

Culture, Diffusion, and Economic Development *

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Abstract

This research explores the effects of culture on technological diffusion and economic development. It shows that culture's direct effects on development and barrier effects to technological diffusion are, in general, observationally equivalent. In particular, using a large set of cultural measures, it establishes empirically that pairwise differences in contemporary development are associated with pairwise cultural differences relative to the technological frontier, only in cases where observational equivalence holds. Additionally, it establishes that differences in cultural traits that are correlated with genetic and linguistic distances are statistically and economically significantly correlated with differences in economic development. These results highlight the difficulty of disentangling the direct and barrier effects of culture, while lending credence to the idea that common ancestry generates persistence and plays a central role in economic development.

Keywords: Comparative economic development, economic growth, culture, barriers to technological diffusion, genetic distances, linguistic distances

JEL Classification: O10, O11, O20, O33, O40, O47, O57, Z10

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1 Introduction

Economists have been studying the effects of culture on economic development at least since Weber (1930) proposed his famous “protestant ethic” thesis, which posited that protestantism was conducive to capitalist development due to its emphasis on thrift, hard work, and human capital accumulation (Andersen et al., 2013). Additional cultural determinants of comparative development have been suggested in the literature, including differences in levels of trust, cooperation, family ties, individualism, obedience, and attitudes towards work and other individuals (Alesina and Giuliano, 2010, 2014; Giuliano, 2007; Guiso et al., 2006, 2009; Knack and Keefer, 1997; Zak and Knack, 2001).

This literature has focused mainly on the *direct effects* of culture on development, i.e. how having a certain *absolute* level of a cultural trait affects economic development. Thus, for example, analyzing whether being more or less patient affects development through its impact on human and physical capital accumulation (Dohmen et al., 2015; Galor and Özak, 2014). On the other hand, a more recent strand of the literature has emphasized the *barrier effect* of culture on development, i.e. how *relative* levels of a cultural trait affect economic development (Basso and Cuberes, 2016; Guiso et al., 2009; Spolaore and Wacziarg, 2009a). In particular, cultural differences relative to the technological frontier, like not sharing its religion or language, might act as cultural barriers to technological diffusion and thus lower economic development (Spolaore and Wacziarg, 2012, 2013a).

This research further explores the effects of culture on technological diffusion and economic development. It shows that culture’s direct effects on development and barrier effects to technological diffusion are, in general, observationally equivalent. In particular, using a large set of cultural measures, it establishes empirically that pairwise differences in contemporary development are associated with pairwise cultural differences relative to the technological frontier, only in cases where observational equivalence holds. Additionally, it establishes that differences in cultural traits that are correlated with genetic and linguistic distances are statistically and economically significantly correlated with differences in economic development. These results highlight the difficulty of disentangling the direct and barrier effects of culture while lending credence to the idea that common ancestry generates persistence and plays a central role in economic development.

Previous analyses of the barrier effect have used genetic distances to proxy for cultural differences. For example, Spolaore and Wacziarg (2009a) have shown that the difference in contemporary income per capita among two countries is associated with their difference in the genetic distance to the United States, but is not associated with the genetic distance between them. Thus, suggesting that the barrier effect, as captured by relative genetic

distances to the United States, is essential to contemporary economic development. The reasoning behind this approach is that the genetic distance between two populations captures cultural differences as it measures the amount of time elapsed since they diverged from a common ancestral population, allowing the two populations to diverge culturally.

A drawback of these analyses is that they do not identify the cultural traits that generate these results. This prevents the identification of the potential channels behind underdevelopment and the implementation of policies that might help minimize the lag caused by the barrier effect. Moreover, while the link between genetic and linguistic distances is well established, its relation to cultural differences relevant for development has not been studied.¹

Thus, as a first step, this research explores which cultural differences are associated with genetic distances. In particular, using measures for a large set of cultural traits that have been associated with development, the analysis establishes that cultural differences are associated with differences in ancestral origin as measured by genetic, linguistic and religious distances. Among these, linguistic distances have the strongest association with the largest set of cultural traits. On the other hand, genetic distances are most strongly correlated with differences in levels of generalized trust and individualism, which have been found to play a pivotal role in comparative development (Gorodnichenko and Roland, 2011; Tabellini, 2010).

In a second stage, the research explores the association between differences in contemporary income per capita levels and cultural differences between countries and their cultural differences relative to the technological frontier, i.e. the United States. It establishes that differences in measures of individualism, vertical hierarchy, family ties, and generalized trust are statistically and economically significantly associated with differences in contemporary income. On the other hand, linguistic distances are the only cultural difference relative to the United States that is statistically and economically significantly associated with differences in contemporary income. Moreover, although genetic distances remain economically and statistically significantly associated with income differences once the above mentioned cultural traits are accounted for, genetic distances relative to the US cease to be so.

Although these findings might suggest that the barrier effect is mostly generated by barriers to communication, the results could be capturing the barrier effect of other traits, e.g individualism. In particular, given that the United States is the most individualistic country in the sample, differences in individualism and differences in individualism relative to the US are perfectly correlated. Thus, it is not possible to disentangle the direct and barrier effects in this case, i.e. they are observationally equivalent. Moreover, while the case

¹This sentiment is echoed by Spolaore and Wacziarg (2013b), who say that “A more fruitful discussion [...] is to try to better distinguish between the modes of operation of vertical traits. These traits, in principle, could bear direct effects on economic outcomes, or operate as barriers to economic interactions between populations.”

of Individualism is extreme, the correlation between absolute and relative cultural distances is generally high. Since these measures are widely used to identify direct and barrier effects, this observational equivalence can confound many previous empirical results.

Interestingly, this observational equivalence of absolute and relative cultural distances has not been previously identified in the literature and could play an important role in identifying and understanding the direct and barrier effects of culture. In particular, since the direct and barrier effects might generate completely different policy recommendations it seems important to further understand and disentangle the cultural mechanisms behind each.

The rest of the paper is structured as follows. Section 2 presents a model that exemplifies the problem of observational equivalence. Section 3 introduces the data used in the analysis. Section 4 presents the main empirical results. Section 5 concludes.

2 Model

This section explores theoretically the relation between cultural differences and economic development. In particular, using an open economy model with technological diffusion in a world without trade, it shows the problem of observational equivalence between the effect of absolute and relative cultural differences.

2.1 Setup

Consider a world with N Ramsey type economies in continuous time, which interact with each other only through technological exchange, i.e. in which they cannot trade with each other. For simplicity, assume all economies have the same constant returns to scale production function

$$Y_i(t) = K_i(t)^\alpha (A_i(t)L_i(t))^{1-\alpha} \quad (1)$$

where $Y_i(t)$ is output, $K_i(t)$ is the aggregate stock of capital, $L_i(t)$ the number of workers, and $A_i(t)$ the level of technology, all for economy i in period t . Thus, output per effective worker can be written as

$$y_i(t) = k_i(t)^\alpha \quad (2)$$

where $y_i(t) = Y_i(t)/(A_i(t)L_i(t))$ is output per effective worker, and $k_i(t) = K_i(t)/(A_i(t)L_i(t))$ is capital per effective worker. Assume population in economy i grows at rate $n_i > 0$ and every period capital depreciates at rate $\delta_i \in (0, 1)$.

The level of technology in economy i in period t changes due to both imitation from the

global technological frontier and through domestic innovation. In particular, letting $A(t)$ denote the level of technology in the global technological frontier, which is assumed to grow at an exogenous rate $g > 0$, the change of technology in economy i is given by

$$\dot{A}_i(t) = \sigma_i(A(t) - A_i(t)) + \eta_i A_i(t). \quad (3)$$

Here $\sigma_i(A(t) - A_i(t))$ with $\sigma_i > 0$ represents the change in technology due to the process of catching up with the global technological frontier through imitation. Additionally, $\eta_i A_i(t)$ with $\eta_i \in [0, g]$ represents the accumulation of technology through domestic innovation. Let f denote countries at the technological frontier, i.e. $A_f(t) = A(t)$ for all t . This implies, in particular, that $\eta_f = g$.

Let $a_i(t) = A_i(t)/A(t)$ denote the inverse technological distance from the frontier. Then this distance evolves according to

$$\dot{a}_i(t) = \sigma_i + (\eta_i - \sigma_i - g)a_i(t). \quad (4)$$

Assume each economy has a representative agent with preferences given by

$$U_i = \int_0^\infty e^{-(\rho_i - n_i)t} \frac{c_i(t)^{1-\theta_i} - 1}{1-\theta_i} dt \quad (5)$$

where $\theta_i > 0$ is her constant relative risk aversion coefficient, and $\rho_i > n_i$ her discount rate.

It is known that in a steady state, each economy i has income per effective worker given by

$$y_i^* = \left(\frac{\alpha}{\rho_i + \delta_i + \theta_i g} \right)^{\frac{\alpha}{1-\alpha}} \implies \ln y_i^* = \frac{\alpha}{1-\alpha} \ln \alpha - \frac{\alpha}{1-\alpha} \ln(\rho_i + \delta_i + \theta_i g) \quad (6)$$

and the steady state technological distance is

$$a_i^* = \frac{\sigma_i}{\sigma_i + g - \eta_i}. \quad (7)$$

This implies that the steady state level of income per capita is

$$\hat{y}_i(t) = A_i^*(t)y_i^* = \frac{\sigma_i}{\sigma_i + g - \eta_i} \left(\frac{\alpha}{\rho_i + \delta_i + \theta_i g} \right)^{\frac{\alpha}{1-\alpha}} A(t). \quad (8)$$

Thus, for any two countries i, j

$$\begin{aligned} (\ln \hat{y}_i(t) - \ln \hat{y}_j(t)) &= (\ln \sigma_i - \ln \sigma_j) - (\ln(\sigma_i + g - \eta_i) - \ln(\sigma_j + g - \eta_j)) \\ &\quad - \frac{\alpha}{1-\alpha} \left(\ln(\rho_i + \delta_i + \theta_i g) - \ln(\rho_j + \delta_j + \theta_j g) \right). \end{aligned} \quad (9)$$

Culture in this model is captured by the preference parameters ρ_i , θ_i , η_i , and $\tilde{\sigma}_i$ a parameter underlying the effectiveness in imitation of country i , σ_i . In particular, assume that $\sigma_i = \sigma(|\tilde{\sigma}_f - \tilde{\sigma}_i|)$, so that diffusion and imitation of technology in economy i is determined by its cultural distance relative to the frontier f in terms of $\tilde{\sigma}$. On the other hand, assume innovation depends only on other cultural aspects particular to each country i as captured by η_i . Under these assumptions, equation (9) shows the relationship between differences in culture and development.

2.2 Homogeneous Diffusion and Innovation

Consider the case when countries are identical in the cultural traits that determine the diffusion and innovation of technology, i.e. $\tilde{\sigma}_i = \tilde{\sigma}$, $\eta_i = \eta$, and $\delta_i = \delta$ for all $i \neq f$. If $\tilde{\sigma} = \tilde{\sigma}_f$ and $\eta = \eta_f$, then the model is equivalent to the case when all economies are closed. In particular, under these conditions, culture would only have a direct effect on income and no barrier effect on diffusion. The barrier effect would be absent since all economies would have the same level of technology, $A_i(t) = A(t)$, and thus, would never imitate. Moreover, the country with the highest income per capita would be the one with the lowest value of $\rho_i + \delta_i + \theta_i g$. Denote this economy with m , i.e. $m = \arg \min_i \{\rho_i + \delta_i + \theta_i g\}$, so that $\hat{y}_m(t) \geq \hat{y}_i$ for all i . Then,

$$\begin{aligned} \ln \hat{y}_i(t) &= \ln \hat{y}_m(t) - \frac{\alpha}{1-\alpha} \left(\ln(\rho_i + \delta_i + \theta_i g) - \ln(\rho_m + \delta_m + \theta_m g) \right) \\ &= \ln \hat{y}_m(t) - \frac{\alpha}{1-\alpha} d_{im}, \end{aligned} \quad (10)$$

where $d_{im} \equiv \left| \ln(\rho_i + \delta_i + \theta_i g) - \ln(\rho_m + \delta_m + \theta_m g) \right|$ measures the cultural distance between i and m . Let d_{ij} denote the similar cultural distance between any two countries i and j . Notice that

$$\left| \ln \hat{y}_i(t) - \ln \hat{y}_j(t) \right| = \frac{\alpha}{1-\alpha} \left| d_{im} - d_{jm} \right| = \frac{\alpha}{1-\alpha} d_{ij}. \quad (11)$$

Thus, the absolute value of the difference of log-incomes between countries i and j is ultimately a function of the cultural distance between i and j . But, since that distance will be perfectly correlated with the relative cultural distance of i and j with respect to m , $d_{ij}^R = \left| d_{im} - d_{jm} \right|$, it can be misleadingly represented as a function of this relative distance, as shown in figures 1(a) and 1(b).

Consider now the poorest economy n , which has the highest value of $\rho_i + \delta_i + \theta_i g$. Then, similarly,

$$\left| \ln \hat{y}_i(t) - \ln \hat{y}_j(t) \right| = \frac{\alpha}{1-\alpha} \left| d_{in} - d_{jn} \right| = \frac{\alpha}{1-\alpha} d_{ij}. \quad (12)$$

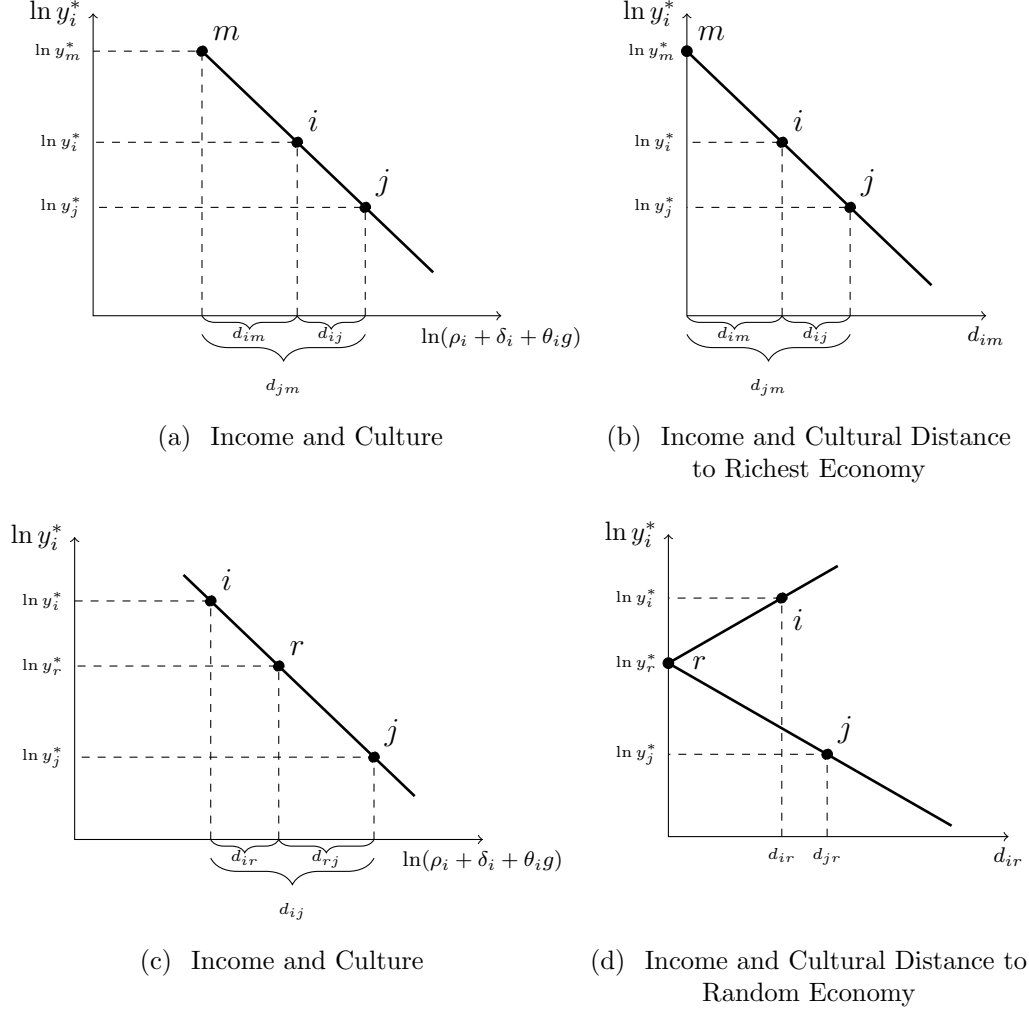


Figure 1: Culture and Steady-State Income per Capita

Thus, again cultural distances between i and j *cause* income differences, but relative distances to n correlate perfectly with “absolute” cultural distances and can be mistakenly seen as causing income differences. Moreover, taking *any* economy r the level of income of economy i can be written as

$$\ln \hat{y}_i(t) = \ln \hat{y}_r(t) \begin{cases} -\frac{\alpha}{1-\alpha} d_{ir} & \text{if } \rho_r + \delta_r + \theta_r g \leq \rho_i + \delta_i + \theta_i g \\ +\frac{\alpha}{1-\alpha} d_{ir} & \text{if } \rho_r + \delta_r + \theta_r g > \rho_i + \delta_i + \theta_i g. \end{cases} \quad (13)$$

Let $\gamma_{ir} = (\rho_i + \delta_i + \theta_i g) - (\rho_r + \delta_r + \theta_r g)$, then for any pair of countries i and j

$$\begin{aligned} \left| \ln \hat{y}_i(t) - \ln \hat{y}_j(t) \right| &= \begin{cases} \frac{\alpha}{1-\alpha} |d_{ir} - d_{jr}| & \text{if } \gamma_{ir} \gamma_{jr} \geq 0 \\ \frac{\alpha}{1-\alpha} |d_{ir} + d_{jr}| & \text{if } \gamma_{ir} \gamma_{jr} < 0 \end{cases} \\ &= \frac{\alpha}{1-\alpha} d_{ij}. \end{aligned} \quad (14)$$

Again, absolute log-income differences between i and j are a function of their cultural distances, but can be misleadingly be represented by their relative cultural difference or the sum of their cultural differences, as shown in figures 1(c) and 1(d).

