Product-Based Cultural Change: Is the Village Global? *

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Abstract

This paper makes three contributions to the growing literature on culture and economics. Using answers to the World Values Survey for a sample of 79 countries over the 1989-2004 period, we first provide evidence of cultural homogenization between countries. Second, we provide a model of product-based cultural change. Our main theoretical predictions are: (i) bilateral trade openness reduces bilateral cultural distance; (ii) the more differentiated the products, the more trade reduces cultural distance; (iii) trade openness has a lock-in effect on culture. Third, we test the model using an instrumental variable approach and including various time and country-pair fixed effects. We find that, over the period, the historical increase in bilateral trade openness experienced by the average country-pair accounts for 67% of the trend in cultural homogenization.

Keywords: culture, trade, persistence
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1. Introduction

What is the impact of globalization on values and preferences? Do cultural values get progressively homogenized and converge towards common patterns over the world, or is there an irreducible persistence of cultural specificities across communities? This issue is the subject of intense debate among political scientists and sociologists. The case for cultural persistence is most vividly made by Samuel Huntington (1996) who emphasizes the lasting differences of values between Western and non-Western civilizations and the resulting geopolitical tensions. On the contrary, sociologists such as George Ritzer (1993, 2002) argue that the strive for economic efficiency leads to standardization of production and consumption across countries[1]. Interestingly, economists have largely chosen to stay aside from this debate. This paper is a first attempt to shed both theoretical and empirical light on these issues from an economist's perspective.

This paper provides a simple theory of product-based cultural change where we borrow insights from psychology and the branch of marketing called consumer research and we incorporate these insights into an otherwise standard economic model. The key feature of our theory is that consumption of differentiated goods endogenously shapes values and drives cultural change. Our main theoretical result is that product market integration reduces bilateral cultural distance. Using answers to the World Values Survey for a sample of 79 countries over the 1989-2004 period, we construct a measure of bilateral cultural distance and we find evidence of a trend toward cultural homogenization. Our econometric results suggest that, over the period, the historical increase in bilateral trade openness experienced by the average country-pair accounts for 67% of this trend.

Our theoretical framework has three building blocks. The first building block corresponds to a standard economic model à la Krugman (1979) where firms produce differentiated products under monopolistic competition. The second building block ties products to culture. We assume that (i) upon entry, firms anchor their products to a specific cultural type; (ii) agents have preferences which overweight consumption of products that convey symbols associated with their type. The third block of our model is a micro-founded model of cultural transmission *à la* Bisin and Verdier (1998).

The key insight of our theory is that the long-run distribution of preferences and the supply of (differentiated) consumption goods are co-determined at the equilibrium. Preferences naturally drive the demand for consumption goods but the supply of consumption goods has a feedback effect on preferences. Hence any exogenous supply shock may have a long-run effect on preferences. In particular, we show that product market integration between two countries leads to a decrease in their bilateral cultural distance. This is because the removal of trade barriers increases the incentives of firms to anchor their products to symbols common to agents in the two countries. We also show that the effect is larger when the traded goods are more differentiated. This is because product differentiation drives the strength of the feedback effect. Finally, we show that a temporary increase

[1] A third view is that globalization generates new cultural forms through a process of creolization, syncretism or metissage (Nederveen Pieterse 2004) or creative destruction (Cowen 2002).

in trade openness may have a permanent effect on the distribution of cultural types in the economy. This lock-in effect arises because there exists multiple long-run equibria under autarky but only an unique equilibrium under free-trade.

We put our theoretical predictions to the test in the last part of the paper. Using answers to the World Values Survey we build a measure of bilateral cultural distance. For a given pair of countries it corresponds to the probability, averaged across a set of cultural values, that two randomly picked individuals do not share the same value. We report that the average bilateral cultural distance has gone down over the period in our sample, thus supporting the existence of a trend toward cultural homogenization. To investigate the causal link from trade integration to bilateral cultural distance we exploit the panel dimension of our dataset and we implement an instrumental variable strategy which filters out unobserved heterogeneity and the reverse causality link from culture to trade. We also control for various time-varying codeterminants of trade and cultural distance (information flows, GDP differential, migration, FDI). We find that trade flows are a strong vector for cultural homogenization as a one standard deviation increase in bilateral trade openness translates into a 43% standard deviation decrease in bilateral cultural distance. Decomposing trade flows into three categories, we next show that the impact of trade on culture is driven by trade in differentiated products and by trade in cultural goods; trade in homogenous goods having no effect. This confirms the insight that differentiated goods vehicle elements of cultural transmission. It also indicates that this effect is not driven by cultural goods only. We finally provide indirect evidence on lock-in effects: we find that an increase in bilateral trade openness reduces bilateral cultural distance while a decrease in trade openness appears to have little effect.

From a theoretical standpoint, our work is related to Van Ypersele and François (2001), Bala and Van Long (2004), Janeba (2004) and Rauch and Trindade (2008). All these papers consider cultural diversity as an exogenous and static feature of the economy. Our purpose is different as we focus on the reverse causal link, namely the impact of trade openness on (*endogenous*) cultural distance. Our analysis is dynamic in nature and provides a general framework for analyzing the joint determination of cultural distance and economic equilibrium. In this respect, a closely related paper is Olivier, Thoenig and Verdier (2008) which analyzes the theoretical properties of a perfectly competitive model of trade in cultural goods only (where cultural goods are defined as goods that can be used to build social networks).

Finally, our paper provides an additional perspective in the current debate among economists on the possible sources of long-run persistence in economic outcomes. Over the past few years, two schools of thoughts have provided contrasted views on the issue. The first one, led by Acemoglu, Johnson and Robinson (2001), emphasizes the role of institutions such as the judicial system or the enforcement of property rights. Institutions are shown to persist over the course of many centuries and are also shown to have a significant and robust impact on economic outcomes. The second one emphasizes instead the role of culture, and more specifically the role of *values* such as trust, social capital or religiousness[2]. Distinguishing between the two hypotheses has proved delicate. For instance, Tabellini (2007) provides a broad spectrum of cross-sectional evidence suggesting that the causality runs from values to institutions. Reciprocally, Alesina and Fuchs (2007) and Aghion, Algan, Cahuc and Shleifer (2009) emphasize the impact of institutions on culture[3]. Our results point in a different and complementary direction: we show that cultural values can exhibit higher frequency variations as they react to supply side shocks of the economy such as trade integration. All in all, this suggests that the long run pattern of economic performances, cultural values and institutions can perhaps be best viewed as a coevolutionary process between the three components, any exogenous change in one dimension generating medium term feedback effects on the two others.

The remainder of the paper is organized as follows. We first review selected work in anthropology, psychology and consumer research in section 2 so as to motivate our basic assumption that consumer products have cultural meaning which can be framed by firms to be in congruence with consumers' cultural types. We analyze a simple model of time-varying culture in Section 3, where we derive testable implications on the impact of trade on culture. Section 4 is the empirical section where we construct two alternative measures of cultural distance and where we test our theory. We conclude in Section 5.

2. The cultural meaning of consumer goods

Our analysis departs from conventional economic theory by assuming that individuals are endowed with different clusters of cultural values and that these cultural values can be tied to consumption. These ideas build on a well established tradition in anthropology, psychology and marketing emphasizing the fact that products have a significance that goes beyond their functional utility. People buy products not only for what they do but also for what they symbolize (Levy 1959).

Two findings from the marketing literature are worth stressing. First the symbolic content of products is an important factor in directing consumer preferences. Salhlin's influential work (1976) on the symbolism of North American consumption goods shows how consumption of food and clothing items can be directly related to the cultural category of individuals. Motivated by self-consistency, consumers prefer products that have a symbolic meaning consistent with their own identity and values (Sirgy, 1982). Since the seminal paper of Belk (1988), researchers on consumer behavior have also investigated what is called the *extended self* that is the notion that "who we are is what we have"[4].

