the sample

Albania, Belarus, Bosnia and Herzegovina, Bulgaria, Croatia, Czech Republic, Estonia, Former Yugoslav Republic of Macedonia, Hungary, Latvia, Lithuania, Moldova, Montenegro, Poland, Romania, Russian Federation, Serbia, Slovak Republic, Slovenia, Turkey, Ukraine.

Table A2: Geographical and temporal delimitations of Empires in the sample

	400 years or more	200 to 400 years	200 years or less
Ottoman Empire	Albania, Sancak of Bosnia, Bulgaria (except part which became independent in 1878), FYROM, Turkey	Rest of Bosnia, Bulgaria which became independent in 1878, Bessarabia, Crimea, Moldavia, outer Montenegro, Serbia except Vojvodina, Wallachia	Transylvania, Vojvodina, southern Hungary, eastern Croatia
Habsburg Empire	Slovakia, Hungary (except southern-ottoman Hungary)	Croatia (except Dalmatia), Czech Republic, Southern (ottoman) Hungary , Polish Silesia, Slovenia, Transylvania, Vojvodina	Dalmatia, Galicia, Habsburg Poland (Krakow, Rzeszow), Bosnia, western Ukraine (Lviv)
Prussia	Pomerania (Poland)	Estonia, Latvia, Polish Silesia, Royal Prussia	Polish Silesia, Kaliningrad, Klaipeda (Lithuania)
Russian Empire		Russia (except Kaliningrad), Ukraine (except Crimea and Kouban)	Armenia, Azerbaijan, Belarus, Baltic states (except Klaipeda), Georgia, , Kazakhstan, Kyrgyzstan, Moldova, eastern-central Poland (Warsaw, Lodz), rest of Ukraine, Tajikistan

Source: Periodical Atlas of Europe 1300-2000

Table A3: Descriptive statistics

Variable	Description	Mean	s.d..	Min	Max
General trust	Manhattan Distance general trust	0.87	0.37	0	2
Occupation	Manhattan Distance Occupation	0.89	0.31	0.04	2.48
Same Empire	Dummy = 1 if PSU pair in same former dynastic empire (Habsburg, Ottoman, Prussia and Russian Empires) for more than 100 years	0.25	0.43	0	1
Distance in km	distance between 2 PSUs (in km)	1029	783	0	12737
Distance	Logarithm of distance in km	6.66	0.83	0	9.45
MD religion	Manhattan distance for main religions (Muslim, Christian, Jewish, other religion and Atheist)	0.79	0.71	0	2
MD social class	Manhattan distance of proportions of rich, poor and middle income	0.65	0.36	0	2
MD education	Manhattan distance education (5 education categories)	0.89	0.37	0	2
Difference in age	Absolute value of difference in average age of PSUs	8.12	6.14	0	49.46
MD labor index	Absolute value of the difference in the proportion of respondents in the active labor force who are self-employed with more than five employees, or have a formal labor contract and either: work in a small enterprise, work in a medium enterprise, work in a private firm, work in a newly created enterprise (since 1989)	0.58	0.45	0	3.61
Same country	Dummy =1 if PSU pair in same country	0.05	0.21	0	1
Contiguous	Dummy =1 if PSU pair in adjacent countries	0.17	0.38	0	1
Same Empire for 100 to 200 years	Dummy = 1 if PSU pair in same former dynastic empire (Habsburg, Ottoman, Prussia and Russian Empires) for between 100 and 200 years	0.12	0.32	0	1
Same Empire for 200 to 400 years	Dummy = 1 if PSU pair in same former dynastic empire (Habsburg, Ottoman, Prussia and Russian Empires) for between 100 and 200 years	0.03	0.16	0	1
Same Empire for more than 400 years	Dummy = 1 if PSU pair in same former dynastic empire (Habsburg, Ottoman, Prussia and Russian Empires) for more than 400 years	0.05	0.21	0	1
Habsburg Empire	Dummy = 1 if PSU pair in the Habsburg Empire for more than 100 years	0.12	0.32	0	1
Ottoman Empire	Dummy = 1 if PSU pair in the Ottoman Empire for more than 100 years	0.20	0.40	0	1
Prussia	Dummy = 1 if PSU pair in Prussia for more than 100 years	0.014	0.12	0	1
Russian Empire	Dummy = 1 if PSU pair in the Russian Empire for more than 100 years	0.12	0.32	0	1
USSR	Dummy =1 if PSU pair in former USSR	0.11	0.31	0	1
Yugoslavia	Dummy =1 if PSU pair in former Yugoslavia	0.08	0.27	0	1
EU	Dummy =1 if PSU pair in European Union (EU)	0.23	0.42	0	1
EU candidate	Dummy =1 if PSU pair in candidate countries to EU	0.01	0.12	0	1
EU-EU candidate	Dummy =1 if 1 PSU in EU, the other in candidate country	0.14	0.34	0	1

Source: Life in Transition Survey 2009; Periodical Atlas of Europe 1300-2000.