Proposition 2.1. *Under homogeneous diffusion, absolute log-income differences between any pair of countries i and j are caused by their “absolute” cultural differences. Their cultural differences relative to another country r have no causal effect on income differences. Moreover, their cultural differences relative to the poorest and richest countries are observationally equivalent to their absolute cultural differences, i.e. $d_{ij} = d_{ij}^{Rm} \equiv |d_{im} - d_{jm}|$ and $d_{ij} = d_{ij}^{Rn} \equiv |d_{in} - d_{jn}|$.*

The effect of cultural differences can be estimated by a regression of the form

$$|\ln \hat{y}_i - \ln \hat{y}_j| = \beta_0 + \beta_1 d_{ij} + e_{ij}, \quad (15)$$

where $\beta_1 > 0$ and d_{ij} is an exogenous measure of cultural distance. If instead of the absolute cultural distance d_{ij} , the estimation uses relative cultural distances to r , $|d_{ir} - d_{jr}|$, it will generate an unbiased estimate of β_1 only if country r is the country with the lowest or highest value of the cultural trait. In any other case the estimate will be biased, with the size and sign of the bias depending on the correlation between $|d_{ir} - d_{jr}|$ and $|d_{ir} + d_{jr}|$ and the share of economies with a higher value of the cultural trait than r .

Notice that the frontier f does not play any role in the previous results. Thus, a similar result follows for all pairs of countries (i, j) with $i \neq f$ and $j \neq f$, if $\sigma \neq \sigma_f$ or $\eta \neq \eta_f$. Moreover, equation (6) implies that the results of this subsection apply to the differences in income per effective worker in the general case, since diffusion plays no role in the determination of steady state levels of income per effective worker.

2.3 Homogeneous Consumers

Consider the case when all economies have identical consumers, i.e. $\rho_i = \rho$, $\theta_i = \theta$ and $n_i = n$ for all i . This implies that $\hat{y}_f(t) \geq \hat{y}_i(t)$ and

$$\ln \hat{y}_i(t) = \ln \hat{y}_f(t) + \ln \sigma_i - \ln(\sigma_i + |\eta_f - \eta_i|) \quad (16)$$

for all i . Thus,

$$\ln \hat{y}_i(t) - \ln \hat{y}_j(t) = (\ln \sigma_i - \ln \sigma_j) - \left(\ln(\sigma_i + |\eta_f - \eta_i|) - \ln(\sigma_j + |\eta_f - \eta_j|) \right). \quad (17)$$

So, the absolute log-difference in income per capita between economies i and j is

$$\begin{aligned} |\ln \hat{y}_i(t) - \ln \hat{y}_j(t)| &= \left| \ln \left(1 + \frac{|\eta_f - \eta_i|}{\sigma(|\tilde{\sigma}_f - \tilde{\sigma}_i|)} \right) - \ln \left(1 + \frac{|\eta_f - \eta_j|}{\sigma(|\tilde{\sigma}_f - \tilde{\sigma}_j|)} \right) \right| \\ &\simeq \left| \frac{|\eta_f - \eta_i|}{\sigma(|\tilde{\sigma}_f - \tilde{\sigma}_i|)} - \frac{|\eta_f - \eta_j|}{\sigma(|\tilde{\sigma}_f - \tilde{\sigma}_j|)} \right| \end{aligned} \quad (18)$$

Notice that for pairs of economies for which $\tilde{\sigma}_i = \tilde{\sigma}_j$, so that $\sigma_i = \sigma_j = \sigma$,

$$|\ln \hat{y}_i(t) - \ln \hat{y}_j(t)| \simeq \frac{1}{\sigma} |\eta_i - \eta_j| = \frac{1}{\sigma} \eta_{ij}^R, \quad (19)$$

where $\eta_{ij}^R = ||\eta_i - \eta_f| - |\eta_i - \eta_f||$. This captures the effect of cultural differences between i and j that affect development directly through innovation. In this case, the frontier f plays a similar role as economy m in the previous subsection, since it has the *best* value of this cultural trait for development. Clearly, the same result holds for the economy with the lowest value of η_i .

On the other hand, if $\eta_i = \eta_j$, then

$$|\ln \hat{y}_i(t) - \ln \hat{y}_j(t)| = \tilde{\eta} \left| \frac{1}{\sigma(|\tilde{\sigma}_f - \tilde{\sigma}_i|)} - \frac{1}{\sigma(|\tilde{\sigma}_f - \tilde{\sigma}_j|)} \right| \quad (20)$$

where $\tilde{\eta} = |\eta_f - \eta_i| = |\eta_f - \eta_j|$. Clearly, the cultural distance relative to the technological frontier f plays a fundamental causal role through its effect on imitation. On the other hand, the absolute cultural distance between country i and j does not play a causal role in this case. Still, if instead of σ one were to measure the cultural trait $\mu_i = 1/\sigma_i$, one could rewrite the relation as

$$|\ln \hat{y}_i(t) - \ln \hat{y}_j(t)| = \tilde{\eta} |\mu_i - \mu_j|, \quad (21)$$

which would erroneously associate a causal effect to absolute differences.

Finally, if $\eta_i \neq \eta_j$ and $\tilde{\sigma}_i \neq \tilde{\sigma}_j$, equation (18) implies that the relative cultural differences play both a causal a non-causal role. Thus, in this case, although the presence of observational equivalence is less clear, the observed causal effect of relative cultural differences might be overstated.

Proposition 2.2. *If consumer's are homogeneous, absolute log-income differences between any pair of countries i and j are caused by their relative cultural differences. Their absolute cultural differences have no causal effect on income differences. Moreover, an estimation of the effect of relative cultural differences on income differences might overestimate its causal effect.*

2.4 Heterogeneous Economies

Consider now the general case and assume the technological frontier f also has the highest income per effective worker, i.e. $\rho_f + \delta_f + \theta_f g \leq \rho_i + \delta_i + \theta_i g$. The results from the previous subsections imply that

$$|\ln \hat{y}_i(t) - \ln \hat{y}_j(t)| \simeq \left| \frac{|\eta_f - \eta_i|}{\sigma(|\tilde{\sigma}_f - \tilde{\sigma}_i|)} - \frac{|\eta_f - \eta_j|}{\sigma(|\tilde{\sigma}_f - \tilde{\sigma}_j|)} - \frac{\alpha}{1-\alpha}(d_{if} - d_{jf}) \right|. \quad (22)$$

Clearly, the absolute log-difference in income per capita between two countries with similar consumers or diffusion processes will be as above. More generally, letting γ_{ij} be defined as before and $\tilde{\gamma}_i = |\eta_f - \eta_i| / \sigma(|\tilde{\sigma}_f - \tilde{\sigma}_i|)$, then if the element in the absolute value on the right hand side of equation (22) is non-negative,

$$|\ln \hat{y}_i(t) - \ln \hat{y}_j(t)| \simeq \begin{cases} \left| \frac{|\eta_f - \eta_i|}{\sigma(|\tilde{\sigma}_f - \tilde{\sigma}_i|)} - \frac{|\eta_f - \eta_j|}{\sigma(|\tilde{\sigma}_f - \tilde{\sigma}_j|)} \right| - \frac{\alpha}{1-\alpha} d_{ij} & \text{if } \gamma_{ij} \geq 0, \tilde{\gamma}_i \geq \tilde{\gamma}_j \\ - \left| \frac{|\eta_f - \eta_i|}{\sigma(|\tilde{\sigma}_f - \tilde{\sigma}_i|)} - \frac{|\eta_f - \eta_j|}{\sigma(|\tilde{\sigma}_f - \tilde{\sigma}_j|)} \right| - \frac{\alpha}{1-\alpha} d_{ij} & \text{if } \gamma_{ij} \geq 0, \tilde{\gamma}_i < \tilde{\gamma}_j \\ \left| \frac{|\eta_f - \eta_i|}{\sigma(|\tilde{\sigma}_f - \tilde{\sigma}_i|)} - \frac{|\eta_f - \eta_j|}{\sigma(|\tilde{\sigma}_f - \tilde{\sigma}_j|)} \right| + \frac{\alpha}{1-\alpha} d_{ij} & \text{if } \gamma_{ij} < 0, \tilde{\gamma}_i \geq \tilde{\gamma}_j \\ - \left| \frac{|\eta_f - \eta_i|}{\sigma(|\tilde{\sigma}_f - \tilde{\sigma}_i|)} - \frac{|\eta_f - \eta_j|}{\sigma(|\tilde{\sigma}_f - \tilde{\sigma}_j|)} \right| + \frac{\alpha}{1-\alpha} d_{ij} & \text{if } \gamma_{ij} < 0, \tilde{\gamma}_i < \tilde{\gamma}_j \end{cases} \quad (23)$$

and if it is negative, then

$$|\ln \hat{y}_i(t) - \ln \hat{y}_j(t)| \simeq \begin{cases} - \left| \frac{|\eta_f - \eta_i|}{\sigma(|\tilde{\sigma}_f - \tilde{\sigma}_i|)} - \frac{|\eta_f - \eta_j|}{\sigma(|\tilde{\sigma}_f - \tilde{\sigma}_j|)} \right| + \frac{\alpha}{1-\alpha} d_{ij} & \text{if } \gamma_{ij} \geq 0, \tilde{\gamma}_i \geq \tilde{\gamma}_j \\ \left| \frac{|\eta_f - \eta_i|}{\sigma(|\tilde{\sigma}_f - \tilde{\sigma}_i|)} - \frac{|\eta_f - \eta_j|}{\sigma(|\tilde{\sigma}_f - \tilde{\sigma}_j|)} \right| + \frac{\alpha}{1-\alpha} d_{ij} & \text{if } \gamma_{ij} \geq 0, \tilde{\gamma}_i < \tilde{\gamma}_j \\ - \left| \frac{|\eta_f - \eta_i|}{\sigma(|\tilde{\sigma}_f - \tilde{\sigma}_i|)} - \frac{|\eta_f - \eta_j|}{\sigma(|\tilde{\sigma}_f - \tilde{\sigma}_j|)} \right| - \frac{\alpha}{1-\alpha} d_{ij} & \text{if } \gamma_{ij} < 0, \tilde{\gamma}_i \geq \tilde{\gamma}_j \\ \left| \frac{|\eta_f - \eta_i|}{\sigma(|\tilde{\sigma}_f - \tilde{\sigma}_i|)} - \frac{|\eta_f - \eta_j|}{\sigma(|\tilde{\sigma}_f - \tilde{\sigma}_j|)} \right| - \frac{\alpha}{1-\alpha} d_{ij} & \text{if } \gamma_{ij} < 0, \tilde{\gamma}_i < \tilde{\gamma}_j \end{cases} \quad (24)$$

This implies, that the results of the previous sections still apply in this case. In particular, notice that $d_{ij} = d_{ij}^{Rf}$. Thus, there exists observational equivalence between relative and absolute distances. Moreover, the estimated effect of relative distances will overestimate its true causal effect.

The analysis of the previous two subsections showed that absolute and relative cultural distances play different roles in the determination of comparative development. In particular, it showed that if higher (lower) levels of a cultural trait increase innovation or the steady-state level of income per effective worker, i.e. are better for development, then the effect of this cultural trait on pairwise comparative levels of development is captured by the pairwise absolute cultural distances d_{ij} , which are identical to the cultural distances relative to the economy that has the best or worst level of the particular cultural trait. On the other hand, cultural traits that affect imitation can be classified as good or bad for development *only* in relation to the level of the cultural trait in the technological frontier. Thus, only relative cultural distances relative to the frontier can affect comparative levels of development. The problem in the general case is that both types of relations are determined by the technological frontier. Thus, identifying the importance of the barrier and direct effects becomes extremely difficult in such a setting.

3 Data

This section introduces the data used in the empirical analysis. In particular, it introduces the measures of culture, genetic, linguistic and religious distances.

3.1 Cultural Distances

Cultural differences across countries are measured based on responses to international cross-cultural survey questions on norms, attitudes and preferences. The surveys used in the

analysis are two of the most widely used cross-cultural databases in economics, Hofstede et al. (2010) and *World Value Survey* (1981-2014).

Hofstede (1980, 1991) identified six cultural dimensions that capture cultural traits that distinguish countries from each other. Hofstede et al. (2010) presents updated data on the six Hofstede Cultural Dimensions, namely (i) Power Distance (PDI), which measures the extent to which the less powerful members accept and expect that power is distributed unequally; (ii) Individualism vs. Collectivism (IDV), which measures the degree to which individuals are expected to fend for themselves; (iii) Competition vs. Cooperation (CVC), which refers to level of cooperation and competition among members of society; (iv) Uncertainty Avoidance (UAI), which measures the extent to which members of a culture feel threatened by ambiguous and unknown situations; (v) Long-Term Orientation (LTO), which measures the extent to which a culture fosters virtues oriented towards future rewards, in particular perseverance and thrift, (vi) Indulgence vs. Restraint (IVR), which measures the extent to which a culture allows enjoying life and having fun through free gratification of human drives or suppresses them through strict social norms. The empirical analysis uses all six Hofstede cultural dimensions for the sample of countries for which all measures are available. Table 1 shows the pairwise correlations between the Hofstede dimensions across countries. Clearly, most dimensions are uncorrelated with each other, except for (PDI) and (IDV), (PDI) and (IVR), and (LTO) and (IVR). Thus, one can expect each dimension to capture specific cultural elements that are not captured by the others (Hofstede et al., 2010).

Table 1: Correlation between Hofstede Cultural Dimensions (Levels)

	Correlation Coefficient					
	PDI	IDV	CVC	UAI	LTO	IVR
Power Distance	1.00					
Individualism	-0.65***	1.00				
Competition/Cooperation	0.15	0.03	1.00			
Uncertainty Avoidance	0.21*	-0.19	0.03	1.00		
Long-Term Orientation	0.03	0.09	0.02	-0.02	1.00	
Indulgence/Restraint	-0.31**	0.16	0.08	-0.07	-0.51***	1.00

Notes: *** denotes statistical significance at the 1% level, ** at the 5% level, and * at the 10% level, all for two-sided hypothesis tests.

Additionally, this research uses cultural dimensions based on the World Value Survey (WVS), which since 1981 has conducted nationally representative surveys using a common set of questionnaires in more than 100 countries covering 90 percent of the world's population. In particular, the analysis employs 14 measures based on the WVS, which have previously been suggested to affect economic development and which differentiate economic cultures across societies (Alesina and Giuliano, 2013; Inglehart and Welzel, 2005, 2010). The study

uses the data provided by all six survey waves covering the period from 1981 to 2014 and considers the average values across survey waves if a country is surveyed more than once.

The first two measures based on the WVS are Survival vs. Self-Expression Values (SSV) and Traditional vs. Secular-Rational Values (TRV). These measures explain more than 70 percent of the cross-national variance in a factor analysis of ten indicators (Inglehart and Welzel, 2005, 2010). Traditional societies emphasize the importance of parent-child ties, deference to authority, absolute standards and traditional family values; they reject divorce, abortion, euthanasia, and suicide, express high levels of national pride and a nationalistic outlook. On the other hand, Self-expression emphasizes environmental protection, tolerance of diversity, gender equality, rising demands for participation in decision making in economic and political life, interpersonal trust placing less emphasis on economic and physical security, with relatively less ethnocentric outlooks. Figure A.1 in the Appendix illustrates a cultural map depicting countries in the two dimensional space spanned by these values.

Additionally, the research analyzes other country-level cultural measures, which have been previously been used in the literature or which should capture elements highlighted by it. In particular, it focuses on the following additional 12 measures: Generalized Trust (Trust), Obedience (OBD), Hard Work (HW), Family Ties (FT), Work vs. Luck (WL), Cheating (CHT), Social Capital (SCK), Caring about Equality (EQY), Market Orientation (MKO), Tolerance (TOL), and Protestant Ethic (PET). Table 2 shows the pairwise correlations between the WVS measures across countries. As expected, Survival-Self-Expression and Traditional-Rational Values are highly correlated with the other cultural measures. Moreover, and in contrast to the Hofstede measures, many WVS based measures are highly correlated with each other, suggesting they capture similar elements. In particular, cultural traits like Family Ties, Obedience and Trust correlate strongly with each other.²

For each Hofstede and WVS cultural dimension two distance measures are constructed for each country pair. In particular, given a cultural trait X , the *absolute pairwise distance* between countries i and j , X_{ij} , is given by $X_{ij} = |X_i - X_j|$, and the *relative pairwise distance* between countries i and j , X_{ij}^R , is given by $X_{ij}^R = |X_{iUS} - X_{jUS}|$, where it is assumed that the technological frontier is the US, and X_{iUS} is the absolute distance between country i and the US. Interestingly, while the correlation between the different measures of culture can be low, as shown in Table 1, the absolute cultural differences are generally highly correlated as shown in Tables A.1-A.2.

Finally, in order to capture a general level of cultural difference, an additional measure is constructed based on the Survival-Self-Expression and Traditional-Rational Values. This

²Some of the correlation is generated by construction since some measures share the underlying information. For others, it might suggest that certain cultural traits are transmitted simultaneously.

Table 2: Correlation between WVS Cultural Measures (Levels)

	Correlation Coefficient												
	TRV	SSV	Trust	OBD	HW	FT	WL	CHT	SCK	EQY	MKOTOLPET		
TRV	1.00												
SSV	0.03	1.00											
Trust	0.55***	0.46***	1.00										
Obedience	-0.71***	-0.11	-0.37**	1.00									
Hard Work	-0.44***	-0.74***	-0.52***	0.32**	1.00								
Family Ties	-0.74***	-0.32**	-0.60***	0.67***	0.57***	1.00							
Work/Luck	0.39***	0.11	-0.05	-0.20	-0.48***	-0.25*	1.00						
Cheating	0.14	-0.03	-0.20	0.12	-0.23	-0.16	0.35**	1.00					
Social Capital	-0.18	0.09	0.19	-0.12	0.20	0.15	-0.41***	-0.96***	1.00				
Equality	0.44***	0.27*	0.17	-0.26*	-0.42***	-0.44***	0.29*	0.21	-0.20	1.00			
Market Orientation	0.02	0.46***	0.35**	-0.16	-0.18	-0.09	-0.37**	-0.28*	0.29*	0.08	1.00		
Tolerance	0.27*	0.69***	0.32**	-0.14	-0.70***	-0.42***	0.41***	0.24	-0.21	0.32**	0.28*	1.00	
Protestant Ethic	0.54***	-0.24	0.25*	-0.40***	-0.03	-0.33**	-0.09	-0.03	0.02	0.32**	0.20	-0.20	1.00

Notes: *** denotes statistical significance at the 1% level, ** at the 5% level, and * at the 10% level, all for two-sided hypothesis tests.