[2] See e.g. Guiso, Sapienza and Zingales (2006, 2008 and 2009)

[3] Spolaore and Wacziarg (2008) provide an intriguing third possibility: genetic distance seems to proxy for the missing persistent explanatory variable in cross-country income regressions. Desmet et al. (2006) argue that genetic distance plays the role of an instrument for cultural distance. Ashraf and Galor (2008) show that genetic distance is also correlated with economic outcomes in the pre-colonial times *à la* Acemoglu, Johnson and Robinson. They also argue in favour of a direct role of genetic diversity on economic outcomes.

[4] A striking example of feedback from consumption to self-perception and preferences is that of cars. Citing Belk (1988): "One of the modern equivalents of the parlor organ in terms of impact on extended self is the automobile, especially for males (e.g., Myers 1985; Weiland 1955). The owner of an expensive Porsche describes his attachment in

Agents use their consumption patterns to define their own identity by signaling information to their Self and to other agents (Holman 1981, Solomon 1983, Berger and Heath 2007). As a consequence, firms tend to take this dimension into account in their marketing strategies and brand image management (Aaker 1997, Govers and Schoormans 2005).

This simple theory receives supporting evidence in various domains (Ericksen and Sirgy 1989, Heath and Scott 1998, Hong and Zinkhan 1995, Malhotra 1988). Several studies in experimental psychology provide behavioral evidence that marketing actions can succesfully affect consumers decision by manipulating nonintrinsic attributes of goods.[5]

A second interesting point underlined by the marketing literature is the fact that with technological improvements and systematic quality controls across industries, the symbolic meaning of goods becomes also increasingly important. Citing Berger and Heath (2007): "*Nowadays, differentiating products based on their technical functions or quality is difficult (Dumaine, 1991; Veryzer, 1995). Since the wave of the quality controls in the 1980s, products can be expected to fulfill their functions reasonably well. Symbolic meaning provides another way to differentiate products.*" In his influential work on movements of cultural meanings, Mc Cracken (1986a, 1986b and 1988) provides a detailed description of the process by which cultural values and symbols transit into consumer products through advertising and product design. More specifically, advertising is viewed as a process that ties a consumer good to a set of representations and beliefs in such a way that the potential consumer perceives some similarity between them. When associated to characteristics perceived as positive, this association increases the propensity to consume the product.

To summarize, our reading of the literature in anthropology and in consumer research suggests that: (i) consumer goods convey symbols; (ii) consumers prefer products that convey symbols congruent with their own identity and cultural type; (iii) firms can and do anchor their products to a specific cultural type goes through marketing policy, advertising and product design. In the next section, we include some of these elements in our model of trade and cultural evolution.

this way (Stein 1985, p. 30): *Sometimes I test myself. We have an ancient, battered Peugeot, and I drive it for a week. It rarely breaks, and it gets great mileage. But when I pull up next to a beautiful woman, I am still the geek with the glasses. Then I get back into the Porsche. It roars and tugs to get moving, h accelerates even going uphill at 80. It leadeth trashy women . . . to make pouting looks at me at stoplights. It makes me feel like a tomcat on the prowl,. . . Nothing else in my life compares—except driving along Sunset at night in the 928, with the sodium-vapor lamps reflecting off the wine-red finish, with the air inside reeking of tan glove-leather upholstery and the . . . Blaupunkl playing the Shirelles so loud it makes my hair vibrate. And with the girls I will never see again pulling up next to me. giving the cara once-over, and looking at me as if I were a cool guy, not a worried overextended 40-year-old schnook writer."* Other examples of differentiated products with similar effects include conspicuous consumption goods, food, clothes and cultural goods.

[5] For example, knowledge of a beer's ingredients and brand can affect reported taste quality (Lee et al., 2006; Allison and Uhl 1964). Two recent contributions in neurosciences analyze the neural mechanisms trough which marketing affects consumers decision. Delivering Coke and Pepsi to human subjects, McLure et al. (2004) find evidence that brand knowledge has a dramatic influence not only on their expressed behavioral preferences but also on the measured brain responses. Plassman et al. (2008) confirm this finding by providing evidence for the ability of marketing actions to modulate neural correlates of experienced pleasantness of consumption.

3. A Simple Model of Time-Varying Culture

Our model is composed of three ingredients. The first ingredient is common with a standard model à la Krugman (1979): a demand side of the economy characterized by agents with preferences that exhibit a love for variety over differentiated products, and a supply side characterized by free entry and a zero profit condition. The second ingredient of our model is composed of two assumptions on goods characteristics and preferences: (i) agents of a given cultural type have preferences which overweight products that convey symbols congruent with their own cultural type; (ii) upon entry, firms anchor their product to one particular cultural type. The third ingredient of our model is a dynamics of preferences along the lines of micro-founded models of preference transmission.

3.1. Preferences, goods characteristics and technology

3.1.1. The Demand side

We assume that there are two cultural types, X and Y. Associated to these cultural types are two types of goods and two types of individuals. At a date t, type-X agents represent a share q_t of the population and type-Y agents a share $(1-q_t)$. Agents have Cobb-Douglas preferences (U_X, U_Y) which overweight goods associated to their own cultural type:

$$U_X(X,Y) = X^{(1+\omega)/2}Y^{(1-\omega)/2} \text{ ; } U_Y(X,Y) = X^{(1-\omega)/2}Y^{(1+\omega)/2} \tag{3.1}$$

with $\omega \in (0,1)$. Each of the composite goods (X,Y) is differentiated into a number of varieties (N_X, N_Y) in a Dixit-Stiglitz way: $X = (\int_0^{N_X} c_{x,i}^{(\sigma-1)/\sigma} di)^{\sigma/(\sigma-1)}$ and $Y = (\int_0^{N_y} c_{y,j}^{(\sigma-1)/\sigma} dj)^{\sigma/(\sigma-1)}$ where $\sigma > 1$ is the elasticity of substitution.

We consider a non overlapping generation model in continuous time with a population size normalized to 1. Each agent supplies one unit of labor in a competitive labor market. The wage rate is taken as a numeraire $w = 1$. The problem of each agent of type $c \in \{X, Y\}$ is then to maximize her preference function $U_c(X,Y)$ under the budget constraint $\int_0^{N_X} p_x c_x dx + \int_0^{N_Y} p_y c_y dx = w = 1$, where (p_x, p_y) are variety prices. Standard computation yields:

$$\begin{cases} \text{For type } X \text{ agents: } c_x = \frac{1+\omega}{2} P_X^{(\sigma-1)} p_x^{-\sigma} \text{ and } c_y = \frac{1-\omega}{2} P_Y^{(\sigma-1)} p_y^{-\sigma} \\ \text{For type } Y \text{ agents: } c_x = \frac{1-\omega}{2} P_X^{(\sigma-1)} p_x^{-\sigma} \text{ and } c_y = \frac{1+\omega}{2} P_Y^{(\sigma-1)} p_y^{-\sigma} \end{cases} \tag{3.2}$$

where the aggregate price index for each composite good $c \in \{X, Y\}$ is given by: $P_c = (\int_0^{N_c} p_{c,i}^{1-\sigma} di)^{1/(1-\sigma)}$. Given q_t, the current fraction of individuals of type X, aggregate demands for varieties (x, y) are given by:

$$D_x = \left[\frac{1}{2} + \omega\left(q_t - \frac{1}{2}\right)\right] P_X^{(\sigma-1)} p_x^{-\sigma} \text{ and } D_y = \left[\frac{1}{2} + \omega\left(\frac{1}{2} - q_t\right)\right] P_Y^{(\sigma-1)} p_y^{-\sigma} \tag{3.3}$$

3.1.2. The supply side

Upon entry, firms anchor their product to a cultural type, X or Y, and a fixed labor cost F must be paid to start production. Then the production of one unit of product requires one unit of labor. Monopolistic competition prevails on the product market. Finally, we assume that entry and exit (and therefore the number of varieties N_X and N_Y that are tied to a particular cultural type) adjust instantaneously within each period t, such that profits are equal to zero. This captures in a stylized way the idea that cultural transmission and evolution of preferences across generations takes more time than the market structure adjustment.