WVS cultural distance is defined as the Manhattan distance between countries on the plane determined by these two measures. Based on this measure, the largest cultural distance in the sample is between Sweden and Tanzania and the smallest is between Mexico and the Dominican Republic. The *relative WVS cultural distance* is constructed in the same manner as other relative distances.

3.2 Genetic Distances

The analysis employs genetic distances as a measure of the time since two populations diverged from a common ancestor. The genetic distance data employed in the analysis is taken from Spolaore and Wacziarg (2009a), who constructed genetic distances between countries based on ethnic-level data from Cavalli-Sforza et al. (1994). Spolaore and Wacziarg (2009a) provide 3 measures of genetic distance for each country pair: (i) F_{ST} -*dominant*, which is the distance between the major ethnic groups of each country in a pair; (ii) F_{ST} -*weighted*, which is the ethnic-level weighted genetic distance between two randomly selected individuals (one from each country); and (iii) F_{ST} -*1500*, which proxies the genetic distance between countries as of 1500. The analysis employs F_{ST} -*weighted* as the main genetic distance measure, since it better represents the average genetic distance between countries and is the measure used in the main analysis of Spolaore and Wacziarg (2009a,b, 2012, 2013a,b).³ Based on these genetic distances, the analysis constructs *relative genetic distances* for each country pair in a similar fashion as other relative distances.

³The results are robust to the genetic distance measure used.

3.3 Additional Controls

Cultural differences between societies are not only affected by the time since they shared a common ancestor, but also by other elements that affect ancestry, like religion and language, and by differences in other determinants of culture like geography (Alesina et al., 2013; Galor and Özak, 2014). Thus, in order to overcome potential biases due to omitted factors, this research accounts for a large set of additional pairwise differences. In particular, the analysis accounts for geographic, linguistic and religious distances, differences in a large set of geographical conditions (absolute latitude, elevation, agricultural and caloric suitability, being landlocked or islands, climatic conditions, etc.), and a full set of pairwise continental fixed effects (whether one or both or none of the countries in the pair are in a specific continent). Importantly, the analysis accounts for country fixed effects, which ensures that only non-linear pairwise omitted factors could potentially bias the results.

4 Empirical Analysis

This section explores empirically the relation between absolute and relative cultural distances and economic development. Additionally, it examines the relation between differences in cultural traits and various proxies of cultural differences used in the literature. In particular, it analyzes the relation between the Hofstede and WVS cultural distances introduced in the previous section and genetic, linguistic, and religious distances.

4.1 Cultural Differences and Genetic Distances

This section analyzes the association between cultural differences and genetic, linguistic, and religious distances across countries. Genetic distances have played an essential role in the literature as a proxy of cultural differences. Thus, it is only natural that it also plays a central role in the following analysis. In particular, while the interpretation of genetic distances as a measure of the time since two populations shared a common ancestor is well established, which cultural differences are captured by genetic distances is poorly understood. For example, using genetic distances among European regions, Desmet et al. (2011) find suggestive evidence that genetic distances capture generic cultural differences among these regions. On the other hand, Giuliano et al. (2006) suggest that genetic distances among European regions capture transportation costs and not cultural differences.⁴

⁴In particular, Giuliano et al. (2006) show that after controlling for geography, the impact of genetic distance on trade disappears. They suggest that geographic factors that shaped genetic patterns in the past are also relevant for current transportation costs and that is what drives the correlation between trading flows and genetic distance.

This research differs from the previous literature in various aspects: (i) it explores the relation between genetic distances and actual measures of differences in cultural values that ought to be relevant to economic development at the country level. This allows the identification of the potential cultural channels that genetic distance is proxying. (ii) It accounts for the effect of other geographical distances and country fixed effects. Thus, accounting for the potential effect of transportation costs and other geographically determined effects. (iii) It accounts for linguistic and religious distances, which also capture common ancestry, in order to identify the main channels through which ancestry can play a role in cultural differences. (iv) It includes a large sample of countries and is not limited to a specific region or continent.

The general empirical specification used in this section is

$$\text{Cultural distance}_{ij} = \alpha + \beta_G GD_{ij} + \beta_L LD_{ij} + \beta_R RD_{ij} + \sum_k \gamma_k X_{ij}^k + c_i + c_j + \epsilon_{ij},$$

where GD_{ij} is the genetic distance between countries i and j , LD_{ij} is their linguistic distance, RD_{ij} is their religious distance, $\{X_{ij}^k\}_k$ is a large set of additional pairwise controls, including geographic distances and differences in geographic factors (absolute latitude, landlocked, island, close to coast or river, terrain ruggedness, agricultural and caloric suitability, climatic zones, etc.), common history (ever same country, ever in colonial relationship, have common colonizer), difference in the number of years since the Neolithic transition, a complete set of continental fixed effects (whether one, both or none of the countries in the pair belong to a specific continent), c_i and c_j are country fixed effects, and ϵ_{ij} is an error term. Given that the construction of cultural differences can potentially generate correlation across observations for each country i , the analysis clusters standard errors at two levels, one for each country in the pair (Cameron et al., 2011).

4.1.1 Hofstede Cultural Dimensions

This section uses differences in Hofstede’s cultural dimensions as the dependent variables in the analysis. Table 3 shows the results of the Ordinary Least Squares (OLS) regression between differences in Hofstede’s cultural dimensions and genetic distances without any additional controls. As can be seen there, differences in Individualism, Long-Term Orientation, and Indulgence vs. Restraint are significantly correlated with genetic distances. In particular, the estimated coefficients imply that a one-standard deviation increase in genetic distance between countries i and j is associated with about a half standard deviation increase in their difference in Individualism.⁵

⁵All tables report the standardized beta coefficients with their standardized errors in the parenthesis. Standardized beta coefficients report the number of standard deviation changes in the dependent variable

Table 3: Hofstede’s Cultural Dimensions and Genetic Distances (Unconditional)

	Hofstede Cultural Dimensions (OLS)					
	Power Distance	Individualism	Competition Cooperation	Uncertainty Avoidance	Long-Term Orientation	Indulgence Restraint
	(1)	(2)	(3)	(4)	(5)	(6)
Genetic Distance	0.01 (0.07)	0.17*** (0.05)	-0.02 (0.05)	0.11 (0.08)	0.17*** (0.06)	0.10* (0.06)
Country FE	No	No	No	No	No	No
Additional Distances	No	No	No	No	No	No
Adjusted- R^2	0.00	0.03	0.00	0.01	0.03	0.01
Observations	1891	1891	1891	1891	1891	1891

Notes: This table shows the simple correlation between each of Hofstede’s cultural dimensions and genetic distance. Coefficients are standardized betas. Two-way clustered standard errors in parentheses. *** denotes statistical significance at the 1% level, ** at the 5% level, and * at the 10% level, all for two-sided hypothesis tests.

Table 4: Hofstede’s Cultural Dimensions and Genetic Distances (Fixed Effects)

	Hofstede Cultural Dimensions (OLS)					
	Power Distance	Individualism	Competition Cooperation	Uncertainty Avoidance	Long-Term Orientation	Indulgence Restraint
	(1)	(2)	(3)	(4)	(5)	(6)
Genetic Distance	0.18** (0.08)	0.48*** (0.09)	0.01 (0.02)	0.16** (0.08)	0.07 (0.05)	0.11** (0.06)
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Additional Distances	No	No	No	No	No	No
Adjusted- R^2	0.42	0.27	0.55	0.33	0.30	0.37
Observations	1891	1891	1891	1891	1891	1891

Notes: This table shows the correlation between each of Hofstede’s cultural dimensions and genetic distance after accounting for country fixed effect. Coefficients are standardized betas. Two-way clustered standard errors in parentheses. *** denotes statistical significance at the 1% level, ** at the 5% level, and * at the 10% level, all for two-sided hypothesis tests.

Table 4 accounts for country fixed effects in order to capture any unobserved time-invariant country specific characteristics. The results show that once country specific unobservables are accounted for, the coefficients generally increase both in terms of magnitude and significance, particularly for Power distance. Still, genetic distances might be capturing the confounding effect of other differences among countries.

The potential confounding effect of other differences among countries is explored in Table 5. This table establishes that once one accounts for country fixed effects, pairwise differences in geographical characteristics and continental fixed effects, Individualism is the only cultural distance that remains economically and statistically significantly correlated with when the independent variable changes by one standard deviation.

Table 5: Hofstede’s Cultural Dimensions and Genetic Distances (Geography + FE)

	Hofstede Cultural Dimensions (OLS)					
	Power Distance	Individualism	Competition Cooperation	Uncertainty Avoidance	Long-Term Orientation	Indulgence Restraint
	(1)	(2)	(3)	(4)	(5)	(6)
Genetic Distance	0.14 (0.10)	0.32** (0.14)	-0.01 (0.04)	0.08 (0.07)	-0.09 (0.13)	-0.01 (0.10)
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Additional Distances	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted- R^2	0.45	0.42	0.55	0.38	0.38	0.43
Observations	1830	1830	1830	1830	1830	1830

Notes: This table shows the correlation between each of Hofstede’s cultural dimensions and genetic distance after accounting for country fixed effects, pairwise geographical differences, and continental fixed effects. Coefficients are standardized betas. Two-way clustered standard errors in parentheses. *** denotes statistical significance at the 1% level, ** at the 5% level, and * at the 10% level, all for two-sided hypothesis tests.

genetic distance. This suggests that among the cultural values identified by Hofstede et al. (2010), Individualism is potentially the main cultural value that genetic distance is proxying for. Moreover, these results suggest that Individualism is the only trait for which common ancestry, as measured by genetic distance, plays a role.

In order to further analyze the role of common ancestry, Table 6 additionally accounts for linguistic and religious distances, which also capture common ancestry and historical experience. Interestingly, except for the Competition-Cooperation value, all cultural differences are positively correlated with either linguistic or genetic distances. In particular, Power Distance, Individualism, Uncertainty Avoidance, Long-Term Orientation, and Indulgence vs Restraint are statistically and economically significantly correlated with linguistic distances. On the other hand, only Individualism remains statistically significantly correlated with genetic distances. Furthermore, religious distance is not statistically significantly correlated with any of the differences in cultural dimensions across countries. These results support the view that common ancestry plays a central role in the generation of cultural differences. Moreover, they suggest that linguistic distances capture a wider set of cultural differences than genetic distances, which seem to only correlate with differences in Individualism.

Finally, following Spolaore and Wacziarg (2009a), Table 7 uses genetic distances in 1500CE as an instrumental variable for the contemporary genetic distance to estimate the effect of genetic distances on cultural differences. The exclusion restriction requires that after accounting for all other geographical and ancestral differences and country fixed effects, genetic distance in 1500CE should affect contemporary cultural differences only through contemporary genetic distances. The results suggest that the instrument is not weak as first-stage F-statistics are higher than the usual rule of thumb. Although the qualitative

Table 6: Hofstede’s Cultural Dimensions and Genetic Distances (Linguistic and Religious Distances)

	Hofstede Cultural Dimensions (OLS)					
	Power Distance	Individualism	Competition Cooperation	Uncertainty Avoidance	Long-Term Orientation	Indulgence Restraint
	(1)	(2)	(3)	(4)	(5)	(6)
Genetic Distance	0.13 (0.09)	0.31** (0.13)	-0.03 (0.05)	0.06 (0.08)	-0.09 (0.11)	-0.03 (0.08)
Linguistic Distance	0.31*** (0.11)	0.35** (0.18)	0.04 (0.07)	0.33*** (0.09)	0.16*** (0.06)	0.23*** (0.09)
Religious Distance	0.10* (0.06)	0.05 (0.04)	0.07 (0.06)	0.06 (0.09)	0.04 (0.09)	0.06 (0.07)
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Additional Distances	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted- R^2	0.47	0.44	0.54	0.40	0.38	0.45
Observations	1711	1711	1711	1711	1711	1711

Notes: This table shows the correlation between each of Hofstede’s cultural dimensions and genetic distance after accounting for country fixed effects, pairwise geographical differences, continental fixed effects, and linguistic and religious distances. Coefficients are standardized betas. Two-way clustered standard errors in parentheses. *** denotes statistical significance at the 1% level, ** at the 5% level, and * at the 10% level, all for two-sided hypothesis tests.

results do not change, they weaken the statistical significance of the positive association between genetic distance and Individualism, and increase the significance of the negative association between genetic distance and differences between Indulgence vs. Restraint.

Overall, the analysis of this subsection suggests that genetic distances capture mostly the effects of Individualism, while linguistic distances capture the effects of differences in a larger set of cultural values. These results might explain the economic and statistical significance of both Individualism and genetic distances found in the literature (Gorodnichenko and Roland, 2011; Spolaore and Wacziarg, 2009a). Additionally, it supports the view that common ancestry explains commonality in cultural values and the persistence of culture (Alesina and Giuliano, 2013; Galor and Özak, 2014; Galor et al., 2016; Guiso et al., 2006).

4.1.2 WVS Cultural Measures

This section explores the relation between genetic distances and differences in the WVS cultural measures introduced in section 3. Table 8-Panel A shows the results of the Ordinary Least Squares (OLS) regression between differences in WVS cultural dimensions and genetic distances without any additional controls. In particular, differences in Tradition-Rational, Generalized Trust, Obedience, and Hard Work are statistically significantly positively correlated with genetic distance. On the other, Survival-Self-Expression and Market Orientation are statistically significantly negatively correlated with genetic distances, in contradiction to

Table 7: Hofstede’s Cultural Dimensions and Genetic Distances (IV)

	Hofstede Cultural Dimensions (IV)					
	Power Distance	Individualism	Competition Cooperation	Uncertainty Avoidance	Long-Term Orientation	Indulgence Restraint
	(1)	(2)	(3)	(4)	(5)	(6)
Genetic Distance	0.04 (0.11)	0.29* (0.16)	-0.10 (0.09)	0.13 (0.10)	-0.22 (0.14)	-0.26** (0.11)
Linguistic Distance	0.30*** (0.10)	0.35** (0.16)	0.04 (0.06)	0.34*** (0.09)	0.16*** (0.05)	0.22** (0.09)
Religious Distance	0.11** (0.05)	0.05 (0.04)	0.07 (0.06)	0.05 (0.08)	0.06 (0.08)	0.09 (0.07)
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Additional Distances	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted- R^2	0.44	0.41	0.52	0.37	0.35	0.41
Observations	1711	1711	1711	1711	1711	1711
F-statistic (first stage)	15.82	15.82	15.82	15.82	15.82	15.82

Notes: This table shows the causal relationship between each of Hofstede’s cultural dimensions and genetic distance after accounting for country fixed effects, pairwise geographical differences, continental fixed effects, and linguistic and religious distances. Genetic distance in 1500CE is used as an instrument for contemporary genetic distance. Coefficients are standardized betas. Two-way clustered standard errors in parentheses. *** denotes statistical significance at the 1% level, ** at the 5% level, and * at the 10% level, all for two-sided hypothesis tests.

the expected effect that genetic distance ought to have on cultural distances due to common ancestry.

The negative correlation between genetic distance and Survival-Self-Expression and Market Orientation might be generated due to omitted variable bias. In particular, as established in Table 8-Panel B, once one accounts for country fixed effects, the coefficient on genetic distance becomes non-negative for all WVS cultural values including the Survival-Self-Expression and Market Orientation. Moreover, the coefficient increases in economic and statistical significance for the Tradition-Rational, Generalized Trust, Obedience, Hard Work and Family Ties.

Table 8-Panel C establishes that genetic distances are not statistically and economically significantly correlated with Tradition-Rational and Survival-Self-Expression once one additionally accounts for other geographical and historical differences. On the other hand, Generalized Trust, Obedience, Hard Work and Family Ties remain statistically and economically significantly correlated with genetic distances. This suggests that genetic distances capture mainly differences in cultural traits that are expected to have economic effects.

Table 9 explores whether genetic distances are the only measures of common ancestry that might correlate with the WVS cultural distances. Interestingly, and in contrast to the analysis based on the Hofstede measures, linguistic distances are only statistically and economically significantly correlated with differences in three cultural traits, namely the

Table 8: WVS Cultural Measures and Genetic Distances

	WVS Cultural measures													
	WVS (1)	TRV (2)	SSV (3)	Trust (4)	OBD (5)	HW (6)	FT (7)	WL (8)	CHT (9)	SCK (10)	EQY (11)	MKO (12)	TOL (13)	PET (14)
Panel A: Unconditional														
Genetic Distance	-0.06 (0.05)	0.17*** (0.06)	-0.19*** (0.04)	0.12** (0.06)	0.36*** (0.07)	0.22** (0.09)	0.13* (0.07)	-0.00 (0.06)	0.03 (0.05)	0.03 (0.05)	0.05 (0.06)	-0.14** (0.06)	-0.09** (0.04)	0.07 (0.05)
Adjusted- R^2	0.00	0.02	0.03	0.01	0.10	0.05	0.01	0.00	0.00	0.00	0.00	0.02	0.01	0.00
Panel B: Fixed Effects														
Genetic Distance	0.09 (0.06)	0.33*** (0.08)	0.12** (0.05)	0.20*** (0.04)	0.38*** (0.10)	0.35*** (0.10)	0.27*** (0.08)	0.08 (0.06)	-0.00 (0.01)	0.00 (0.01)	0.10 (0.07)	0.00 (0.03)	0.09* (0.05)	0.12* (0.07)
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted- R^2	0.61	0.26	0.53	0.53	0.41	0.34	0.46	0.48	0.44	0.45	0.32	0.52	0.42	0.30
Panel C: Geography + Fixed Effects														
Genetic Distance	0.04 (0.05)	0.08 (0.07)	0.05 (0.05)	0.13** (0.05)	0.23** (0.10)	0.34*** (0.09)	0.16*** (0.06)	0.03 (0.06)	-0.03* (0.02)	-0.03 (0.03)	0.06 (0.06)	-0.00 (0.03)	-0.01 (0.05)	0.04 (0.07)
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Additional Distances	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted- R^2	0.62	0.57	0.54	0.56	0.53	0.39	0.58	0.49	0.44	0.45	0.36	0.52	0.46	0.35
Observations	3486	3486	3486	4005	1891	1485	2080	3570	3655	3655	2850	2701	3828	4005

Notes: This table shows correlation between each of the WVS cultural measures and genetic distance. Panel A shows the correlation without any controls. Panel B accounts for country fixed effects. Panel C additionally accounts for pairwise geographical differences and continental fixed effects. Each column shows the relation to with respect to one measure, where the WVS measures are WVS distance, Survival vs. Self-Expression Values (SSV), Traditional vs. Secular-Rational Values (TRV), Generalized Trust (Trust), Obedience (OBD), Hard Work (HW), Family Ties (FT), Work vs. Luck (WL), Cheating (CHT), Social Capital (SCK), Caring about Equality (EQY), Market Orientation (MKO), Tolerance (TOL), and Protestant Ethic (PET), see section 3 for additional information on measures. Coefficients are standardized betas. Two-way clustered standard errors in parentheses. *** denotes statistical significance at the 1% level, ** at the 5% level, and * at the 10% level, all for two-sided hypothesis tests.