3.2. Dynamics of Preferences

At this stage, we have described preferences and production at a given date t, and therefore for a given fraction q_t of type-X agents. We now endogenize how the distribution of preferences evolves over time. In this, we follow a recent line of research which provides a simple micro founded selection process of preferences over time[6]. The dynamics of q_t comes through a process of intergenerational transmission of preferences. The key assumption of this approach is that parents are imperfectly altruistic. Parents derive utility from their children's consumption but *value their children' consumption through the filter of their own preferences*. This implies that if their offspring ends up with preferences different from their own, she will choose a consumption profile that maximizes her own utility but not her parents' utility. Thus, it is optimal for a rational parent to spend valuable resources to raise the probability of her child adopting her parents' preferences. According to this process, the distribution of preferences across agents evolves over time and reaches a long run stationary state.

Preference transmission partly results from the direct effort of parental transmission but it also depends on indirect contamination from the rest of the society in case of failure of direct transmission. More precisely with probability τ_c the offspring is directly socialized by her parent of type $c \in \{X, Y\}$; otherwise with probability $(1 - \tau_c)$ she remains naive and gets socialized by another old generation individual, of type X or Y, through random matching with conditional probabilities $(q_t, 1 - q_t)$. Thus, a parent of type c who exerts an effort τ_c will successfully transmit her type to her offspring with probability[7] P_c. Effort has a convex cost that we assume quadratic $\tau_c^2/2$.

Consider now $V_t^{cc'}$, the expected welfare derived from the optimal consumption behavior of an agent of type c' *as perceived through the preferences* of an agent of type c. When offsprings are of a different cultural type than their parents, the parents incur a utility cost, ΔV^c to see their kids different from them. It is equal to: $\Delta V_t^c = V_t^{cc} - V_t^{cc'}$. As a consequence each parent of type c chooses

[6] See Bisin and Verdier (1998) in the context of interdependent preferences, Bisin and Verdier (2000) and (2004) for mariage and religion, Francois (2000) for social capital and development, Hauk and Saez-Marti (2002) for corruption, Saez-Marti and Zenou (2004) for racial discrimination, Jellal and Wolf (2002) for intergenerational altruism, Tabellini (2008) for pro-social behaviors.

[7] we have $P_X = \tau_X + (1 - \tau_X)q_t$ and $P_Y = \tau_Y + (1 - \tau_Y)(1 - q_t)$.

an optimal effort of transmission which is given by $\tau_c = \arg\max_{\tau} \{P_c(\tau)V_t^{cc} + (1 - P_c(\tau))V_t^{cc'} - \tau^2/2\}$. Solving this maximization problem yields the optimal efforts of transmission for parents of type X and Y :

$$\tau_X = \Delta V_t^X (1 - q_t) \text{ and } \tau_Y = \Delta V_t^Y q_t \tag{3.4}$$

For a parent of type X the optimal effort of transmission depends positively on the utility cost ΔV_t^X but negatively on the size of her community q_t. This externality effect is easy to interpret. The larger a given cultural community, the smaller the individual incentives of a parent of that community to spend resources socializing his offspring to his preference profile. Indeed, as the community increases in size, the larger the probability of the offspring to pick up a role model from that community and to adopt the community preferences. This provides therefore stronger individual incentives to free ride and rely on this socialization mechanism by the group. From this it follows that majority groups tend to spend less individual socialization resources at the margin than minority groups. In Appendix A we show that the resulting law of motion of q_t is simply given by:

$$\dot{q}_t = q_t(1 - q_t)(\tau_X - \tau_Y) \tag{3.5}$$

3.3. Equilibrium under autarky

We now solve the model in two stages. In a first stage, we derive the product market equilibrium for a given distribution of preferences, that is for a given q_t. In a second stage, we solve for the equilibrium dynamics of q_t and analyze its long-run convergence.

3.3.1. Product market equilibrium

Each monopolistic firm producing a given variety associated to a cultural type $i \in \{X, Y\}$ is maximizing profits and imposing a constant mark-up over marginal cost: $p_i = \sigma/(\sigma - 1)$. Equilibrium profit are easily computed as $\pi_i = D_i (p_i - 1)$ where the demand function D_i is given by (3.3). Finally in a free entry equilibrium we necessarily have $\pi_i = F$ which implies that at equilibrium firms are indifferent between anchoring their product to the cultural type X or Y. Combining these three expressions yield the equilibrium number of varieties at each date t :

$$N_{X,t} = \left[\frac{1}{2} + \omega\left(q_t - \frac{1}{2}\right)\right] / \sigma F \text{ and } N_{Y,t} = \left[\frac{1}{2} + \omega\left(\frac{1}{2} - q_t\right)\right] / \sigma F \tag{3.6}$$

Those relationships reflect the standard market size effect as found in many monopolistic competition frameworks. A larger q_t implies a larger market size for good X (resp. Y), which in turn promotes entry of type X varieties (resp. Y).

3.3.2. Phase diagram

From (3.4) we need to evaluate the utility cost functions ΔV^X and ΔV^Y in order to characterize the dynamics of preferences. Substituting the equilibrium price $p_i = \sigma/(\sigma - 1)$ into the optimal consumptions (3.2) yields the equilibrium demands. Substituting the equilibrium demands into the preference functions (3.1) yields:

$$\Delta V^X = \bar{\omega} \left[N_X^{(1+\omega)/2} N_Y^{(1-\omega)/2} \right]^{1/(\sigma-1)} \tag{3.7}$$

$$\Delta V^Y = \bar{\omega} \left[N_X^{(1-\omega)/2} N_Y^{(1+\omega)/2} \right]^{1/(\sigma-1)} \tag{3.8}$$

where $\bar{\omega}$ is a scaling parameter.[8]

Collecting (3.5), (3.4), (3.7), and (3.8) we get the dynamics of preferences:

$$\dot{q}_t \gtreqless 0 \text{ if and only if } \frac{N_{Xt}}{N_{Yt}} \gtreqless \left(\frac{q_t}{1-q_t} \right)^{\frac{(\sigma-1)}{\omega}} \tag{CS}$$

The dynamics of q_t is shaped by two opposite effects. The first effect, that we label *relative-variety effect*, is supply-driven: a larger ratio N_{Xt}/N_{Yt} leads to a larger $\dot{q}_t$. Indeed, due to love for variety in utility, a larger relative supply of type X varieties increases the utility cost for a parent of type X to have a child adopting preferences of type Y. Hence this raises the effort of transmission by parents of type X; it has the opposite effect on parents of type Y. The second effect, that we label *cultural free riding effect*, is driven by the socialization process: the larger is the share of agents of type X relative to agents of type Y, $q_t/(1-q_t)$, the more type-X parents free-ride on the socialization process to transmit their type to their offspring. In turn, they reduce their effort of transmission τ_X and therefore $\dot{q}_t$ is lower.

Insert Figure 1 and Figure 2

We can now analyze the full dynamics of our model, which are depicted in the phase diagram on Figure 1. The dashed curve CS in Figure 1 represents the locus of Cultural Stationarity corresponding to equality in condition (CS). It is an upward sloping curve. It represents the set of $(q_t, N_{Xt}/N_{Yt})$ such that the two forces at play in the dynamics of q_t exactly counterbalance each other. From (CS), we get that $\dot{q}_t > 0$ iff the economy lies to the left of the CS curve, that is when the free-riding driven by the current fraction of agents of type X, q_t, is small relative to the incentives provided by the relative supply of varieties of type X, N_{Xt}/N_{Yt}.