Survival-Self-Expression, Tolerance and Protestant Ethic. On the other hand, and also in contrast to the analysis based on the Hofstede measures, religious distances are statistically and economically significantly correlated with various measures, including the Survival-Self-Expression, Hard Work, and Tolerance.

Moreover, genetic distances remain statistically and economically significantly correlated with Generalized Trust, Obedience, Hard Work and Family Ties when using OLS (Table 9 Panel A). On the other hand, if as in the previous section one instruments contemporary genetic distances with genetic distances in 1500CE (Table 9 Panel B), their effect on Obedience and Family Ties becomes statistically insignificant. Additionally, the coefficient on genetic distance becomes negative statistically and economically significant in the analysis of differences in Cheating, Social Capital, Market Orientation, Tolerance and Protestant Ethic.

Thus, genetic distances seem to be only consistently correlated with Generalized Trust and Hard Work. Moreover, given the central role that Generalized Trust seems to play in economic development (Alesina and Giuliano, 2013; Tabellini, 2010; Zak and Knack, 2001), these results suggest that genetic distances might be capturing differences in an essential

Table 9: WVS Cultural Measures and Ancestry

	WVS Cultural measures													
	WVS (1)	TRV (2)	SSV (3)	Trust (4)	OBD (5)	HW (6)	FT (7)	WL (8)	CHT (9)	SCK (10)	EQY (11)	MKO (12)	TOL (13)	PET (14)
Panel A: OLS														
Genetic Distance	0.03 (0.05)	0.07 (0.07)	0.03 (0.04)	0.13** (0.05)	0.23** (0.09)	0.31** (0.12)	0.15*** (0.06)	0.02 (0.05)	-0.03* (0.02)	-0.03 (0.02)	0.05 (0.06)	-0.01 (0.03)	-0.03 (0.06)	0.03 (0.07)
Linguistic Distance	0.07 (0.07)	0.03 (0.04)	0.21** (0.10)	-0.02 (0.05)	0.09 (0.05)	0.05 (0.11)	0.02 (0.05)	-0.01 (0.04)	0.00 (0.04)	0.00 (0.04)	0.06 (0.05)	0.15 (0.09)	0.17** (0.08)	0.19** (0.09)
Religious Distance	0.02 (0.03)	0.04* (0.03)	0.20*** (0.04)	0.03 (0.02)	-0.03 (0.03)	0.24*** (0.08)	0.08* (0.05)	0.07 (0.05)	0.04 (0.03)	0.03 (0.03)	0.04 (0.04)	-0.01 (0.02)	0.14*** (0.05)	-0.02 (0.04)
Adjusted- R^2	0.62	0.58	0.58	0.55	0.53	0.42	0.58	0.50	0.44	0.45	0.36	0.52	0.47	0.36
Panel B: Panel B: IV														
Genetic Distance	-0.01 (0.03)	0.03 (0.05)	-0.02 (0.04)	0.10** (0.04)	0.11 (0.08)	0.34*** (0.08)	0.12* (0.06)	-0.02 (0.04)	-0.06*** (0.01)	-0.06*** (0.01)	0.02 (0.05)	-0.06** (0.03)	-0.16*** (0.05)	-0.15** (0.06)
Linguistic Distance	0.08 (0.07)	0.04 (0.05)	0.25** (0.11)	-0.02 (0.05)	0.07* (0.04)	0.04 (0.10)	0.03 (0.05)	-0.01 (0.05)	0.00 (0.04)	0.01 (0.04)	0.06 (0.04)	0.16* (0.09)	0.21** (0.10)	0.23** (0.10)
Religious Distance	0.02 (0.03)	0.05* (0.02)	0.21*** (0.04)	0.03 (0.02)	-0.03 (0.03)	0.25*** (0.07)	0.09** (0.04)	0.08 (0.05)	0.04 (0.03)	0.03 (0.03)	0.04 (0.04)	-0.01 (0.02)	0.15*** (0.05)	-0.02 (0.04)
F-statistic	91.34	91.34	91.34	88.29	36.32	141.59	33.47	56.52	90.66	90.66	90.48	86.86	90.15	88.29
Adjusted- R^2	0.61	0.56	0.56	0.54	0.51	0.39	0.56	0.49	0.43	0.43	0.34	0.51	0.45	0.33
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Additional Distances	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3486	3486	3486	3916	1891	1485	2080	3486	3655	3655	2850	2701	3741	3916

Notes: Panel A of the table shows the coefficients of an Ordinary Least Squares (OLS) regression between each of the WVS cultural measures and genetic distance after accounting for country fixed effects, pairwise geographical differences, continental fixed effects, and linguistic and religious distances. Panel B uses an instrumental variable (IV) approach to show the causal effect of the genetic distance on each of WVS cultural measures after accounting for all controls. Each column shows the relation to with respect to one measure, where the WVS measures are WVS distance, Survival vs. Self-Expression Values (SSV), Traditional vs. Secular-Rational Values (TRV), Generalized Trust (Trust), Obedience (OBD), Hard Work (HW), Family Ties (FT), Work vs. Luck (WL), Cheating (CHT), Social Capital (SCK), Caring about Equality (EQY), Market Orientation (MKO), Tolerance (TOL), and Protestant Ethic (PET), see section 3 for additional information on measures. Coefficients are standardized betas. Two-way clustered standard errors in parentheses. *** denotes statistical significance at the 1% level, ** at the 5% level, and * at the 10% level, all for two-sided hypothesis tests.

element behind comparative development. Finally, given the high correlation between Individualism and Generalized Trust, it is reassuring to find similar results using both measures, even though the results are based on different samples.

4.2 Income and Cultural Differences

This section explores the direct and barrier effects of culture on economic development. In particular, it analyzes whether absolute or relative cultural distances are significantly associated with differences in economic development. Moreover, it explores which cultural values have direct and barrier effects on development. Additionally, it complements the analysis of the previous section by studying the cultural mechanisms that are behind the association between genetic distances relative to frontier and economic development.

The analysis generalizes the empirical specification in Spolaore and Wacziarg (2009a) in order to include absolute and relative cultural differences. Thus, the empirical specification used in the analysis is

$$y_{ij} = \alpha + \beta_G^R GD_{ij}^R + \beta_C C_{ij} + \beta_C^R C_{ij}^R + \beta_L LD_{ij} + \beta_L^R LD_{ij}^R + \beta_R RD_{ij} + \beta_R^R RD_{ij}^R + \sum_k \gamma_k X_{ij}^k + c_i + c_j + \epsilon_{ij},$$

where the dependent variable, y_{ij} , is the absolute value of the pairwise difference in log income per capita in 1995 between country i and j , GD_{ij}^R is the relative genetic distance to the US between countries i and j , C_{ij} is their cultural distance, C_{ij}^R is their relative cultural distance, LD_{ij} is their linguistic distance, LD_{ij}^R is their relative linguistic distance, RD_{ij} is their religious distance, RD_{ij}^R is their relative religious distance, $\{X_{ij}^k\}_k$ is a large set of additional pairwise controls, including geographic distances and differences in geographic factors (absolute latitude, landlocked, island, close to coast or river, terrain ruggedness, agricultural and caloric suitability, climatic zones, etc.), common history (ever same country, ever in colonial relationship, have common colonizer), difference in the number of years since the Neolithic transition, a complete set of continental fixed effects (whether one, both or none of the countries in the pair belong to a specific continent), c_i and c_j are country fixed effects, and ϵ_{ij} is an error term.⁶ Given that the construction of differences can potentially generate correlation across observations for each country i , the analysis clusters standard errors at two levels, one for each country in the pair (Cameron et al., 2011).

4.2.1 Hofstede Cultural Dimensions

This section explores the direct and barrier effects of the Hofstede cultural dimensions. Table 10 explores the correlation between differences in economic development, relative genetic distances and cultural distances. Column 1 shows that genetic distance relative to frontier is significantly associated with income differences for the subset of countries for which the cultural Hofstede dimensions is available.⁷

Columns 2-7 account for the absolute cultural distances in Individualism, Power Dis-

⁶In order to facilitate comparison with Spolaore and Wacziarg (2009a), the results shown in the main body of the paper use only the subset of controls used by them. The appendix includes the full set of controls, which were employed in section 4.1.

⁷Table C.1 replicates the analysis of Spolaore and Wacziarg (2009a) for the full sample of country pairs for which all non-cultural data is available. As can be seen there, genetic distances relative to the US are economically and statistically significantly associated with differences in economic development as established by Spolaore and Wacziarg (2009a). Interestingly, and contrary to their findings, once one accounts for country fixed effects and other pairwise differences, genetic distances also become economically and statistically significantly correlated with differences in economic development.

tance, Competition vs Cooperation, Uncertainty Avoidance, Long-Term Orientation, and Indulgence vs Restraint, while columns 9-14 account for the relative distances for these same cultural values. The results show that absolute and relative distances in Individualism and Power Distance are positively economically and statistically associated with differences in economic development. Additionally, relative distances in Indulgence vs Restraint are also strongly associated with economic development. Columns 8 and 15 respectively account for all absolute and relative cultural distances jointly with similar results.

The results of columns 2 and 9 establish that once one accounts for differences in Individualism, the genetic distance relative to the US ceases to be associated with differences in economic development. This suggests that genetic distances relative to the US might be capturing the effect of differences in Individualism. This view is supported by the results of section 4.1.1, which established the strong association between genetic distances and differences in Individualism. Furthermore, as shown in Table B.3, relative distances in Individualism are the only relative cultural trait that is economically and statistically significantly correlated with relative genetic distances.

While these results suggest that relative genetic distances might be capturing the barrier effect of Individualism, this interpretation is subject to the problem of observational equivalence. In particular, given that the US has the highest value of Individualism (see Figure 2), the absolute and relative distances are observationally equivalent. So, although column 9 would suggest a barrier effect of individualism, this might just be capturing the direct effect that has been obscured by the observational equivalence. Moreover, in light of this observational equivalence, the results of section 4.1.1 and Tables B.4-B.6, it is possible that relative genetic distances do not capture the barrier effect, but instead the direct effects of culture.

Although these results suggest one potential mechanism being captured by relative genetic distances, it does not help in the identification of the direct vs barrier effects of these various cultural values. In order to analyze this further, Table 11 accounts jointly for both absolute and relative cultural distances. The results show that only absolute distances in Individualism and Power Distance, and relative distances in Indulgence vs Restraint are positively economically and statistically significantly associated with differences in economic development. A horse race between the absolute and relative distances of all the Hofstede cultural values finds that only Individualism and Indulgence vs Restraint remain positively strongly associated with economic development.

Once one accounts for country fixed effects, Table 12, again only absolute distances in Individualism and Power Distance, and the relative distance in Indulgence vs Restraint remain positively economically and statistically significantly associated with differences in

Table 10: Hofstede Cultural Dimensions

	Differences in log per capita income (1995)														
	Direct Effect of Culture							Barrier Effect of Culture							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
Genetic Distance relative to US	0.15** (0.07)	0.10 (0.06)	0.14** (0.06)	0.15** (0.07)	0.14** (0.07)	0.15** (0.07)	0.15** (0.07)	0.11** (0.06)	0.10 (0.06)	0.14** (0.07)	0.15** (0.07)	0.15** (0.07)	0.15** (0.07)	0.15** (0.07)	0.11* (0.06)
Individualism		0.21*** (0.07)						0.15** (0.07)							
Power Distance			0.20*** (0.06)					0.15** (0.06)							
Compet/Cooper				-0.07** (0.03)				-0.11*** (0.03)							
Uncertainty Avoid					0.06 (0.05)			0.04 (0.05)							
Long-Term Orient						-0.06 (0.04)		-0.06 (0.05)							
Indulgence/Restraint							0.11 (0.07)	0.10 (0.06)							
Individualism, relative to US									0.21*** (0.07)						0.16** (0.07)
Power Distance, relative to US										0.15** (0.07)					0.09 (0.07)
Compet/Cooper, relative to US											-0.03 (0.03)				-0.06** (0.03)
Uncertainty Avoid, relative to US												-0.00 (0.03)			-0.02 (0.03)
Long-Term Orient, relative to US													-0.06* (0.03)		-0.07* (0.04)
Indulg/Restraint, relative to US														0.22*** (0.07)	0.20*** (0.06)
Adjusted- R^2	0.02 1830	0.06 1830	0.06 1830	0.03 1830	0.03 1830	0.03 1830	0.03 1830	0.11 1830	0.06 1830	0.04 1830	0.02 1830	0.02 1830	0.03 1830	0.07 1830	0.12 1830

Notes: This table shows correlation between absolute log-differences in income per capita in 1995 and absolute and relative cultural distances based on Hofstede et al. (2010) cultural values. Coefficients are standardized betas. Two-way clustered standard errors in parentheses. *** denotes statistical significance at the 1% level, ** at the 5% level, and * at the 10% level, all for two-sided hypothesis tests.

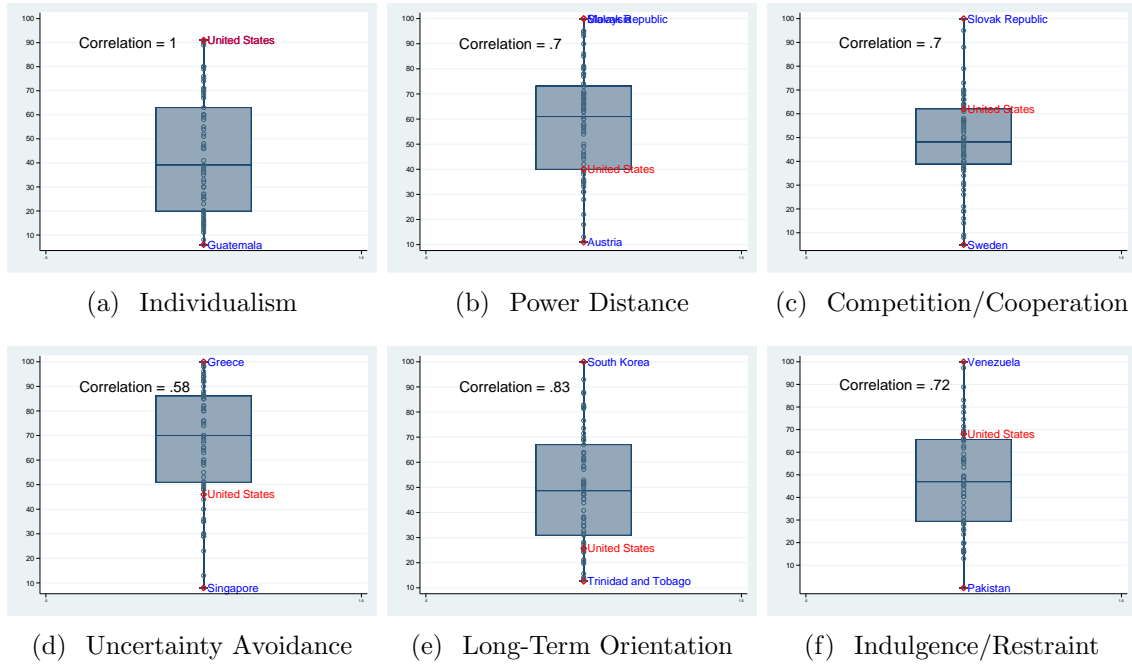


Figure 2: Location of U.S. in the Distribution of Hofstede Dimensions

economic development. Furthermore, neither relative genetic distances nor any of the other distances is statistically significantly associated with economic development. The results of Table 12 also show that in a horse race with all absolute and relative distances, only the absolute distance in Power Distance remains statistically and economically associated with economic development.

Given the potential bias due to omitted variables, Table 13 additionally accounts for geographical differences, pairwise continental fixed effects, other measures of common ancestry, as well as relative linguistic and religious distances. The results are qualitatively and quantitatively similar to the previous ones. In particular, absolute distances in Individualism and Power Distance, and relative distance in Indulgence vs Restraint are positive economically statistically significantly associated with differences in economic development. In particular, the estimates suggest that a one standard deviation increase in the absolute distance in Individualism is associated with a 0.24 standard deviation increase in log-absolute differences in income per capita. Similarly, a one standard deviation increase in the absolute distance in Power Distance is associated with a 0.41 standard deviation increase in log-absolute differences in income per capita. On the other hand, a one standard deviation increase in the relative distance in Indulgence vs Restraint is associated with a 0.28 standard deviation increase in log-absolute differences in income per capita.