[8] $\bar{\omega} \equiv (1 - 1/\sigma) \left(\left(\frac{1+\omega}{2}\right)^{\left(\frac{1+\omega}{2}\right)} \left(\frac{1-\omega}{2}\right)^{\left(\frac{1-\omega}{2}\right)} - \left(\frac{1-\omega}{2}\right)^{\left(\frac{1+\omega}{2}\right)} \left(\frac{1+\omega}{2}\right)^{\left(\frac{1-\omega}{2}\right)} \right)$

The second curve in the phase diagram originates from the previous section. More specifically, we get from equation (3.6):

$$\frac{N_{X,t}}{N_{Y,t}} = \frac{1 + 2\omega\left(q - \frac{1}{2}\right)}{1 - 2\omega\left(q - \frac{1}{2}\right)} \tag{PM}$$

Equation (PM) is represented by the solid curve PM. At any point of time, equilibrium on the Product Market implies that $(q_t, N_{Xt}/N_{Yt})$ is located on PM. PM links q_t, the relative size of the market for good X, to entry decision on the product market for X. PM is also an upward sloping curve. Indeed an increase in q_t leads to an increase in the relative market size of good X. This translates into more entry on the X market and implies an increase in N_{Xt}/N_{Yt}.

A steady-state of the economy is located at the intersection of curves CS and PM and is characterized by:

$$\frac{1 + 2\omega\left(q - \frac{1}{2}\right)}{1 - 2\omega\left(q - \frac{1}{2}\right)} = \left(\frac{q_t}{1 - q_t}\right)^{\frac{(\sigma-1)}{\omega}} \tag{3.9}$$

Due to symmetry, $q = 1/2$ is always a root of equation (3.9). However, the number of solutions to that equation, that is the number of steady states, depends on the elasticity of substitution σ. When the elasticity of substitution is large enough, the steady state $q = 1/2$ is the only stable steady-state (see figure 1). When the elasticity of substitution is small the steady state $q = 1/2$ is unstable and there exists two stable steady-states (see figure 2).

The intuition for the role played by the elasticity of substitution is as follows. Consider a small positive perturbation of q_t around the symmetric steady-state $q_t = 1/2$. On the one hand this increases cultural free-riding by type-X parents and thus pushes q_t down. On the other hand, the relative market size is affected and N_X/N_Y increases. Due to love for variety in preferences, this increases cultural transmission effort by type-X parents and pushes q_t up. For small σ, the love for variety effect is so strong that the *relative-variety effect* dominates the *cultural free-riding effect* and the initial positive perturbation of q_t is self-reinforcing.

We formalize this intuition in Appendix B, resulting in the following proposition:

Proposition 1:

For $\sigma \geq 1 + \omega^2$, the value $q = 1/2$ is the unique steady state which satisfies (3.9) ; it is globally stable. For $1 < \sigma < 1 + \omega^2$, there are three steady states ($q_0 < 1/2 < q_1$) which satisfy (3.9) ; the two stable equilibria are (q_0, q_1) while $q = 1/2$ is not stable.

Proof: See Appendix B.

3.4. Trade Integration

We now consider trade integration between two identical economies, labelled as the domestic and foreign (*) economies. The size of each economy is normalized to 1. We assume that: (1) there are two idiosyncratic cultural types, X and X^*, which are specific to the domestic and the foreign country respectively; (2) there is a cultural type, Y, which is *common to both countries*[9]. As a consequence, type-X goods are consumed only in the domestic country; type-X^* goods are consumed only in the foreign country; type-Y goods are consumed everywhere. Hereafter the ^{aut} and ^{int} superscripts refer to the autarkic equilibrium and to the integrated world equilibrium. The assumption of complete symmetry of the two countries simplifies considerably the analysis. Indeed at any date t we have $q_t = q_t^*$ such that the world equilibrium is still characterized by a two dimensional system.

Insert Figures 3 and 4 Here

We first consider the case $\sigma \geq 1 + \omega^2$. Under this assumption, both economies have the same autarkic steady state $q^{aut} = q^{*aut} = 1/2$. Both economies have converged to that steady-state prior to opening to trade. The analysis of the integrated equilibrium is similar to that under autarky: it is depicted in Figure 3. With respect to autarky, the utility costs functions are unchanged and the law of motion of q_t is still characterized by equation (CS). Regarding the product market equilibrium the aggregate demands for varieties (X, X^*) are similar to their autarkic values: $D_X^{int} = D_{X^*}^{int} = [1/2 + \omega(q - 1/2)]P_X^{(\sigma-1)} p_x^{-\sigma}$. The demand for type-$Y$ varieties is aggregated across the two symmetric countries and is thus equal to twice its autarkic value: $D_Y^{int} = 2D_Y^{aut} = 2[1/2 + \omega(1/2 - q)]P_Y^{(\sigma-1)} p_y^{-\sigma}$. Under constant mark-up on marginal cost, the free entry conditions on each market lead to the equilibrium number of varieties. This leads to the counterpart of the Product Market (PM) condition:

$$\left(\frac{N_{Xt}}{N_{Yt}}\right)^{int} = \frac{1}{2} \times \frac{1 + 2\omega\left(q - \frac{1}{2}\right)}{1 - 2\omega\left(q - \frac{1}{2}\right)} \qquad \text{(PM')}$$

Comparing (PM') with (PM), one can directly observe that, *for a given* q_t, the relative number of type-Y varieties is larger under trade integration than under autarky. This is due to the standard market size effect present in trade models à la Krugman (1979). Here this effect is reinforced by a feedback effect from the cultural dynamics $\dot{q}_t$ on aggregate demand. As depicted on Figure 3, the downward shift of the product market curve from (PM) to (PM') induces a shift in the cultural transmission effort: more effort for parents with the common cultural type Y; less effort for parents with the idiosyncratic cultural types X or X^*. This brings down the steady-state value of q_t. A look at figure 3 shows that the magnitude of the effect depends on the slope of the (CS) curve around the point $q_t = 1/2$, which can be tied to the value of the elasticity of substitution σ. We thus get:

Proposition 2: *Suppose* $\sigma \geq 1 + \omega^2$.
(i) Trade openness brings down q_t *and the new steady-state is such that* $q^{int} < q^{aut}$.
(ii) *The magnitude of the effect decreases with* σ: $q^{int}/q^{aut} \simeq 1 - \omega/[4(\sigma - 1) - 4\omega^2]$

[9] Those are the minimum assumptions that allow us to discuss cross country convergence or persistence in a simple two-cultural trait dynamic model.

Proof : See Appendix C.

The reason why the elasticity of substitution matters for the impact of trade on culture is similar to the reason why it matters for the stability of the autarky equilibrium. The lower σ, the stronger is the *relative variety effect* and the more a given positive shock to the available number of varieties of good Y reinforces the cultural transmission effort of type-Y parents. In words, the more differentiated are the products, the more trade weakens the idiosyncratic cultural type.

The most extreme case is the case where σ is so low that the condition $\sigma < 1 + \omega^2$ applies (see figure 4). As discussed above, this leads to multiple equilibria under autarky. Two cases must then be considered: either the economy has converged to the low q_0^{aut} steady-state or it has converged to the high q_1^{aut} steady-state. In both cases, trade openness leads to a downward shift from (PM) to (PM'). In the first case, this shift implies a continuous decrease from q_0^{aut} to q_0^{int}; this is qualitatively similar to Proposition 2. In the second case, this shift implies a discrete jump from the high autarkic equilibrium q_1^{aut} to the low integrated equilibrium q_0^{int} which constitutes the only equilibrium of the integrated world[10].

This observation has a number of intriguing implications. First, it reinforces the prediction in Proposition 2 that the more differentiated the products, the more trade openness weakens local cultural types X and X^*. It indeed suggests a strong non-linearity in that relationship. Second, a simple look at figure 4 shows that the relationship between trade openness and culture exhibits path-dependency. Once an economy has opened to trade and shifted from the high autarkic equilibrium q_1^{aut} to the low integrated equilibrium q_0^{int}, stability of that equilibrium ensures that the economy is trapped in its neighborhood: if it were to close to trade, (PM') would switch back to (PM) and the economy would converge to the low autarkic equilibrium q_0^{aut}.

3.5. Testable implications

The analysis above has implications both in terms of consumption profiles, through the ratio N_X/N_Y, and in terms of heterogeneity of preferences and cultures, through q. Empirically though, we do not have data which allows us to classify consumption goods along different clusters of symbols and/or values. We are thus obliged to focus on the implications of the model concerning the impact of trade openness on q. In this respect, our empirical strategy is similar in spirit to arguments in the sociology literature which analyzes the impact of the larger supply of consumption goods made possible by international trade on cultural issues such as religion[11], caste[12] or, more simply, on the conception of

[10] Simple (unreported) simulations of the equilibrium system $(CS) - (PM')$ show that q_0^{int} is the only integrated equilibrium for a large range of the parameters (ω, σ) whenever the condition $\sigma < 1 + \omega^2$ is satisfied.

[11] See e.g. B.S. Turner (2008) for the impact on " the recent undermining of the commitment to a religious interpretation of the world" . Interestingly, the strongest effect in magnitude of trade on values we find in the data corresponds to question f024 in the World Value Survey, namely "Belong to a religious denomination" (cf. Table 4)

[12] Citing Jones (2005): "There Rolex has replaced religion and a second unification is happening, in which the affluent young now define themselves by a shared consumer culture and not solely by caste, creed, and language. They are

manners and politeness[13].

The dependent variable in our empirical analysis is a *bilateral cultural distance*, D_t, defined as the probability that two randomly picked up individuals in two different countries do not share the same cultural types. This empirical variable has a clear-cut theoretical counterpart. In our model indeed we have 3 different cultural types: the idiosyncratic types X and X^* and the common type Y. A random pair of individuals belonging to the domestic and the foreign country do share the same cultural type if and only if they are both of type Y. This event has a probability $(1-q_t)^2$. As a consequence bilateral cultural distance D_t is equal in our model to the probability of the complement event:

$$D_t = 1 - (1 - q_t)^2$$

From this definition and from results in the previous section, we deduce the following testable implications:

Proposition 3:

(i) Bilateral cultural distance is decreasing with trade openness.

(ii) *The impact of trade openness on bilateral cultural distance is larger for trade in differentiated goods.*

(iii) The impact of trade openness on bilateral cultural distance exhibits path-dependency.

4. Empirical evidence

In this section we first build a time-varying measure of cultural distance and we provide some descriptive statistics. We then test each of the three predictions in Proposition 3.

4.1. Data

The World Value Survey (WVS) is an opinion survey which conveys information on attitudes, beliefs and values at the household level. In total, more than 200,000 individuals from 82 countries are surveyed in a repeated cross section that comes in four waves (1981-1984, 1989-1993, 1994-1999 and 2000-2004). In line with our microfounded model of cultural transmission we retrieve from the WVS all the questions related to intergenerational transmission of values from parents to children. This consists of a set of 12 questions that are presented in details in Appendix E. Two questions refer to duty and respect between parents and children; ten questions relate to the core values that parents should transmit to their children[14]. We consider enlarged sets of 30 and 50 questions as robustness checks in Section 4.6.

starting to marring within *that* subculture"

[13] See Watson (1997) for an analysis of the role played by McDonald's in the introduction of Western values and practices into East Asia.

[14] Due to a poor statistical coverage we decided to remove the question $a027$ from the WVS which lists "good manners" as an important quality that a child can be encouraged to learn at home.

In order to attenuate measurement errors, we restrict our analysis to the subsample of countries and waves for which the full set of 12 questions is available. This leads to dropping the first wave of the WVS and leaves us with a subsample composed of 40 countries for wave 2; 50 countries for wave 3; and 63 countries for wave 4. When a country is present for a given wave, it is generally also present in the following waves. All in all, we observe 79 different countries with various level of development and geographical locations over the 1989-2004 period. On average each country is present in 2.2 different waves; 52 countries are observed in at least two different waves[15]. The statistical coverage is good in the cross-country dimension but less so in the time-series dimension. Nevertheless our econometric analysis exploits the panel dimension of this dataset in order to circumvent contamination by various time-invariant omitted variables. And remarkably, in spite of the sparse time-series coverage, all our empirical results are robust to inclusion of various fixed effects.

Regarding trade flows we retrieve data from two different sources: the IMF DOTS data set and the UN Comtrade database. Country-level data such as population, GDP and FDI come from the World Bank WDI database. Variables accounting for bilateral trade impediments or facilitating factors come from the CEPII bilateral distance database (www.cepii.fr/anglaisgraph/bdd/distances.htm). The internet, outphone call and cable TV data come from the International Telecommunication Union. See Appendix F for full data description and sources. For all trade and economic variables of interest, we compute the country-level average over each wave of the WVS.

4.2. Construction of the index of cultural distance

We aim to build a measure of bilateral cultural distance at the country-pair level relying on the set of 12 values retrieved from the WVS. To do so, we adapt the indices of fractionalization traditionally used in the economic literature (Fearon, 2003, Alesina et al., 2003). These indices are easy to interpret: they represent the probability that two randomly picked individuals do not share the same observable characteristics. However, they include only one observable dimension - such as the ethnic, linguistic or religious group - while we require a multidimensional index as we compare individuals across different characteristics (i.e. a set of 12 values). One issue involved by the move from an unidimensional to a multidimensional index is that characteristics are potentially correlated with each other.

We first construct cultural distances across individuals. For each country i, there is a population of

[15] The list of countries (with the number of waves where they are surveyed) is: Albania (2), Algeria (1), Argentina (4), Armenia (1), Australia (1), Austria (2), Azerbaijan (1), Bangladesh (2), Belarus (3), Belgium (3), Bosnia and Herzegovina (2), Brazil (2), Bulgaria (3), Canada (3), Chile (3), China (2), Colombia (1), Croatia (1), Czech Republic (3), Denmark (3), Dominican Republic (1), Egypt (1), El Salvador (1), Estonia (3), Finland (3), France (3), Georgia (1), Germany (3), Greece (1), Hungary (4), Iceland (3), India (3), Indonesia (1), Iran (1), Ireland (3), Italy (3), Japan (4), Jordan (1), Kyrgyzstan (1), Latvia (3), Lithuania (3), Luxembourg (1), Macedonia (2), Malta (3), Mexico (3), Morocco (1), Netherlands (3), New Zealand (1), Nigeria (3), Norway (3), Pakistan (2), Peru (2), Philippines (2), Poland (2), Portugal (2), Republic of Korea (4), Republic of Moldova (2), Romania (3), Russian Federation (3), Saudi Arabia (1), Singapore (1), Slovakia (3), Slovenia (3), South Africa (3), Spain (4), Sweden (4), Switzerland (1), Taiwan (1), Turkey (3), Uganda (1), Ukraine (2), United Kingdom (3), Tanzania (1), United States of America (4), Uruguay (1), Venezuela (2), Viet Nam (1), Serbia (2), Zimbabwe (1)

agents $a = (1, ..., N_i)$ with a random vector $\mathbf{v}_a$ of 12 values $(v_{a,1}, ..., v_{a,12})^T$ where each value is measured by $v_{a,k}$, the ordinal answer to the question k. Let us consider two individuals (a, b) randomly picked in the world population. We define d_{ab}, the inter-individual cultural distance between a and b as:

$$d_{ab} \equiv (\mathbf{v}_a \ominus \mathbf{v}_b)^T \mathbf{W} (\mathbf{v}_a \ominus \mathbf{v}_b) \tag{4.1}$$

where $(\mathbf{v}_a \ominus \mathbf{v}_b)$ corresponds to the vector of "ordinal differences" defined as: $\forall k \in (1, 12), (v_{a,k} \ominus v_{b,k}) = 1 \ if \ v_{a,k} \neq v_{b,k}$ and 0 otherwise and where $\mathbf{W}$ is a 12×12 weighting matrix.