Column 8 in Table 13 shows the results of the horse race between all absolute and relative

Table 11: Hofstede Cultural Dimensions and Income (Unconditional)

	Differences in log per capita income (1995)							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Genetic Distance relative to US	0.15** (0.07)	0.10 (0.06)	0.14** (0.07)	0.15** (0.07)	0.14** (0.07)	0.15** (0.07)	0.15** (0.07)	0.10* (0.05)
Individualism		0.21*** (0.07)						0.14** (0.07)
Power Distance			0.20*** (0.05)					0.11* (0.06)
Compet/Cooper				-0.11*** (0.04)				-0.11** (0.04)
Uncertainty Avoid					0.10 (0.07)			0.10 (0.07)
Long-Term Orient						0.00 (0.14)		0.09 (0.15)
Indulgence/Restraint							-0.09*** (0.02)	-0.09*** (0.03)
Individualism relative to US		0.00 (0.00)						0.00 (0.00)
Power Distance relative to US			0.00 (0.08)					0.03 (0.08)
Compet/Cooper relative to US				0.05 (0.04)				0.01 (0.04)
Uncertainty Avoid relative to US					-0.07 (0.05)			-0.09 (0.06)
Long-Term Orient relative to US						-0.07 (0.13)		-0.14 (0.14)
Indulg/Restraint relative to US							0.28*** (0.07)	0.25*** (0.07)
Adjusted- R^2	0.02	0.06	0.06	0.03	0.03	0.03	0.08	0.14
Observations	1830	1830	1830	1830	1830	1830	1830	1830

Notes: This table explores the direct and barrier effects of Hofstede's cultural values by running a horse race between absolute and relative cultural distances. Coefficients are standardized betas of an Ordinary Least Squares (OLS) regression without additional controls. Two-way clustered standard errors in parentheses. *** denotes statistical significance at the 1% level, ** at the 5% level, and * at the 10% level, all for two-sided hypothesis tests.

distances. The results suggest that only the absolute distance in Power Distance is associated with differences in economic development. Moreover, notice that the genetic distance relative to the US is not associated with economic development in any of the columns of this table.

These results suggest that (i) genetic distances relative to the US might be capturing the (direct or barrier) effects of Individualism, (ii) Individualism and Power Distance have significant direct effects on development, (iii) Individualism and Indulgence vs Restraint

Table 12: Hofstede Cultural Dimensions and Income (Fixed Effects)

	Differences in log per capita income (1995)							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Genetic Distance relative to US	0.14*	0.06	0.11*	0.14*	0.14*	0.14*	0.12*	0.06
	(0.08)	(0.10)	(0.07)	(0.08)	(0.07)	(0.08)	(0.07)	(0.06)
Individualism		0.25***						0.15
		(0.09)						(0.09)
Power Distance			0.43***					0.27***
			(0.08)					(0.09)
Compet/Cooper				0.03				0.01
				(0.05)				(0.05)
Uncertainty Avoid					0.06			0.07*
					(0.06)			(0.04)
Long-Term Orient						0.13		0.13
						(0.11)		(0.11)
Indulgence/Restraint							-0.07	-0.03
							(0.06)	(0.06)
Individualism relative to US		0.00						0.00
		(0.00)						(0.00)
Power Distance relative to US			-0.12					-0.08
			(0.09)					(0.08)
Compet/Cooper relative to US				-0.00				-0.01
				(0.04)				(0.04)
Uncertainty Avoid relative to US					-0.02			-0.07
					(0.04)			(0.06)
Long-Term Orient relative to US						-0.12		-0.13
						(0.11)		(0.11)
Indulg/Restraint relative to US							0.26***	0.17*
							(0.10)	(0.09)
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted- R^2	0.44	0.49	0.51	0.44	0.44	0.44	0.47	0.53
Observations	1830	1830	1830	1830	1830	1830	1830	1830

Notes: This table explores the direct and barrier effects of Hofstede's cultural values by running a horse race between absolute and relative cultural distances. Coefficients are standardized betas of an Ordinary Least Squares (OLS) regression after accounting for country fixed effects. Two-way clustered standard errors in parentheses. *** denotes statistical significance at the 1% level, ** at the 5% level, and * at the 10% level, all for two-sided hypothesis tests.

have significant barrier effects on development, and (iv) differences in Power Distance are the main cultural force behind differences in economic development. While these results suggest that direct effects are more fundamental, the existence of observational equivalence between absolute and relative distances calls for caution in the interpretation. In particular,

Table 13: Hofstede Cultural Dimensions and Income (All Controls)

	Differences in log per capita income (1995)							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Genetic Distance relative to US	0.11 (0.10)	0.06 (0.08)	0.10 (0.07)	0.11 (0.09)	0.11 (0.07)	0.11 (0.08)	0.11 (0.07)	0.07 (0.06)
Individualism		0.24*** (0.08)						0.15* (0.09)
Power Distance			0.41*** (0.09)					0.26*** (0.09)
Compet/Cooper				0.00 (0.05)				-0.01 (0.05)
Uncertainty Avoid					0.07 (0.06)			0.05 (0.04)
Long-Term Orient						0.10 (0.10)		0.11 (0.09)
Indulgence/Restraint							-0.09 (0.07)	-0.04 (0.06)
Individualism relative to US		0.00 (0.00)						0.00 (0.00)
Power Distance relative to US			-0.12 (0.10)					-0.07 (0.09)
Compet/Cooper relative to US				-0.00 (0.05)				0.01 (0.04)
Uncertainty Avoid relative to US					-0.03 (0.05)			-0.07 (0.06)
Long-Term Orient relative to US						-0.13 (0.10)		-0.12 (0.10)
Indulg/Restraint relative to US							0.28** (0.11)	0.20* (0.10)
Linguistic Distance	0.12* (0.07)	0.09 (0.06)	0.05 (0.06)	0.12* (0.07)	0.12* (0.07)	0.12* (0.06)	0.13* (0.07)	0.06 (0.07)
Religious Distance	-0.10 (0.13)	-0.07 (0.13)	-0.12 (0.12)	-0.10 (0.13)	-0.11 (0.13)	-0.09 (0.13)	-0.08 (0.13)	-0.08 (0.13)
Linguistic Distance relative to the US	0.13* (0.07)	0.07 (0.06)	0.07 (0.07)	0.13* (0.07)	0.14* (0.07)	0.14* (0.07)	0.05 (0.08)	-0.00 (0.07)
Religious Distance relative to the US	0.15 (0.11)	0.10 (0.11)	0.13 (0.10)	0.15 (0.11)	0.15 (0.12)	0.15 (0.11)	0.12 (0.11)	0.08 (0.10)
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Geo Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Historical Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted- R^2	0.47	0.51	0.53	0.47	0.48	0.47	0.50	0.56
Observations	1653	1653	1653	1653	1653	1653	1653	1653

Notes: This table explores the direct and barrier effects of Hofstede's cultural values by running a horse race between absolute and relative cultural distances, including linguistic and religious distances. Coefficients are standardized betas of an Ordinary Least Squares (OLS) regression after accounting for country fixed effects, geographical differences, pairwise continental fixed effects. Two-way clustered standard errors in parentheses. *** denotes statistical significance at the 1% level, ** at the 5% level, and * at the 10% level, all for two-sided hypothesis tests.

although the observational equivalence is present only in the case of Individualism, the correlation between absolute and relative distances is high for both Power Distance and Indulgence vs Restraint, increasing the potential for a misidentification of the effects of culture.

4.2.2 WVS Cultural Measures

This section further explores the direct and barrier effects of culture. Unlike the previous section, the analysis uses differences in the WVS cultural values as the main independent variables. Table 14 presents the first set of results. In particular, each column in Table 14 explores the association between absolute log-differences in income per capita in 1995 and absolute and relative distances of a specific WVS cultural measure. As explained in section 3, the WVS measures include a general cultural WVS distance (WVS), and 13 cultural distances: Tradition-Rational (TRV), Survival-Self-Expression (SSV), Generalized Trust (Trust), Obedience (OBD), Hard Work (HW), Family Ties (FT), Work vs. Luck belief (WL), Cheating (CHT), Social Capital (SCK), Caring about Equality (EQY), Market Orientation (MKO), Tolerance (TOL), and Protestant Ethic (PET). Additionally, in order to analyze the potential channels captured by genetic distances, all columns account for the effect of genetic distance relative to the US.⁸

Table 14-Panel A explores the correlation between differences in income per capita, relative genetic distances and absolute cultural distances. It shows that relative genetic distances are economically and statistically significantly correlated with differences in economic development. Additionally, it establishes that absolute cultural distances in Tradition-Rational, Survival-Self-Expression, Generalized Trust, Obedience, Hard Work, Family Ties, Caring about Equality, Market Orientation are statistically significantly positively correlated with difference in income per capita. This result supports previous findings in the literature that link some of these cultural values to development.

Table 14-Panel B explores the association between differences in income per capita, relative genetic distances and relative cultural distances. The results for relative genetic distances remain basically unchanged compared to Panel A. On the other hand, the only relative cultural distances that are positive and statistically significantly correlated with economic development are Survival-Self-Expression and Hard Work.

In order to better understand the role of direct and barrier effects, Table 14-Panel C accounts jointly for absolute and relative cultural distances. Although the estimated coef-

⁸Unlike the previous section, each column uses the largest sample that has all data available for the analysis in that column. Given the high correlation among the measures a horse race among them is not feasible. Also, restricting the sample to the set of observations that have all WVS cultural values would result in a much smaller sample without gains in information nor changes in the results.

Table 14: WVS Cultural Dimensions and Income

	Differences in log per capita income (1995)													
	WVS	TRV	SSV	Trust	OBD	HW	FT	WL	CHT	SCK	EQY	MKO	TOL	PET
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Panel A: Pairwise Absolute Differences														
Genetic Distance	0.33***	0.31***	0.33***	0.33***	0.27***	0.18***	0.29***	0.30***	0.33***	0.33***	0.33***	0.33***	0.33***	0.34***
Relative to US	(0.06)	(0.06)	(0.06)	(0.06)	(0.08)	(0.06)	(0.08)	(0.07)	(0.06)	(0.06)	(0.06)	(0.07)	(0.06)	(0.06)
Absolute Distance	0.12***	0.05***	0.09***	0.16***	0.19**	0.19***	0.08**	0.01	-0.00	-0.00	0.02**	0.01***	0.04*	-0.01
	(0.03)	(0.02)	(0.01)	(0.05)	(0.08)	(0.02)	(0.04)	(0.01)	(0.01)	(0.00)	(0.01)	(0.00)	(0.02)	(0.02)
Adjusted- R^2	0.14	0.15	0.21	0.14	0.14	0.39	0.13	0.08	0.11	0.11	0.13	0.13	0.12	0.12
Panel B: Pairwise Relative Differences														
Genetic Distance	0.33***	0.34***	0.33***	0.34***	0.30***	0.17***	0.30***	0.30***	0.33***	0.33***	0.33***	0.33***	0.33***	0.34***
relative to US	(0.06)	(0.06)	(0.06)	(0.06)	(0.09)	(0.06)	(0.09)	(0.07)	(0.06)	(0.06)	(0.07)	(0.07)	(0.06)	(0.06)
Relative Distance	0.01	0.02	0.07***	0.02	0.07	0.12***	0.02	-0.00	-0.01	-0.00	0.00	0.01***	0.00	0.00
	(0.02)	(0.01)	(0.01)	(0.04)	(0.05)	(0.02)	(0.03)	(0.00)	(0.01)	(0.00)	(0.01)	(0.00)	(0.01)	(0.02)
Adjusted- R^2	0.12	0.12	0.21	0.12	0.12	0.37	0.11	0.08	0.11	0.11	0.12	0.13	0.11	0.12
Panel C: Pairwise Absolute and Relative Differences in Horserace														
Genetic Distance	0.33***	0.31***	0.33***	0.33***	0.25***	0.17***	0.29***	0.31***	0.33***	0.33***	0.33***	0.33***	0.32***	0.34***
Relative to US	(0.06)	(0.06)	(0.06)	(0.06)	(0.08)	(0.06)	(0.08)	(0.07)	(0.06)	(0.06)	(0.06)	(0.07)	(0.06)	(0.06)
Absolute Distance	0.22***	0.06***	0.05***	0.19***	0.35*	0.14***	0.13**	0.02	0.01	0.00	0.03***	0.01***	0.11***	-0.02
	(0.05)	(0.02)	(0.02)	(0.05)	(0.19)	(0.03)	(0.06)	(0.02)	(0.02)	(0.01)	(0.01)	(0.00)	(0.03)	(0.02)
Relative Distance	-0.12***	-0.01	0.04**	-0.07*	-0.14	0.03	-0.06*	-0.01	-0.01	-0.01	-0.01	0.00	-0.07***	0.01
	(0.03)	(0.01)	(0.02)	(0.04)	(0.12)	(0.03)	(0.03)	(0.01)	(0.02)	(0.01)	(0.01)	(0.00)	(0.02)	(0.02)
Adjusted- R^2	0.16	0.15	0.22	0.14	0.14	0.40	0.13	0.09	0.11	0.11	0.14	0.13	0.13	0.12
Panel D: The Horserace with Fixed Effects														
Genetic Distance	0.19**	0.16**	0.15**	0.21***	0.09	0.12**	0.10	0.16**	0.21***	0.21***	0.20**	0.20**	0.21**	0.22***
Relative to US	(0.09)	(0.07)	(0.07)	(0.08)	(0.07)	(0.06)	(0.07)	(0.07)	(0.08)	(0.08)	(0.09)	(0.08)	(0.09)	(0.08)
Absolute Distance	0.26***	0.07***	0.12***	0.24***	0.31*	0.27***	0.15**	0.03*	-0.00	0.00	0.03**	0.01	0.15**	-0.01*
	(0.07)	(0.03)	(0.03)	(0.09)	(0.19)	(0.04)	(0.06)	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)	(0.08)	(0.01)
Relative Distance	-0.13***	-0.01	0.01	-0.07	-0.11	-0.04	-0.05*	-0.01	0.03	0.01	-0.01	0.00	-0.08*	-0.00
	(0.03)	(0.02)	(0.03)	(0.05)	(0.12)	(0.04)	(0.03)	(0.01)	(0.02)	(0.01)	(0.01)	(0.00)	(0.04)	(0.01)
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted- R^2	0.38	0.40	0.46	0.38	0.41	0.58	0.41	0.37	0.36	0.36	0.40	0.38	0.36	0.36
Observations	3570	3570	3570	4095	1830	1431	2016	3655	3655	3655	2850	2701	3916	4095

Notes: This table explores the direct and barrier effects of culture on development based on WVS cultural values. Panel A accounts only for relative genetic distances and absolute cultural distances. Panel B accounts only for relative genetic distances and relative cultural distances. Panel C accounts for relative genetic distances and both absolute and relative cultural distances. Panel D additionally accounts for country fixed effects. Absolute and relative distance refer to the measure in the column. The WVS measures are WVS distance, Survival vs. Self-Expression Values (SSV), Traditional vs. Secular-Rational Values (TRV), Generalized Trust (Trust), Obedience (OBD), Hard Work (HW), Family Ties (FT), Work vs. Luck (WL), Cheating (CHT), Social Capital (SCK), Caring about Equality (EQY), Market Orientation (MKO), Tolerance (TOL), and Protestant Ethic (PET), see section 3 for additional information on measures. Coefficients are standardized betas of an Ordinary Least Squares (OLS) regression. Two-way clustered standard errors in parentheses. *** denotes statistical significance at the 1% level, ** at the 5% level, and * at the 10% level, all for two-sided hypothesis tests.

ficients on absolute cultural distances increase, the cultural values that have a statistically significant correlation are the same as in Panel A, i.e. Tradition-Rational, Survival-Self-Expression, Generalized Trust, Obedience, Hard Work, Family Ties, Caring about Equality,

Market Orientation. Similarly, relative genetic distances remain positively economically and statistically significantly correlated with differences in income per capita. On the other hand, none of the relative cultural distances remains positively statistically significantly associated with differences in development.

Clearly, the results might be biased due to omitted variables. Thus, Table 14-Panel D accounts for country fixed effects, which capture country specific unobserved factors and, thus, all pairwise linearly omitted variables. The results show that none of the relative cultural distances remains positively statistically significantly correlated with economic development. Also, the economic and statistical significance of relative genetic distances decreases, suggesting they might potentially be correlated with omitted factors. On the other hand, the economic and statistical significance of WVS distance, Tradition-Rational, Survival-Self-Expression, Generalized Trust, Hard Work, Family Ties, and Tolerance increase. The estimates imply e.g. that a one standard deviation increase in Generalized Trust is associated with an increase in the absolute log-difference in income per capita by 0.24 standard deviations.

Table 15 additionally accounts for absolute and relative linguistic and religious distances, as well as other geographical differences, pairwise continental fixed effects and common history measures. Doing so does not alter the results qualitatively. In particular, WVS distance, Tradition-Rational, Survival-Self-Expression, Generalized Trust, Hard Work, Family Ties, and Tolerance remain positively statistically significantly correlated with economic development. Similarly, relative genetic distances also remain positively economically and statistically significantly correlated with economic development in most specifications. Also, none of the relative cultural distances remain positively statistically significantly associated with development.