We consider two possible specifications of d_{ab} corresponding to two different specifications of the weighing matrix $\mathbf{W}$. The *unweighted* cultural distance corresponds to the case where $\mathbf{W} = \mathbf{I}_{12}/12$. This distance gives equal weight to all questions. In this case (see appendix), d_{ab} simply corresponds to the fraction of the set of 12 values which individuals a and b disagree upon such that the unweighted cultural distance is the immediate counterpart of standard fractionalization indices. The *weighted* cultural distance considers a weighing matrix $\mathbf{W} = \mathbf{\Omega}^{-1}/sum(\mathbf{\Omega}^{-1})$, where $\mathbf{\Omega}$ is a matrix of correlations across values. This definition of d_{ab} corresponds to the Mahalanobis distance between the random vectors $\mathbf{v}_a$ and $\mathbf{v}_b$, which is a measure of dissimilarity widely used in statistics. We present details of the construction of the weighted cultural distance in Appendix D. Intuitively though, the correction using $\mathbf{\Omega}$ amounts to giving less weight to values that are strongly correlated across individuals. This is to avoid the case where a same underlying value is being tested with more than one question in the survey.

We now construct cultural distances across countries. For a given pair of countries (i, j), we define the bilateral cultural distance as the average of inter-individual distances d_{ab} across individuals belonging to i and j:

$$D_{ij} = \frac{1}{N_i N_j} \sum_{a \in i} \sum_{b \in j} d_{ab} \tag{4.2}$$

It is also necessary for our purpose to define an *internal* cultural distance. Indeed, a high value of D_{ij} can only be achieved when the two countries i and j are both very homogeneous and very different from one another. Similarly, a very low value is consistent only with homogeneous countries very close from one another. However, intermediate values of D_{ij} may stem either from heterogeneity within each country or from different distributions of types across countries. To control for the effect of within-country heterogeneity in our regression analysis, we define:

$$D_{ii} = \frac{1}{N_i(N_i - 1)} \sum_{a \in i} \sum_{b \in j} d_{ab} \tag{4.3}$$

The internal cultural distance can be interpreted as the probability that two randomly picked individuals from the *same* country have different values.

We close this section on a technical note. Implementing (4.2) and (4.3) directly is difficult because of dimensionality issues. There are more than $200,000$ individual observations in the WVS. This corresponds roughly to $2 \cdot 10^{10}$ pairs of individuals and inter-individual distances. Reducing the dimensionality of this system is thus crucial. This is straightforward for the case of the unweighted distance where (4.2) can be rewritten as: $D_{ij} = 1 - \sum_k \langle \mathbf{q}_k^i, \mathbf{q}_k^j \rangle / 12$, where $\mathbf{q}_k^i$ represents the vector of country-level frequencies for each question k and $\langle ., . \rangle$ the inner product. We derive a similar result for the case of the weighted distance in Appendix D.

Because the unweighted distance is the immediate counterpart of standard unidimensional fractionalization indices we have opted to use it as our benchmark measure of cultural distance and to use the weighted distance only as a robustness check in Section 4.6. Results obtained using the two definitions are close to one another. The full set of results using the weighted distance is available upon request from the authors.

4.3. Summary statistics

We now present some important descriptive statistics both in the cross-section and in the time-series dimension. Cross-sectional statistics are based on the wave 2000-2004, which has the best statistical coverage. Table 1A presents the sample distribution of bilateral cultural distance. Sample average and standard deviation are respectively equal to 42.9% and 3.1%. By way of comparison, those figures are equal to 25.2% and 2.1% for internal cultural distance. Quite naturally internal distance is on average significantly smaller than bilateral distance. Table 1B reports extreme values for bilateral cultural distances. The interpretation of numbers in the table is simple: with a probability of 33.8% a Dane and a Swede will *not* share a same value whereas this probability jumps to 56.3% when we consider a Dane and Tanzanian.

Insert Figure 5 Here

Figure 5 depicts the time evolution of bilateral cultural distance for country-pairs which are observed continuously over the 1989-2004 period. The horizontal axis represents distances for the 1989-1993 wave and the vertical axis represents distances for the 2000-2004 wave. All points located below the red 45° line correspond to pairs of countries which experienced a decrease in bilateral cultural distance over the period. Figure 5 thus highlights a clear pattern of cultural convergence as the average value of cultural distance decreases over time: The absolute value of this decrease is equal to 0.7%. While this number may seem small at first sight, it is statistically significant at the 1% level. It also corresponds to one quarter of the cross-sectional standard deviation, which is a meaningful change when talking about evolution of cultures over less than two decades.

Our objective in the rest of the paper is to investigate the determinants of cultural convergence: why does a specific pair of countries end up either below or above the 45° line in Figure 5?

4.4. Empirical strategy

In this section, we present our strategy to identify a causal link from international trade openness to bilateral cultural distance. For a given pair of countries (i, j) at a given year t, the basic specification consists in regressing D_{ijt}, our measure of bilateral cultural distance, on the log of bilateral trade openness defined as $\ln OPEN_{ijt} \equiv \ln(M_{ijt}/GDP_{it} + M_{jit}/GDP_{jt})$ where M_{ijt} represents the imports by i from j:

$$D_{ijt} = \beta_1 \cdot \ln OPEN_{ijt} + \mathbf{CONTROL}_{ijt} \cdot \boldsymbol{\beta} + \mathbf{FE}_{ijt} + \varepsilon_{ijt} \tag{4.4}$$

where ε_{ijt} is an error term, $\mathbf{CONTROL}_{ijt}$ is a set of control variables and $\mathbf{FE}_{ijt}$ is a set of country-pair and time fixed effects.

The identification of our main coefficient of interest, β_1, is potentially contaminated by two sources of endogeneity: (1) there are many codeterminants of trade openness and cultural distance such as geography, common history, language, migration and information flows; (2) there is a reverse causality link from cultural distance to trade flows as recently shown by Guiso et al. (2009) and Falbermayr et al. (2009). We next explain how we deal with those two issues.

4.4.1. Controlling for codeterminants of trade and culture

Codeterminants of trade and culture can be either time-varying or time invariant. We control for unobserved time-invariant (or slow moving) codeterminants of culture and trade by including country-pair fixed effects in all (but one) regressions. An additional benefit of this approach is that our dependent variable is retrieved from the WVS: like other opinion surveys, the WVS potentially suffers from cross-country variations in the interpretation of the questions. Country-pair fixed effects purges for such country-specific interpretation biases. It should also be noticed that including country-pair fixed effects is quite demanding with respect to the data given the short time series dimension of our sample.

We control for time-varying codeterminants of trade and culture in several ways. First, we systematically include year dummies in order to filter out the potential impact of worldwide time trends in cultural change and international trade from our bilateral specification. Second, we explicitely control for alternative channels which are likely to affect trade and culture:

(1) Heterogeneity within countries: we control for the *sum of internal cultural distances* at the country-pair level. By construction, countries with large internal cultural distance tend to have larger bilateral cultural distances with other countries. Moreover a large internal cultural distance could affect the propensity to trade through heterogeneity in preferences.

(2) Information flows: Information flows are likely to bring down bilateral cultural distance and to co-move with trade in goods. The data we have on information flows includes *country-pair internet access*, *country-pair cable TV access* and *country-pair phone call outflows per capita.*[16] Sample coverage

[16] These variables correspond to the probability that two randomly picked individuals in the pair of countries do both have an access to internet, to cable TV or do both phone abroad.

is significantly better for the last variable than for the other two. We thus use *country-pair phone call outflows per capita* as control variable in our baseline regressions. However robustness checks reported in Section 4.6 show that our results are robust to including internet access and cable TV despite a severe reduction in sample size.

(3) Migration: a probable time-varying codeterminant of trade and cultural distance is migration. We thus control for the *log of bilateral migration*, which we lag by five years to limit simultaneity concern. Due to a lack of panel data on bilateral stocks of migrants, we exploit data on bilateral migration flows. However, most of the unobserved heterogeneity in migration stocks is likely to be captured by the country-pair fixed effects.

(4) FDI: we control for the *log of the sum of FDI* since trade flows and FDI tend to be substitute at the aggregate level.

(5) Income differences: we control for the *differential in GDP per capita* measured as $\ln |GDP_{it} - GDP_{jt}|$. Indeed the postmodern view in sociology (Baker and Inglehart, 2000) claims that economic development drives a cultural shift from traditional to postmodern values. Since trade openness is also affected by economic development, it is crucial to control for the GDP differential.

(6) Finally, we include ($country \times year$) fixed effects in one specification. This specification is very demanding with respect to the data but it filters out all the unobserved, country-specific but time-varying, codeterminants of trade and culture.

4.4.2. Controlling for reverse causality

In order to control for the reverse causality link from cultural distance to trade, we implement an instrumental variable strategy. This approach also removes any residual omitted variable bias. Our objective is to find time-varying instruments that impact bilateral trade openness without directly affecting the bilateral cultural relationship between countries i and j.

Our first instrumental variable is a measure of the country-pair economic remoteness to the rest of the world. This variable is routinely used in the international trade literature as one of the determinants of trade flows (see Baier & Bergstrand, 2004; Rose, 2004 and Martin et al. 2008 for recent examples). Intuitively, remoteness measures each importer's set of alternative sourcing countries for their imports. Due to increased competition, a pair of countries with many nearby and large alternative sources of goods will decrease its bilateral imports. Following the literature, our definition of the bilateral remoteness variable is:

$$REMOTE_{ijt} = -\ln \left(\sum_{k \neq i,j} \frac{GDP_{k,t}}{distance_{i,k}} + \frac{GDP_{k,t}}{distance_{j,k}} \right) \tag{4.5}$$

An increase in $REMOTE_{ijt}$ is expected to increase bilateral trade openness within the pair of country (i, j). The fact that we include country-pair fixed effects in all our IV regressions is important to guarantee the exogeneity of this instrument. Indeed, the purely geographical part of the remoteness index is time invariant and could be linked to cultural history between the two countries. Another important point is that $REMOTE_{ijt}$ varies in the time dimension only through variations in GDP growth of countries k outside the country-pair (i, j). It is therefore not affected by the bilateral relation of the two countries for which we want to estimate the index of cultural distance.

Our second instrumental variable is a measure of trade contagion at the country-pair level. Recent empirical works (Egger and Larch 2008, Baldwin and Jaimovich 2008) show that bilateral trade of a given pair of countries is positively affected by the signing of a FTA with a third country. This stems from the threat of trade diversion that forces the pair of countries to reduce their bilateral trade barriers. Hence there is a contagion effect of FTAs. We consider the following bilateral index of contagion by Baldwin and Jainovic (2008)[17]:

$$CONTAGION_{ijt} = \sum_{k \neq i,j} \left[\frac{M_{kj0}}{GDP_{k0}} \times FTA \right]_{ikt} + \sum_{k \neq i,j} \left[\frac{M_{ki0}}{GDP_{k0}} \times FTA \right]_{jkt} \tag{4.6}$$

where FTA_{ikt} is a dummy variable coding for the existence of a FTA between i and k at date t; and M_{kj0}/GDP_{k0} is the share of imports by country k from country j the year the FTA between i and k was signed. In words, this represents for a given year t the accumulated sum of the FTAs signed by i with the countries outside the pair in the past years, weighted by the commercial importance of the third countries to j. Just like the previous instrument, the time variation of the contagion index is not affected by the bilateral relation between countries i and j. An increase in $CONTAGION_{ijt}$ is expected to increase bilateral trade openness within the pair of countries i and j.

Controlling for country-pair fixed effects implies that the causal impact of the IVs on bilateral trade openness is identified along the time-series (ie. within country-pair) dimension only. Interestingly the time-series correlation between the two IVs is pretty low (0.22) meaning that exploiting the IVs separately offers two independent identification strategies. Yet, our base specification uses 2SLS estimates of equation (4.4) where openness is instrumented with both IVs at the same time as it allows us to perform overidentification tests which are discussed in the next. However, we also report results of 2SLS estimates where openness is instrumented with each IV separately in the robustness checks section. We find that the choice of IV does not affect significantly our point estimates.

4.4.3. Testing for path dependency

Due to the existence of multiple equilibria, our theoretical analysis suggests that the relationship between trade openness and cultural distance exhibits path-dependency: once an economy has opened to trade and cultural distance has been reduced, a reversion (ie. a decrease) in trade openness should not generate a reversion (ie. an increase) in cultural distance. We test this hypothesis by estimating a first-difference version of (4.4) on two subsamples: the subsample of country-pairs having experienced an increase in trade openness and the subsample of country-pairs having experienced a decrease in

[17] We are grateful to Richard Baldwin and Dany Jainovic for sharing their data with us.

openness. Evidence in favour of path dependency is found if β_1, the coefficient of openness, is larger for the first than for the second subsample

4.5. Baseline Regressions

Results of baseline regressions are reported in Table 2. Columns 1-3 present OLS estimates of equation (4.4) while columns 4-8 present 2SLS estimates. The corresponding first stage regressions are reported in Table 3. In all specifications, time dummies are included and error terms are clustered at the country-pair level. When country-pair fixed effects are included, the model is estimated in first-differences; our robustness analysis in table 4 shows that a within estimator produces similar results.

Insert Tables 2 and 3 Here

Column 1 reports cross-sectional evidence. The coefficient of our variable of interest, *bilateral openness in all goods*, is negative and significant at the 1% threshold, as predicted by the theory. The coefficients of internal cultural distance and GDP differential are also of the expected sign (positive) and significant at the 1% level. Geographical distance has a positive and significant impact on cultural distance. This effect likely captures a myriad of long run bilateral influences, from past wars to immigration waves. From a quantitative standpoint though, the effect of geographical distance is somewhat modest as a tenfold increase in geographical distance translates into an increase in cultural distance of 0.45 percentage point (i.e. 16% of the cross-sectional standard deviation). Interestingly, we find a much larger effect of common legal origins, which decreases cultural distance by 1.33 percentage point. This finding is consistent with the view that institutions rather than geography shape culture and values (see Alesina and Fuchs 2007; Landier et al., 2008).

In column 2 we include country-pair fixed effects in order to control for unobserved slow-moving codeterminants of trade and cultural distance.The sample size shrinks relative to column 1 because the model is estimated in first differences and many country-pairs are observed only once in the time-series dimension. In column 2 we also include time-varying control variables for information flows, FDI and migration. All coefficients have the expected sign. However, the coefficient of GDP differential is not significant and drops sharply with respect to its cross-sectional estimate in column 1. This suggests only weak support for the postmodern view of cultural change in the sociology literature. More importantly for our purpose, we find that the coefficient of trade openness is robust to the inclusion of country pair fixed effects and of time-varying control variables and remains negative and significant at the 1% level.

We control for ($country \times year$) fixed effects in column 3. This specification captures all the unobserved, time-varying, country-specific heterogeneity. Remarkably, the coefficient of bilateral openness is robust to the inclusion of this extremely demanding specification: it does decrease by nearly one half with respect to its estimate in column 2 but it remains negative and significant at the 5% level. Beyond providing a robustness check, this regression shows that the negative causal impact of trade openness on cultural distance is driven by bilateral interactions within the pair of countries. In other words, our econometric results cannot be entirely due to the fact that countries are converging toward the same worldwide cultural model. A large part of the phenomenon takes place at the bilateral level with countries converging toward a set of country-pair specific values. This evidence is in line with our theoretical model.