Finally, Table 16 accounts additionally for absolute genetic distances. The results show that relative genetic distances are not statistically significantly correlated with development when absolute genetic distances are accounted for. On the other hand, absolute genetic distances have a strong association with development in about 25% of the specifications. As in previous results, WVS distance, Tradition-Rational, Survival-Self-Expression, Generalized Trust, Hard Work, Family Ties, and Tolerance remain positively statistically significantly correlated with economic development. Moreover, with the exception of Tradition-Rational, the estimated coefficients suggest an economically significant association between absolute cultural distances and economic development. On the contrary, relative cultural distances, as well as religious and linguistic distances, do not have a statistically significant association with economic development. Finally, the results in Table 16 suggest that the relative linguistic distances are the only relative distances that are statistically and economically positively

Table 15: WVS Cultural Dimensions and Income (All Controls)

	Differences in log per capita income (1995)													
	WVS (1)	TRV (2)	SSV (3)	Trust (4)	OBD (5)	HW (6)	FT (7)	WL (8)	CHT (9)	SCK (10)	EQY (11)	MKO (12)	TOL (13)	PET (14)
Genetic Distance	0.18**	0.18**	0.15*	0.21***	0.07	0.09	0.07	0.15*	0.20**	0.20**	0.19**	0.18*	0.20**	0.21***
Relative to US	(0.09)	(0.08)	(0.09)	(0.08)	(0.09)	(0.07)	(0.08)	(0.09)	(0.08)	(0.08)	(0.09)	(0.09)	(0.08)	(0.08)
Absolute Distance	0.25***	0.08***	0.14***	0.23**	0.31*	0.26***	0.13**	0.02	-0.00	-0.00	0.03**	0.01	0.14*	-0.02
	(0.07)	(0.02)	(0.03)	(0.09)	(0.16)	(0.04)	(0.06)	(0.02)	(0.01)	(0.00)	(0.01)	(0.01)	(0.07)	(0.01)
Relative Distance	-0.13***	-0.02	-0.00	-0.07	-0.10	-0.04	-0.05*	-0.01	0.02	0.01	-0.01	0.00	-0.08**	-0.01
	(0.03)	(0.01)	(0.03)	(0.04)	(0.11)	(0.04)	(0.03)	(0.01)	(0.02)	(0.01)	(0.01)	(0.00)	(0.04)	(0.01)
Linguistic Distance	-0.01	-0.01	-0.04	-0.01	-0.05	0.16***	-0.02	-0.02	-0.01	-0.01	0.04	0.07	-0.02	-0.01
	(0.04)	(0.05)	(0.04)	(0.04)	(0.05)	(0.06)	(0.04)	(0.04)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.04)
Religious Distance	0.10	0.04	0.11	0.10	0.14*	-0.07	0.09	0.09	0.11	0.11	0.14*	0.14*	0.13*	0.13*
	(0.07)	(0.07)	(0.07)	(0.07)	(0.08)	(0.08)	(0.08)	(0.07)	(0.07)	(0.07)	(0.08)	(0.08)	(0.07)	(0.07)
Linguistic Distance	0.10**	0.14**	-0.02	0.14**	0.16	0.04	0.09	0.18***	0.16**	0.16**	0.14	0.12	0.11*	0.16**
Relative to the US	(0.05)	(0.06)	(0.05)	(0.06)	(0.14)	(0.08)	(0.10)	(0.06)	(0.07)	(0.07)	(0.09)	(0.08)	(0.05)	(0.06)
Religious Distance	0.03	0.08	-0.07	0.03	0.04	0.10	0.06	0.06	0.05	0.05	0.00	0.02	0.01	0.00
Relative to the US	(0.08)	(0.08)	(0.08)	(0.07)	(0.09)	(0.08)	(0.09)	(0.08)	(0.08)	(0.08)	(0.08)	(0.09)	(0.07)	(0.07)
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Geo Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Historical Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted- R^2	0.42	0.44	0.47	0.41	0.46	0.60	0.46	0.41	0.41	0.41	0.44	0.43	0.40	0.40
Observations	3486	3486	3486	3916	1830	1431	2016	3486	3570	3570	2775	2628	3741	3916

Notes: This table explores the direct and barrier effects of culture on development based on WVS cultural values. Absolute and relative distance refer to the measure in the column. The WVS measures are WVS distance, Survival vs. Self-Expression Values (SSV), Traditional vs. Secular-Rational Values (TRV), Generalized Trust (Trust), Obedience (OBD), Hard Work (HW), Family Ties (FT), Work vs. Luck (WL), Cheating (CHT), Social Capital (SCK), Caring about Equality (EQY), Market Orientation (MKO), Tolerance (TOL), and Protestant Ethic (PET), see section 3 for additional information on measures. Coefficients are standardized betas of an Ordinary Least Squares (OLS) regression after accounting for country fixed effects, geographical differences, pairwise continental fixed effects. Two-way clustered standard errors in parentheses. *** denotes statistical significance at the 1% level, ** at the 5% level, and * at the 10% level, all for two-sided hypothesis tests.

significantly associated with economic development.

The results of this section suggest important direct effects of the WVS cultural values. In particular, absolute distances in WVS distance, Generalized Trust, and Hard Work potentially have the largest direct effects among the WVS values. Additionally, Tradition-Rational, Survival-Self-Expression, Family Ties, and Tolerance are statistically significantly correlated with differences in development, although the estimated standardized coefficients of the latter group are about 50% smaller than the estimated direct effects of the former. This provides additional support to the previous literature that had found effects of these traits on development.

On the other hand, the results suggest that none of the WVS cultural measures has a barrier effect on development. In particular, the estimated coefficients of the barrier

Table 16: WVS Cultural Dimensions, Income and Genetic Distance

	Differences in log per capita income (1995)													
	WVS (1)	TRV (2)	SSV (3)	Trust (4)	OBD (5)	HW (6)	FT (7)	WL (8)	CHT (9)	SCK (10)	EQY (11)	MKO (12)	TOL (13)	PET (14)
Genetic Distance	0.21** (0.10)	0.15 (0.11)	0.22** (0.10)	0.17* (0.09)	0.05 (0.12)	0.10 (0.14)	0.06 (0.09)	0.16 (0.10)	0.20* (0.11)	0.20* (0.11)	0.26** (0.10)	0.29*** (0.11)	0.19* (0.11)	0.19 (0.12)
Genetic Distance Relative to US	0.08 (0.09)	0.11 (0.10)	0.05 (0.12)	0.13 (0.09)	0.05 (0.12)	0.04 (0.08)	0.05 (0.08)	0.09 (0.10)	0.11 (0.10)	0.11 (0.10)	0.06 (0.10)	0.03 (0.09)	0.11 (0.09)	0.12 (0.11)
Absolute Distance	0.25*** (0.07)	0.07*** (0.02)	0.14*** (0.03)	0.22** (0.09)	0.29* (0.15)	0.26*** (0.04)	0.13** (0.06)	0.02 (0.02)	-0.00 (0.01)	-0.00 (0.00)	0.02** (0.01)	0.01 (0.01)	0.14** (0.07)	-0.03* (0.02)
Relative Distance	-0.13*** (0.03)	-0.01 (0.01)	-0.00 (0.03)	-0.08* (0.05)	-0.09 (0.11)	-0.04 (0.04)	-0.04* (0.03)	-0.01 (0.01)	0.02 (0.02)	0.01 (0.01)	-0.01 (0.01)	0.00 (0.00)	-0.08** (0.04)	-0.01 (0.01)
Linguistic Distance	-0.01 (0.04)	-0.01 (0.05)	-0.04 (0.04)	-0.01 (0.04)	-0.05 (0.06)	0.14*** (0.06)	-0.01 (0.04)	-0.02 (0.04)	-0.01 (0.05)	-0.01 (0.05)	0.05 (0.05)	0.08 (0.05)	-0.02 (0.05)	-0.01 (0.04)
Religious Distance	0.09 (0.07)	0.04 (0.07)	0.10 (0.07)	0.10 (0.07)	0.13 (0.08)	-0.06 (0.08)	0.09 (0.08)	0.08 (0.07)	0.10 (0.07)	0.10 (0.07)	0.13* (0.08)	0.13 (0.08)	0.12* (0.07)	0.12* (0.07)
Linguistic Distance Relative to the US	0.11** (0.05)	0.15*** (0.06)	-0.01 (0.05)	0.15*** (0.06)	0.17 (0.14)	0.05 (0.08)	0.09 (0.10)	0.18*** (0.06)	0.17** (0.07)	0.17** (0.07)	0.16* (0.09)	0.14* (0.08)	0.11** (0.05)	0.16*** (0.06)
Religious Distance Relative to the US	0.04 (0.08)	0.09 (0.08)	-0.06 (0.08)	0.03 (0.07)	0.04 (0.09)	0.10 (0.09)	0.06 (0.09)	0.07 (0.08)	0.06 (0.08)	0.06 (0.08)	0.02 (0.08)	0.04 (0.09)	0.01 (0.07)	0.01 (0.07)
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Geo Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Historical Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted- R^2	0.43	0.45	0.49	0.42	0.46	0.60	0.47	0.42	0.42	0.42	0.46	0.46	0.41	0.41
Observations	3486	3486	3486	3916	1830	1431	2016	3486	3570	3570	2775	2628	3741	3916

Notes: This table explores the direct and barrier effects of culture on development based on WVS cultural values. Absolute and relative distance refer to the measure in the column. The WVS measures are WVS distance, Survival vs. Self-Expression Values (SSV), Traditional vs. Secular-Rational Values (TRV), Generalized Trust (Trust), Obedience (OBD), Hard Work (HW), Family Ties (FT), Work vs. Luck (WL), Cheating (CHT), Social Capital (SCK), Caring about Equality (EQY), Market Orientation (MKO), Tolerance (TOL), and Protestant Ethic (PET), see section 3 for additional information on measures. Coefficients are standardized betas of an Ordinary Least Squares (OLS) regression after accounting for country fixed effects, geographical differences, pairwise continental fixed effects. Two-way clustered standard errors in parentheses. *** denotes statistical significance at the 1% level, ** at the 5% level, and * at the 10% level, all for two-sided hypothesis tests.

effects captured by relative distances are not statistically significantly different from zero. Additionally, the theoretical results in section 2 suggested a potential upward bias in the estimated causal effect of relative distances. Thus, the results suggest the barrier effect does not operate through any of these cultural values.

Still, as with the results based on the Hofstede cultural values, the economically and statistically significant effects found in this section are potentially subject to the issue of observational equivalence. In particular, as shown in Figure 3 the correlation between absolute and relative distances is high for most cultural values. In particular, the US is in the top or bottom of the distribution for Survival-Self-Expression, Trust, Hard Work, Market Orientation and Tolerance.

Finally, the results suggest that the only relative distance that is strongly associated with development is relative linguistic distance. One potential interpretation of this result is that



Figure 3: Location of U.S. in the Distribution of WVS Cultural Measures

speaking a language more similar to the frontier eases the flow of ideas and technologies. In particular, if the other controls that have been accounted for, including absolute and relative cultural traits, genetic and religious distances, and geographical differences capture all cultural elements not captured by relative linguistic distances, language would be the only barrier to diffusion. Moreover, it would suggest clear and simple policies for the elimination of the barrier effect. Although this interpretation is plausible and sensible, the results in Galor et al. (2016) suggest that linguistic distances, absolute and relative, may well capture many other elements of culture.

5 Conclusion

This research explores the direct effects of culture on economic development and its barrier effects on technological diffusion. In particular, using a large set of measures of culture, the analysis shows that most cultural values only have direct effects on development. In particular, the analysis suggests that the cultural values of Individualism, Trust, and Hard Work have strong direct effects on comparative development. On the other hand, with the exception of Indulgence vs Restraint and Language, no other cultural values seem to have a barrier effect on development. This suggests, in particular, the potential benefits to policies that target linguistic barriers to the diffusion of technology and knowledge.

While promising, these results also show the difficulty of disentangling the direct and barrier effects in a fully satisfactory manner. In particular, absolute and relative cultural distances are commonly used in the literature in order to identify the direct and barrier effects of culture. But, as the analysis shows, both theoretically and empirically, whenever the technological frontier is in the top or bottom of the world distribution of a cultural value, there exists an observational equivalence between both types of distances, preventing the distinction among both effects. Thus, other strategies are needed to better identify these effects.

Additionally, the research shows that Individualism and Trust are the main cultural differences associated with genetic distances, while linguistic distances are associated with a larger set of cultural differences. This result provides a potential channel behind the strong robust empirical association between genetic distances and comparative development. Moreover, it suggest a link between the literature that has explored the effects of Trust and Individualism, although a more systematic analysis of this potential link is still an open question.

References

- Alesina, A. F. and Giuliano, P. (2013). Culture and institutions, *NBER Working Paper* (19750).
- Alesina, A. and Giuliano, P. (2010). The power of the family, *Journal of Economic growth* **15**(2): 93–125.
- Alesina, A. and Giuliano, P. (2014). Family ties, *Handbook of Economic Growth*, Vol. 2, Elsevier, pp. 177–215.
- Alesina, A., Giuliano, P. and Nunn, N. (2013). On the origins of gender roles: Women and the plough, *The Quarterly Journal of Economics* **128**(2): 469–530.

- Andersen, T. B., Bentzen, J., Dalgaard, C.-J. and Sharp, P. (2013). Pre-reformation roots of the protestant ethic, *Technical report*, Competitive Advantage in the Global Economy (CAGE).
- Basso, A. and Cuberes, D. (2016). Deep-rooted determinants of the fertility transition across countries., *Macroeconomic Dynamics* .
- Cameron, A. C., Gelbach, J. B. and Miller, D. L. (2011). Robust inference with multiway clustering, *Journal of Business & Economic Statistics* **29**(2).
- Cavalli-Sforza, L. L., Menozzi, P. and Piazza, A. (1994). *The history and geography of human genes*, Princeton University Press, Princeton, N.J.
- Desmet, K., Le Breton, M., Ortuño-Ortín, I. and Weber, S. (2011). The stability and breakup of nations: a quantitative analysis, *Journal of Economic Growth* **16**(3): 183–213.
- Dohmen, T., Enke, B., Falk, A., Huffman, D. and Sunde, U. (2015). Patience and the wealth of nations.
- Galor, O. and Özak, Ö. (2014). The agricultural origins of time preference, *NBER Working Paper* (w20438).
- Galor, O., Özak, Ö. and Sarid, A. (2016). The geographical origins of the tower of babel: The economic causes and consequences of linguistic structures, *SMU Working Paper* .
- Giuliano, P. (2007). Living arrangements in western europe: Does cultural origin matter?, *Journal of the European Economic Association* **5**(5): 927–952.
- Giuliano, P., Spilimbergo, A. and Tonon, G. (2006). Genetic, cultural and geographical distances, *Technical report*, CEPR Discussion Papers.
- Gorodnichenko, Y. and Roland, G. (2011). Which dimensions of culture matter for long-run growth?, *The American Economic Review* **101**(3): 492–498.
- Guiso, L., Sapienza, P. and Zingales, L. (2006). Does culture affect economic outcomes?, *Journal of Economic Perspectives* **20**(2): 23–48.
- Guiso, L., Sapienza, P. and Zingales, L. (2009). Cultural biases in economic exchange?, *The Quarterly Journal of Economics* **124**(3): 1095–1131.
- Hofstede, G. H. (1980). *Culture's consequences: international differences in work-related values*, Cross cultural research and methodology series, Sage Publications, Beverly Hills, Calif.
- Hofstede, G. H. (1991). *Cultures and organizations: software of the mind*, McGraw-Hill, London.
- Hofstede, G. H., Hofstede, G. J. and Minkov, M. (2010). *Cultures and organizations: software of the mind : intercultural cooperation and its importance for survival*, 3rd ed edn, McGraw-Hill, New York.

- Inglehart, R. and Welzel, C. (2005). *Modernization, cultural change, and democracy: the human development sequence*, Cambridge University Press, Cambridge, UK.
- Inglehart, R. and Welzel, C. (2010). The wvs cultural map of the world, *World Values Survey*, http://www.worldvaluessurvey.org/wvs/articles/folder_published/article_base_54 (consulté le 29 octobre 2012) .
- Knack, S. and Keefer, P. (1997). Does social capital have an economic payoff? a cross-country investigation, *The Quarterly journal of economics* pp. 1251–1288.
- Spolaore, E. and Wacziarg, R. (2009a). The diffusion of development, *The Quarterly Journal of Economics* **124**(2): 469–529.
- Spolaore, E. and Wacziarg, R. (2009b). War and relatedness, *Technical report*, National Bureau of Economic Research.
- Spolaore, E. and Wacziarg, R. (2012). Long-term barriers to the international diffusion of innovations, *NBER International Seminar on Macroeconomics*, Vol. 8, JSTOR, pp. 11–46.
- Spolaore, E. and Wacziarg, R. (2013a). How deep are the roots of economic development?, *Journal of Economic Literature* **51**(2): 325–369.
- Spolaore, E. and Wacziarg, R. (2013b). Long-term barriers to economic development, *Technical report*, National Bureau of Economic Research.
- Tabellini, G. (2010). Culture and institutions: economic development in the regions of europe, *Journal of the European Economic Association* **8**(4): 677–716.
- Weber, M. (1930). *The Protestant ethic and the spirit of capitalism*, Scribner, New York.
- World Value Survey* (1981-2014). World Values Survey Association (www.worldvaluessurvey.org). LONGITUDINAL AGGREGATE v.20150418.
- Zak, P. J. and Knack, S. (2001). Trust and growth, *The economic journal* **111**(470): 295–321.

Appendix

A Cultural Measures (Hofstede and WVS)

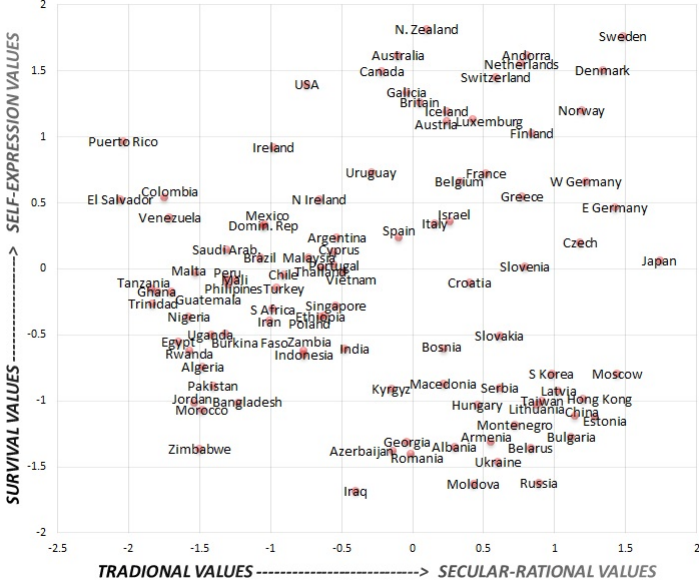


Figure A.1: Cultural map based on the two dimensions of the WVS.

Table A.1: Correlation of the Hofstede Cultural Pairwise Differences

	Correlation Coefficient					
	PDI	IDV	CVC	UAI	LTO	IVR
Power Distance	1.00					
Individualism	0.36***	1.00				
Compet/Cooper	0.18***	0.04*	1.00			
Uncertainty Avoid	0.14***	0.05**	-0.00	1.00		
Long-Term Orientation	-0.07***	0.01	0.01	-0.06***	1.00	
Indulgence/Restraint	0.11***	0.10***	0.03	-0.05**	0.19***	1.00

Notes: This table shows the correlation coefficients between the pairwise differences of Hofstede Cultural Dimesnsions *** denotes statistical significance at the 1% level, ** at the 5% level, and * at the 10% level, all for two-sided hypothesis tests.

Table A.2: Correlation of the WVS Cultural Pairwise Differences

	Correlation Coefficient												
	TRV	SSV	Trust	OBD	HW	FT	WL	CHT	SCK	EQY	MTO	TOL	PET
Traditional/Rational	1.00												
Survival/Self Expression	0.13***	1.00											
Trust	0.23***	0.44***	1.00										
Obedience	0.42***	0.03	0.13***	1.00									
Hard Work	0.19***	0.58***	0.28***	0.14***	1.00								
Family Ties	0.54***	0.21***	0.41***	0.41***	0.25***	1.00							
Work/Luck	0.06*	-0.12***	-0.13***	0.04	0.20***	-0.01	1.00						
Cheating	0.05	-0.06*	-0.05	-0.05	-0.05	0.01	0.07**	1.00					
Social Capital	0.04	-0.07**	-0.07**	-0.06*	-0.08**	0.01	0.13***	0.90***	1.00				
Equality	0.21***	-0.02	-0.05	0.08**	0.14***	0.12***	0.09***	0.04	0.01	1.00			
Market Orientation	-0.03	0.30***	0.05	-0.05	0.18***	-0.08**	0.15***	0.01	0.01	-0.02	1.00		
Tolerance	0.14***	0.52***	0.24***	0.05	0.44***	0.15***	0.13***	-0.02	-0.03	0.06*	0.16***	1.00	
Prot. Ethic	0.26***	-0.07**	0.02	0.16***	-0.01	0.08***	0.08**	-0.03	-0.04	0.10***	-0.02	0.11***	1.00

Notes: This table shows the correlation coefficients between the pairwise differences of WVS Cultural Measures *** denotes statistical significance at the 1% level, ** at the 5% level, and * at the 10% level, all for two-sided hypothesis tests.

Table A.3: Correlation of the Hofstede Cultural Differences Relative to US

	Correlation Coefficients					
	PDI	IDV	CVC	UAI	LTO	IVR
Power Distance, Relative to US	1.00					
Individualism, Relative to US	0.23***	1.00				
Competition/Cooperation, Relative to US	0.05**	0.07***	1.00			
Uncertainty Avoidance, Relative to US	0.11***	0.05**	0.03	1.00		
Long-Term Orientation, Relative to US	0.01	-0.01	-0.01	-0.01	1.00	
Indulgence/Restraint, Relative to US	0.12***	0.12***	0.05**	-0.02	0.06***	1.00

Notes: This table shows the correlation coefficients between the relative to US differences of Hofstede Cultural Dimensions *** denotes statistical significance at the 1% level, ** at the 5% level, and * at the 10% level, all for two-sided hypothesis tests.

Table A.4: Correlation of the WVS Cultural Differences Relative to US

	Correlation Coefficient												
	TRV	SSV	Trust	OBD	HW	FT	WL	CHT	SCK	EQY	MTO	TOL	PET
Traditional/Rational, Relative to US	1.00												
Survival/Self Expression, Relative to US	0.06*	1.00											
Trust, Relative to US	0.13***	-0.00	1.00										
Obedience, Relative to US	-0.04	0.12***	0.07**	1.00									
Hard Work, Relative to US	0.04	0.40***	0.03	0.17***	1.00								
Family Ties, Relative to US	0.45***	0.17***	0.21***	0.09**	0.07**	1.00							
Work/Luck, Relative to US	-0.04	-0.08**	-0.03	-0.08**	0.01	0.02	1.00						
Cheating, Relative to US	-0.12***	0.12***	-0.01	-0.04	-0.05	-0.09***	-0.02	1.00					
Social Capital, Relative to US	-0.12***	0.09***	-0.04	-0.07**	-0.08**	-0.11***	0.07**	0.84***	1.00				
Equality, Relative to US	-0.08**	-0.00	-0.05*	0.10***	0.14***	-0.06*	-0.03	-0.02	-0.04	1.00			
Market Orientation, Relative to US	0.00	0.14***	-0.09***	-0.01	0.08**	-0.05	0.07**	0.09***	0.08**	-0.00	1.00		
Tolerance, Relative to US	-0.03	0.15***	-0.03	0.00	0.22***	0.03	0.00	-0.01	-0.04	0.09***	0.03	1.00	
Prot. Ethic, Relative to US	0.09***	-0.04	0.05	0.10***	0.06*	0.02	-0.06*	0.01	0.01	-0.01	0.02	0.15***	1.00

Notes: This table shows the correlation coefficients between the Relative to US Differences of WVS Cultural Measures *** denotes statistical significance at the 1% level, ** at the 5% level, and * at the 10% level, all for two-sided hypothesis tests.

B Cultural and Genetic Distances

Table B.1: Regressions when one of the countries is the United States (Hofstede)

	Hofstede Cultural Dimensions (OLS)					
	Power Distance	Individualism	Competition Cooperation	Uncertainty Avoidance	Long-Term Orientation	Indulgence Restraint
	(1)	(2)	(3)	(4)	(5)	(6)
Genetic Distance	-0.02 (0.01)	0.19*** (0.01)	0.19*** (0.01)	0.19*** (0.03)	0.26*** (0.02)	0.29*** (0.03)
Linguistic Distance	0.21*** (0.03)	0.29*** (0.02)	0.03 (0.02)	0.28*** (0.01)	0.10* (0.05)	0.36*** (0.04)
Religious Distance	-0.08** (0.04)	0.23*** (0.03)	0.31*** (0.01)	0.10*** (0.01)	0.39*** (0.01)	0.30*** (0.02)
Additional Distances	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted- R^2	0.48	0.78	0.50	0.56	0.61	0.60
Observations	58	58	58	58	58	58

Notes: This table shows the partial correlation between each of Hofstede's cultural dimensions and genetic distance, when one of the countries in each pair is the United States, accounting for linguistic and religious distances and all the control variables. Coefficients are standardized betas. Two-way clustered standard errors in parentheses. *** denotes statistical significance at the 1% level, ** at the 5% level, and * at the 10% level, all for two-sided hypothesis tests.

Table B.2: Regressions when one of the countries is the United States (WVS)

	WVS Cultural measures													
	WVS	TRV	SSV	Trust	OBD	HW	FT	WL	CHT	SCK	EQY	MKO	TOL	PET
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Genetic Distance	-0.44*** (0.06)	0.47*** (0.05)	0.30*** (0.05)	0.35*** (0.08)	0.15*** (0.03)	0.11*** (0.04)	0.10*** (0.02)	-0.29*** (0.07)	0.10*** (0.02)	0.12*** (0.03)	-0.39*** (0.06)	0.15 (0.09)	-0.26** (0.13)	0.05 (0.09)
Linguistic Distance	-0.01 (0.08)	0.05 (0.09)	0.09*** (0.02)	-0.03 (0.12)	-0.12*** (0.02)	-0.08 (0.07)	-0.04*** (0.01)	0.01 (0.07)	0.16*** (0.04)	0.14*** (0.04)	-0.14*** (0.05)	-0.05 (0.16)	0.00 (0.03)	0.01 (0.09)
Religious Distance	-0.18*** (0.07)	0.12 (0.07)	0.61*** (0.03)	0.11 (0.12)	-0.48*** (0.08)	0.22*** (0.06)	-0.12** (0.05)	-0.08*** (0.02)	-0.00 (0.02)	-0.03 (0.03)	-0.13 (0.09)	0.13 (0.10)	0.17*** (0.02)	0.39*** (0.02)
Additional Distances	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted- R^2	0.34	0.48	0.52	0.34	0.73	0.68	0.46	0.40	0.19	0.20	0.39	0.29	0.57	0.36
Observations	83	83	83	88	61	54	64	83	85	85	75	73	86	88

Notes: This table shows the partial correlation between each of WVS cultural measures and genetic distance, when one of the countries in each pair is the United States, accounting for linguistic and religious distances and all the control variables. Coefficients are standardized betas. Two-way clustered standard errors in parentheses. *** denotes statistical significance at the 1% level, ** at the 5% level, and * at the 10% level, all for two-sided hypothesis tests.

Table B.3: Relative Cultural and Relative Genetic Distances

	Hofstede Cultural Dimensions Relative to US (OLS)					
	Power Distance	Individualism	Competition Cooperation	Uncertainty Avoidance	Long-Term Orientation	Indulgence Restraint
	(1)	(2)	(3)	(4)	(5)	(6)
Genetic Distance Relative to US	0.05 (0.06)	0.23*** (0.06)	-0.02 (0.04)	-0.01 (0.02)	0.10** (0.05)	-0.01 (0.04)
Adjusted- R^2	0.00	0.05	0.00	0.00	0.01	0.00
Observations	1830	1830	1830	1830	1830	1830

Notes: This table shows the correlation between each Hofstede's cultural dimension relative to US and genetic distance relative to US. Coefficients are standardized betas. Two-way clustered standard errors in parentheses. *** denotes statistical significance at the 1% level, ** at the 5% level, and * at the 10% level, all for two-sided hypothesis tests.

Table B.4: Relative Cultural and Relative Genetic Distances

	Hofstede Cultural Dimensions Relative to US (OLS)					
	Power Distance	Individualism	Competition Cooperation	Uncertainty Avoidance	Long-Term Orientation	Indulgence Restraint
	(1)	(2)	(3)	(4)	(5)	(6)
Genetic Distance Relative to US	-0.03 (0.04)	0.14 (0.09)	-0.04 (0.08)	-0.03 (0.02)	-0.03 (0.05)	0.04 (0.09)
Linguistic Distance	0.12 (0.11)	0.27 (0.17)	0.03 (0.05)	0.40*** (0.12)	0.12** (0.06)	0.11 (0.09)
Religious Distance	0.05 (0.03)	0.07 (0.05)	0.04 (0.05)	0.06 (0.08)	0.08 (0.10)	0.08 (0.07)
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Additional Distances	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted- R^2	0.44	0.44	0.48	0.25	0.37	0.32
Observations	1653	1653	1653	1653	1653	1653

Notes: This table shows the correlation between each Hofstede's cultural dimension relative to US and genetic distance relative to US with all controls including in the regressions. Coefficients are standardized betas. Two-way clustered standard errors in parentheses. *** denotes statistical significance at the 1% level, ** at the 5% level, and * at the 10% level, all for two-sided hypothesis tests.

Table B.5: Relative Cultural and Relative Genetic Distances

	Hofstede Cultural Dimensions Relative to US (OLS)					
	Power Distance	Individualism	Competition Cooperation	Uncertainty Avoidance	Long-Term Orientation	Indulgence Restraint
	(1)	(2)	(3)	(4)	(5)	(6)
Genetic Distance Relative to US	-0.04 (0.03)	0.12 (0.09)	-0.04 (0.07)	-0.02 (0.04)	-0.03 (0.05)	0.02 (0.06)
Linguistic Distance Relative to the US	0.17 (0.12)	0.38** (0.16)	0.19** (0.08)	0.22* (0.12)	0.10 (0.06)	0.45*** (0.11)
Religious Distance Relative to the US	0.03 (0.04)	0.14** (0.06)	-0.01 (0.02)	-0.05** (0.02)	0.02 (0.06)	0.11 (0.08)
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Additional Distances	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted- R^2	0.44	0.45	0.48	0.23	0.37	0.35
Observations	1653	1653	1653	1653	1653	1653

Notes: This table shows the correlation between each Hofstede's cultural dimension relative to US and genetic distance relative to US with all controls including in the regressions, including linguistic distance relative to US and religious distance relative to US. Coefficients are standardized betas. Two-way clustered standard errors in parentheses. *** denotes statistical significance at the 1% level, ** at the 5% level, and * at the 10% level, all for two-sided hypothesis tests.

Table B.6: Relative Cultural and Relative Genetic Distances

	Hofstede Cultural Dimensions Relative to US (OLS)					
	Power Distance	Individualism	Competition Cooperation	Uncertainty Avoidance	Long-Term Orientation	Indulgence Restraint
	(1)	(2)	(3)	(4)	(5)	(6)
Genetic Distance	0.08 (0.08)	0.31** (0.12)	0.04 (0.08)	-0.00 (0.08)	-0.06 (0.10)	0.03 (0.08)
Linguistic Distance	0.12 (0.10)	0.29* (0.17)	0.03 (0.05)	0.40*** (0.13)	0.12** (0.06)	0.11 (0.09)
Religious Distance	0.04 (0.03)	0.05 (0.04)	0.03 (0.05)	0.06 (0.08)	0.08 (0.10)	0.08 (0.08)
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Additional Distances	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted- R^2	0.44	0.45	0.48	0.25	0.37	0.32
Observations	1653	1653	1653	1653	1653	1653

Notes: This table shows the correlation between each Hofstede's cultural dimension relative to US and genetic distance relative to US with all controls including in the regressions, including linguistic distance and religious pairwise distances. Coefficients are standardized betas. Two-way clustered standard errors in parentheses. *** denotes statistical significance at the 1% level, ** at the 5% level, and * at the 10% level, all for two-sided hypothesis tests.

Table B.7: Relative Cultural and Relative Genetic Distances

	WVS Cultural Distances Relative to US													
	WVS	TRV	SSV	Trust	OBD	HW	FT	WL	CHT	SCK	EQY	MKO	TOL	PET
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Genetic Distance	-0.03	-0.03	-0.00	0.12**	0.03	0.24***	-0.02	0.07	-0.00	-0.01	-0.01	0.02	-0.07***	0.07
Relative to US	(0.02)	(0.03)	(0.03)	(0.05)	(0.05)	(0.09)	(0.04)	(0.04)	(0.05)	(0.05)	(0.04)	(0.05)	(0.02)	(0.06)
Adjusted- R^2	0.00	0.00	0.00	0.01	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Observations	3570	3570	3570	4095	1830	1431	2016	3655	3655	3655	2850	2701	3916	4095

Notes: This table shows the correlation between each WVS cultural measure relative to US and genetic distance relative to US. Each column shows the relation to with respect to one measure, where the WVS measures are WVS distance, Survival vs. Self-Expression Values (SSV), Traditional vs. Secular-Rational Values (TRV), Generalized Trust (Trust), Obedience (OBD), Hard Work (HW), Family Ties (FT), Work vs. Luck (WL), Cheating (CHT), Social Capital (SCK), Caring about Equality (EQY), Market Orientation (MKO), Tolerance (TOL), and Protestant Ethic (PET), see section 3 for additional information on measures. Coefficients are standardized betas of an Ordinary Least Squares (OLS) regressions. Two-way clustered standard errors in parentheses. *** denotes statistical significance at the 1% level, ** at the 5% level, and * at the 10% level, all for two-sided hypothesis tests.

Table B.8: Relative Cultural and Relative Genetic Distances

	WVS Cultural Distances Relative to US													
	WVS	TRV	SSV	Trust	OBD	HW	FT	WL	CHT	SCK	EQY	MKO	TOL	PET
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Panel A: Genetic Distance Relative to US														
Genetic Distance	-0.03	-0.07**	0.10*	0.04	-0.08	0.09	-0.03	0.07	-0.01	-0.01	-0.01	0.00	-0.01	-0.03
Relative to US	(0.02)	(0.03)	(0.06)	(0.09)	(0.06)	(0.08)	(0.05)	(0.08)	(0.03)	(0.03)	(0.04)	(0.04)	(0.04)	(0.02)
Linguistic Distance	-0.00	-0.03	0.15**	-0.05	0.12*	0.06	0.04	-0.03	0.08**	0.08**	0.05	0.10	0.15**	-0.03
	(0.05)	(0.04)	(0.07)	(0.05)	(0.07)	(0.12)	(0.05)	(0.04)	(0.04)	(0.04)	(0.06)	(0.07)	(0.07)	(0.05)
Religious Distance	-0.02	0.01	0.25***	0.01	-0.02	0.25***	0.05	-0.01	-0.00	-0.01***	0.01	-0.02	0.15***	0.08*
	(0.02)	(0.03)	(0.05)	(0.02)	(0.03)	(0.08)	(0.04)	(0.04)	(0.00)	(0.00)	(0.03)	(0.02)	(0.05)	(0.04)
Adjusted- R^2	0.46	0.35	0.44	0.30	0.49	0.34	0.54	0.40	0.48	0.48	0.32	0.50	0.42	0.36
Panel B: Genetic, Linguistic and Religious Distances relative to US														
Genetic Distance	-0.03	-0.07**	0.11**	0.03	-0.07	0.10	-0.03	0.07	-0.01	-0.00	-0.00	0.01	-0.01	-0.03
Relative to US	(0.02)	(0.03)	(0.05)	(0.09)	(0.07)	(0.09)	(0.04)	(0.08)	(0.03)	(0.03)	(0.03)	(0.04)	(0.04)	(0.02)
Linguistic Distance	-0.01	-0.03	0.35***	-0.02	-0.02	0.18	0.01	-0.03	0.12**	0.11**	0.05	0.15	0.35***	0.06
Relative to the US	(0.03)	(0.04)	(0.12)	(0.05)	(0.08)	(0.13)	(0.04)	(0.03)	(0.05)	(0.05)	(0.11)	(0.15)	(0.13)	(0.05)
Religious Distance	-0.02	-0.03	0.33***	-0.02	-0.06**	0.13	-0.02	-0.00	0.01	-0.00	0.00	-0.00	0.23***	0.04
Relative to the US	(0.01)	(0.02)	(0.07)	(0.02)	(0.03)	(0.09)	(0.02)	(0.03)	(0.01)	(0.01)	(0.02)	(0.02)	(0.07)	(0.04)
Adjusted- R^2	0.46	0.35	0.49	0.30	0.49	0.32	0.54	0.40	0.48	0.48	0.32	0.50	0.45	0.36
Panel C: Pairwise Absolute Genetic Distances														
Genetic Distance	0.04	-0.03	0.03	0.15	0.06	0.34**	-0.02	0.02	-0.03*	-0.03**	0.04	-0.01	-0.03	0.00
	(0.05)	(0.04)	(0.04)	(0.09)	(0.08)	(0.14)	(0.05)	(0.06)	(0.02)	(0.02)	(0.16)	(0.03)	(0.05)	(0.05)
Linguistic Distance	-0.01	-0.04	0.17**	-0.06	0.11	-0.01	0.04	-0.02	0.08**	0.08**	0.05	0.10	0.15**	-0.03
	(0.05)	(0.04)	(0.07)	(0.05)	(0.07)	(0.11)	(0.05)	(0.04)	(0.04)	(0.04)	(0.06)	(0.07)	(0.07)	(0.05)
Religious Distance	-0.02	0.01	0.25***	0.01	-0.02	0.25***	0.05	-0.01	-0.00	-0.01**	0.01	-0.02	0.15***	0.08*
	(0.02)	(0.03)	(0.05)	(0.02)	(0.03)	(0.08)	(0.04)	(0.04)	(0.00)	(0.00)	(0.03)	(0.02)	(0.05)	(0.04)
Adjusted- R^2	0.46	0.35	0.44	0.30	0.49	0.38	0.54	0.40	0.48	0.48	0.32	0.50	0.42	0.36
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Additional Distances	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3403	3403	3403	3828	1830	1431	2016	3403	3570	3570	2775	2628	3655	3828

Notes: This table shows the correlation between each WVS cultural measure relative to US and genetic distance relative to US with all controls including in the regressions. Panel A additionally includes linguistic and religious pairwise differences. Panel B includes linguistic and religious differences relative to US. Panel C considers pairwise genetic distance instead of genetic distance relative to US. Each column shows the relation to with respect to one measure, where the WVS measures are WVS distance, Survival vs. Self-Expression Values (SSV), Traditional vs. Secular-Rational Values (TRV), Generalized Trust (Trust), Obedience (OBD), Hard Work (HW), Family Ties (FT), Work vs. Luck (WL), Cheating (CHT), Social Capital (SCK), Caring about Equality (EQY), Market Orientation (MKO), Tolerance (TOL), and Protestant Ethic (PET), see section 3 for additional information on measures. Coefficients are standardized betas of an Ordinary Least Squares (OLS) regressions. Two-way clustered standard errors in parentheses. *** denotes statistical significance at the 1% level, ** at the 5% level, and * at the 10% level, all for two-sided hypothesis tests.

C Income and Cultural Differences

Table C.1: Income Differences and Genetic Distances

	Differences in log per capita income (1995)							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Genetic Distance	0.22*** (0.05)		0.04 (0.05)	0.17 (0.11)	0.13** (0.06)	0.14** (0.07)	0.15** (0.06)	0.15** (0.07)
Genetic Distance relative to US		0.32*** (0.06)	0.29*** (0.06)	0.24*** (0.09)	0.23*** (0.08)	0.21*** (0.07)	0.21*** (0.07)	0.21*** (0.07)
Linguistic Distance						-0.01 (0.04)		-0.02 (0.04)
Religious Distance						0.12*** (0.04)		0.06 (0.04)
Linguistic Distance relative to the US							0.10 (0.07)	0.10 (0.07)
Religious Distance relative to the US							0.11*** (0.04)	0.07 (0.05)
Country FE	No	No	No	Yes	Yes	Yes	Yes	Yes
Geo Controls	No	No	No	No	Yes	Yes	Yes	Yes
Historical Controls	No	No	No	No	Yes	Yes	Yes	Yes
statistics			11.16	0.79	1.77	1.51	1.43	1.34
significance level			0.00	0.38	0.18	0.22	0.23	0.25
Adjusted- R^2	0.05	0.10	0.10	0.37	0.38	0.38	0.38	0.39
Observations	11175	11175	11175	11175	11175	11175	11175	11175

Notes: This table shows the relationship of income differences between countries with their pairwise genetic distances and genetic distance relative to the frontier for the largest sample of countries. Coefficients are standardized betas. Two-way clustered standard errors in parentheses. *** denotes statistical significance at the 1% level, ** at the 5% level, and * at the 10% level, all for two-sided hypothesis tests.

Table C.2: Hofstede Cultural Dimensions and Income (All Controls)

	differences in log per capita Income, 1995							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Genetic Distance	0.09	0.06	0.09	0.09	0.09	0.09	0.08	0.06
Relative to US	(0.09)	(0.07)	(0.07)	(0.09)	(0.10)	(0.07)	(0.10)	(0.07)
Individualism		0.25***						0.16
		(0.09)						(0.10)
Power Distance			0.42***					0.28***
			(0.09)					(0.10)
Competition/Cooperation				0.03				0.01
				(0.05)				(0.05)
Uncertainty Avoidance					0.07			0.05
					(0.05)			(0.04)
Long-Term Orientation						-0.03		0.02
						(0.09)		(0.11)
Indulgence/Restraint							-0.10	-0.04
							(0.07)	(0.07)
Individualism		0.00						0.00
Relative to US		(0.00)						(0.00)
Power Distance			-0.13					-0.08
Relative to US			(0.09)					(0.09)
Competition/Cooperation				-0.04				-0.01
Relative to US				(0.04)				(0.04)
Uncertainty Avoidance					-0.04			-0.08*
Relative to US					(0.04)			(0.04)
Long-Term Orientation						-0.01		-0.06
Relative to US						(0.10)		(0.09)
Indulgence/Restraint							0.31***	0.22**
Relative to US							(0.10)	(0.10)
Linguistic Distance	0.17**	0.11	0.08	0.17**	0.16**	0.17**	0.17**	0.09
	(0.08)	(0.07)	(0.07)	(0.08)	(0.08)	(0.08)	(0.09)	(0.08)
Religious Distance	-0.06	-0.02	-0.08	-0.05	-0.06	-0.05	-0.04	-0.02
	(0.13)	(0.13)	(0.12)	(0.13)	(0.13)	(0.14)	(0.13)	(0.12)
Linguistic Distance	0.15*	0.07	0.08	0.15*	0.15*	0.15*	0.06	-0.01
Relative to the US	(0.09)	(0.08)	(0.09)	(0.08)	(0.08)	(0.09)	(0.10)	(0.09)
Religious Distance	0.13	0.08	0.11	0.13	0.14	0.13	0.10	0.05
Relative to the US	(0.11)	(0.11)	(0.10)	(0.11)	(0.11)	(0.11)	(0.10)	(0.10)
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Other Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted- R^2	0.48	0.52	0.54	0.49	0.49	0.49	0.52	0.58
Observations	1653	1653	1653	1653	1653	1653	1653	1653

Notes: This table explores the direct and barrier effects of Hofstede's cultural values by running a horse race between absolute and relative cultural distances, including linguistic and religious distances. Coefficients are standardized betas of an Ordinary Least Squares (OLS) regression after accounting for country fixed effects, geographical differences, pairwise continental fixed effects. Two-way clustered standard errors in parentheses. *** denotes statistical significance at the 1% level, ** at the 5% level, and * at the 10% level, all for two-sided hypothesis tests.

Table C.3: WVS Cultural Dimensions and Income (All Controls)

	Differences in log per capita income (1995)													
	WVS (1)	TRV (2)	SSV (3)	Trust (4)	OBD (5)	HW (6)	FT (7)	WL (8)	CHT (9)	SCK (10)	EQY (11)	MKO (12)	TOL (13)	PET (14)
Genetic Distance	0.14*	0.16**	0.11	0.17**	0.06	0.05	0.07	0.12*	0.16*	0.16*	0.15*	0.13	0.16*	0.17**
Relative to US	(0.08)	(0.08)	(0.07)	(0.08)	(0.06)	(0.06)	(0.08)	(0.07)	(0.08)	(0.08)	(0.08)	(0.08)	(0.09)	(0.07)
Absolute Distance	0.23***	0.04	0.13***	0.22***	0.25	0.27***	0.11*	0.01	-0.01	-0.00	0.02*	0.01	0.14*	-0.04***
	(0.07)	(0.03)	(0.03)	(0.08)	(0.17)	(0.05)	(0.06)	(0.01)	(0.01)	(0.00)	(0.01)	(0.01)	(0.07)	(0.01)
Relative Distance	-0.12***	-0.01	0.00	-0.08*	-0.12	-0.05	-0.03	-0.01	0.02	0.01	-0.00	0.00	-0.08*	-0.00
	(0.03)	(0.02)	(0.03)	(0.04)	(0.11)	(0.04)	(0.02)	(0.01)	(0.02)	(0.01)	(0.01)	(0.00)	(0.04)	(0.01)
Linguistic Distance	0.03	0.04	-0.01	0.03	-0.02	0.17**	-0.00	0.02	0.04	0.04	0.04	0.05	0.03	0.04
	(0.04)	(0.04)	(0.04)	(0.04)	(0.05)	(0.07)	(0.04)	(0.04)	(0.04)	(0.04)	(0.05)	(0.05)	(0.04)	(0.04)
Religious Distance	0.10	0.07	0.11	0.11	0.14*	-0.03	0.10	0.10	0.12*	0.12*	0.14**	0.14*	0.13**	0.13*
	(0.07)	(0.06)	(0.07)	(0.06)	(0.08)	(0.08)	(0.08)	(0.07)	(0.07)	(0.07)	(0.07)	(0.08)	(0.06)	(0.06)
Linguistic Distance	0.14***	0.18***	0.02	0.18***	0.17	0.11	0.10	0.21***	0.19***	0.19***	0.20**	0.19**	0.14***	0.19***
Relative to the US	(0.05)	(0.06)	(0.06)	(0.06)	(0.14)	(0.09)	(0.10)	(0.07)	(0.06)	(0.06)	(0.09)	(0.09)	(0.05)	(0.06)
Religious Distance	0.03	0.07	-0.07	0.02	0.03	0.07	0.05	0.05	0.03	0.03	-0.00	0.02	-0.00	0.00
Relative to the US	(0.07)	(0.07)	(0.07)	(0.07)	(0.09)	(0.08)	(0.09)	(0.08)	(0.07)	(0.07)	(0.07)	(0.08)	(0.07)	(0.07)
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Other Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted- R^2	0.49	0.48	0.55	0.47	0.48	0.63	0.50	0.47	0.47	0.47	0.49	0.50	0.47	0.46
Observations	3403	3403	3403	3828	1830	1431	2016	3403	3570	3570	2775	2628	3655	3828

Notes: This table explores the direct and barrier effects of culture on development based on WVS cultural values. Absolute and relative distance refer to the measure in the column. The WVS measures are WVS distance, Survival vs. Self-Expression Values (SSV), Traditional vs. Secular-Rational Values (TRV), Generalized Trust (Trust), Obedience (OBD), Hard Work (HW), Family Ties (FT), Work vs. Luck (WL), Cheating (CHT), Social Capital (SCK), Caring about Equality (EQY), Market Orientation (MKO), Tolerance (TOL), and Protestant Ethic (PET), see section 3 for additional information on measures. Coefficients are standardized betas of an Ordinary Least Squares (OLS) regression after accounting for country fixed effects, geographical differences, pairwise continental fixed effects. Two-way clustered standard errors in parentheses. *** denotes statistical significance at the 1% level, ** at the 5% level, and * at the 10% level, all for two-sided hypothesis tests.

Table C.4: WVS Cultural Dimensions and Income (Country FE-s)

	Differences in log per capita income (1995)													
	Base		Absolute				Relative					Horse Race		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Genetic Distance relative to US	0.29*** (0.09)	0.20** (0.08)	0.25*** (0.09)	0.22*** (0.08)	0.19*** (0.07)	0.07 (0.09)	0.23*** (0.08)	0.28*** (0.09)	0.22*** (0.08)	0.22*** (0.08)	0.08 (0.08)	0.21*** (0.08)	0.19*** (0.07)	0.07 (0.08)
WVS cultural dist		0.37*** (0.07)										0.21** (0.09)		
Traditional/Rational			0.17*** (0.06)		0.15** (0.06)	0.13** (0.06)							0.17** (0.07)	0.15** (0.07)
Survival/Selfexpress				0.39*** (0.06)	0.38*** (0.06)	0.38*** (0.06)							0.27 (0.18)	0.29 (0.18)
Genetic Distance						0.25** (0.11)					0.28*** (0.10)			0.25** (0.11)
WVS cultural dist, relative to US							0.38*** (0.06)					0.21** (0.08)		
Traditional/Rational, relative to US								0.09* (0.05)		0.08* (0.05)	0.07 (0.05)		-0.04 (0.05)	-0.03 (0.05)
Survival/Selfexpression, relative to US									0.36*** (0.06)	0.36*** (0.06)	0.36*** (0.06)		0.10 (0.21)	0.08 (0.21)
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted- R^2	0.36	0.46	0.38	0.46	0.48	0.49	0.46	0.37	0.46	0.46	0.48	0.48	0.48	0.49
Observations	4095	4095	4095	4095	4095	4095	4095	4095	4095	4095	4095	4095	4095	4095

Notes: This table incorporates into the analysis the WVS dimensions and explores how the significance of genetic distance relative to the frontier on income differences is affected. Coefficients are standardized betas. Two-way clustered standard errors in parentheses. *** denotes statistical significance at the 1% level, ** at the 5% level, and * at the 10% level, all for two-sided hypothesis tests.

Table C.5: WVS Cultural Dimensions and Income (Geo and Historical Controls)

	Differences in log per capita income (1995)													
	Base		Absolute				Relative					Horse Race		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Genetic Distance relative to US	0.25*** (0.09)	0.22*** (0.08)	0.25*** (0.08)	0.19*** (0.07)	0.20** (0.10)	0.08 (0.08)	0.23*** (0.08)	0.25*** (0.10)	0.20*** (0.07)	0.20*** (0.07)	0.07 (0.09)	0.22*** (0.07)	0.19*** (0.07)	0.08 (0.08)
WVS cultural dist		0.39*** (0.07)										0.25*** (0.08)		
Traditional/Rational			0.17*** (0.06)		0.16*** (0.06)	0.15** (0.06)							0.19*** (0.07)	0.17*** (0.06)
Survival/Selfexpress				0.38*** (0.06)	0.38*** (0.06)	0.38*** (0.06)							0.25 (0.17)	0.25 (0.18)
Genetic Distance						0.25** (0.10)					0.28** (0.11)			0.24** (0.10)
WVS cultural dist, relative to US							0.37*** (0.06)					0.18** (0.08)		
Traditional/Rational, relative to US								0.08* (0.05)		0.07 (0.05)	0.07 (0.05)		-0.04 (0.05)	-0.04 (0.05)
Survival/Selfexpression, relative to US									0.36*** (0.06)	0.36*** (0.06)	0.36*** (0.06)		0.12 (0.21)	0.13 (0.21)
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Geo Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Historical Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted- R^2	0.37	0.48	0.40	0.47	0.49	0.50	0.47	0.38	0.47	0.47	0.49	0.49	0.49	0.50
Observations	4095	4095	4095	4095	4095	4095	4095	4095	4095	4095	4095	4095	4095	4095

Notes: This table incorporates into the analysis the WVS dimensions and explores how the significance of genetic distance relative to the frontier on income differences is affected. Coefficients are standardized betas. Two-way clustered standard errors in parentheses. *** denotes statistical significance at the 1% level, ** at the 5% level, and * at the 10% level, all for two-sided hypothesis tests.

Table C.6: WVS Cultural Dimensions and Income (All Controls)

	Differences in log per capita income (1995)													
	Base	Absolute					Relative					Horse Race		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Genetic Distance relative to US	0.23*** (0.08)	0.21*** (0.07)	0.23*** (0.08)	0.20*** (0.08)	0.20*** (0.07)	0.09 (0.08)	0.23*** (0.08)	0.24** (0.10)	0.20** (0.10)	0.21*** (0.08)	0.08 (0.11)	0.22*** (0.07)	0.19*** (0.07)	0.09 (0.08)
WVS cultural dist		0.38*** (0.07)										0.27*** (0.08)		
Traditional/Rational			0.17*** (0.06)		0.16*** (0.06)	0.14*** (0.06)							0.19*** (0.07)	0.17*** (0.06)
Survival/Selfexpress				0.37*** (0.06)	0.36*** (0.06)	0.36*** (0.06)							0.27 (0.19)	0.27 (0.19)
Genetic Distance						0.22** (0.10)					0.26** (0.11)			0.22** (0.10)
WVS cultural dist, relative to US							0.34*** (0.06)					0.14* (0.07)		
Traditional/Rational, relative to US								0.06 (0.04)		0.06 (0.04)	0.05 (0.04)		-0.05 (0.05)	-0.04 (0.04)
Survival/Selfexpression, relative to US									0.35*** (0.06)	0.34*** (0.06)	0.35*** (0.06)		0.08 (0.23)	0.09 (0.23)
Linguistic Distance	0.05 (0.05)	-0.00 (0.04)	0.03 (0.04)	-0.00 (0.04)	-0.01 (0.04)	-0.00 (0.04)	0.01 (0.04)	0.04 (0.04)	0.01 (0.04)	0.01 (0.04)	0.01 (0.04)	-0.00 (0.04)	-0.01 (0.04)	-0.00 (0.04)
Religious Distance	0.10 (0.08)	0.05 (0.07)	0.05 (0.07)	0.12 (0.07)	0.08 (0.07)	0.07 (0.07)	0.08 (0.07)	0.08 (0.07)	0.12 (0.07)	0.11 (0.07)	0.10 (0.07)	0.06 (0.07)	0.08 (0.07)	0.07 (0.07)
Linguistic Distance relative to the US	0.20*** (0.07)	0.08 (0.06)	0.17*** (0.06)	0.04 (0.06)	0.04 (0.06)	0.05 (0.06)	0.07 (0.06)	0.17*** (0.06)	0.05 (0.06)	0.05 (0.06)	0.06 (0.06)	0.06 (0.06)	0.04 (0.06)	0.05 (0.06)
Religious Distance relative to the US	0.09 (0.08)	0.07 (0.08)	0.12 (0.08)	-0.02 (0.08)	0.02 (0.08)	0.02 (0.08)	0.02 (0.08)	0.10 (0.08)	-0.02 (0.08)	-0.01 (0.08)	-0.00 (0.08)	0.05 (0.08)	0.02 (0.08)	0.02 (0.08)
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Geo Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Historical Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted- R^2	0.40	0.49	0.42	0.48	0.50	0.51	0.48	0.41	0.48	0.48	0.49	0.50	0.50	0.51
Observations	3741	3741	3741	3741	3741	3741	3741	3741	3741	3741	3741	3741	3741	3741

Notes: This table incorporates into the analysis the WVS dimensions and explores how the significance of genetic distance relative to the frontier on income differences is affected. Coefficients are standardized betas. Two-way clustered standard errors in parentheses. *** denotes statistical significance at the 1% level, ** at the 5% level, and * at the 10% level, all for two-sided hypothesis tests.