Column 4 reports the second stage of a 2SLS specification where *bilateral openness* is instrumented with both *bilateral remoteness* and *bilateral contagion*. We cannot include ($country \times year$) fixed effects in this specification because those ones reduce sharply the statistical power of our two instruments. From the first stage results reported in Column 1 of Table 3 we see that remoteness and contagion impact positively bilateral openness, in line with the theory. Their coefficients are significant at the 1% and 5% level respectively. In addition, the F-test on the joint effect of IVs rejects the null hypothesis and exceeds the threshold of 10 recommended by Staiger and Stock (1997). With two instruments for one endogenous variable we can perform a Sargan test for overidentification. The test reveals a P-value of 0.157, stating that the exogeneity hypothesis on our instruments cannot be rejected. The second stage results (column 4 in table 2) show that the coefficient of bilateral openness is negative and significant at the 1% level. Compared to its OLS estimates in column 2, the coefficient is now a little bit less than three times larger in absolute value. While it may seem initially surprising[18], this finding is actually due to a composition effect which is in line with our theory. Indeed, an important property of our two IVs is that they impact bilateral openness mostly through trade in differentiated goods[19]. Our theory predicts that trade in differentiated products should have a larger impact on cultural distance than trade in homogenous products. As a consequence, an increase in trade in differentiated goods has a larger impact on cultural distance than the same increase in total trade[20]. We test (and confirm) this insight in column 8.

As discussed in the previous section, this 2SLS panel specification with country-pair fixed effects controls for both the omitted variable bias and the reverse causality issue. This constitutes our preferred specification. The impact of openness on cultural distance is economically significant. A one standard deviation increase in bilateral trade openness translates into a 43% standard deviation decrease in bilateral cultural distance. This effect is sizeable and it dominates the effect of the control variables. By comparison indeed, a one standard deviation change in phone call outflows, bilateral

[18] Since we expect that the reverse causation, from cultural distance to trade, to be negative as suggested by the work of Guiso, Sapienza and Zingales.

[19] Unreported first stage regressions show that bilateral remoteness and bilateral contagion are weak instruments for trade in homogenous goods while they perform very well with trade in differentiated goods. A theoretical reason for this statistical feature is that our instruments are more in line with the new trade theory mechanisms than with the traditional comparative advantage channels.

[20] See Frankel and Romer (1999) for a similar argument in a different context.

migration and GDP per cap differential translate into a change in bilateral cultural distance of respectively 34%, 6% and 5% standard deviation[21]. These results imply that the increase in bilateral trade openness experienced by the average country-pair during the 1989-2004 period explains 67% of the average decrease in bilateral cultural distance we reported in Section 4.3.[22]

We test for path-dependency in columns 5 and 6 where our preferred specification is estimated respectively on the subsample of country-pairs experiencing an increase in bilateral openness and on the subsample of pairs experiencing a decrease in openness. In the case of an increase, the coefficient on bilateral openness remains negative and significant at the 1% level; in the case of a decrease, the coefficient is not significantly different from zero. As discussed in the previous section, we can interpret this asymmetry as evidence of path-dependency and lock-in effects. While this result is suggestive, we wish to append to it a number of caveats. First, it should be noticed that the reduction in sample size in column 6 makes the estimate less precise. In addition the statistical power of the IVs is now weak even after dropping bilateral contagion from the set of IVs (see the first stage regression, column 3 in Table 3). Thus the results in column 6 is econometrically more fragile than our other results. This is not surprising given the short length of our sample period (less than two decades) and the longer time period we expect necessary to observe path-dependency.[23]

The last theoretical prediction that we test deals with the relative impact on cultural distance of trade in goods with different levels of product differentiation. This test is implemented in columns 7 and 8 in Table 2. It requires us to make use of a different dataset: We indeed retrieve from UN Comtrade a measure of *bilateral openness in cultural goods* as built by Disdier et al. (2007) and a measure of *bilateral openness in homogenous goods* as defined by Rauch (2001). However, for consistency reason, we need to rebuild our variable of *bilateral openness in all goods* using Comtrade trade flows rather than DoTS trade flows as in the other regressions[24]. In column 7 we re-estimate our preferred specification with the Comtrade based measure of openness and observe that our previous results are qualitatively robust to the change of dataset. We next include *openness in homogenous goods* and *openness in cultural goods* in specification 8[25]. This implies that the coefficient of *openness in all goods* must now be interpreted as the causal impact of trade in differentiated goods net of trade in cultural goods. This coefficient increases by a factor two with respect to the benchmark estimate in column 7. By way of contrast, the coefficient of *openness in homogenous goods* is reduced by a factor five (in absolute value) and is not significantly different from zero. This finding validates our theoretical prediction

[21] It should be noticed however that the results for the control variables should be interpreted with caution: contrary to bilateral trade openness, these variables are not instrumented and their coefficient is thus likely to be contaminated.

[22] In our sample, bilateral trade openness has increased by 91% over the 1989-2004 period while bilateral cultural distance has decreased from 43.3% to 42.6%.

[23] According to our theory, path-dependency is observed once a country switches from one steady-state to another through intergenerational transmission of values.

[24] The correlation in our sample between the Comtrade-based openness and DoTs-based openness is 0.86.

[25] Due to the weak predicting power of our IVs for openness in homogenous goods and cultural goods, we decide to instrument only *bilateral openness in all goods*. This specification allows us to perform overidentification tests. However, a drawback is the potential contamination of the coefficients of *bilateral openness cultural goods* and *bilateral openness cultural goods*

stating that the impact on cultural distance is larger for trade in differentiated goods than for trade in homogenous goods[26]. Also of interest is the coefficient of *openness in cultural goods* which is large and significant. This finding is in line with the common view that trade in cultural goods is likely to be an important channel of bilateral cultural influences[27]. More importantly, the fact that we control for trade in cultural goods implies that trade in differentiated goods, *net of cultural goods*, has a significant causal impact on cultural distance. In other words, we find that differentiated goods vehicle elements of cultural transmission, which supports our theory of *product-based cultural change*.

4.6. Robustness Checks

We now want to investigate whether the results obtained in the previous section are driven in any way either by our econometric specification or by the way we constructed our cultural distance. The results of this investigation are reported in Table 4. All regressions in that table are robustness checks starting from our preferred 2SLS panel regression (column 4 in Table 2). For the sake of exposition, our preferred regression (benchmark) is repeated in the leftmost column and we report only the coefficients of our main variable of interest, namely *bilateral openness in all goods*, in Table 4.

Insert Table 4 Here

In columns 1 to 5 we deal with different econometric specifications. We consider alternative choices of IV in columns 1 and 2: openness is instrumented with bilateral remoteness only in column 1 while it is instrumented with bilateral contagion only in column 2. It is worth recalling that even though our two IVs are both strong predictors of bilateral trade, they are only weakly correlated with each other since their time-series correlation in our sample is equal to only 0.22. Nevertheless, it can be observed by comparing the benchmark to columns 1 and 2 that the choice of instrument affects neither the sign nor the significance level of our main variable, and affects only moderately the point estimate of the coefficient (for the case of contagion). This suggests that our 2SLS results are not an artifact of the instrumenting strategy. In column 3 we include additional controls for information flows. We add country-pair coverage by cable TV and country-pair internet access to our benchmark.

[26] According to Broda and Weinstein (2006) the average elasticity of substitution (σ in our theory) on the 1990-2001 period is equal to 11.6 for good classified as homogenous by Rauch (2001) and equal to 4.7 for those classified as differentiated.

[27] In Disdier et al. (2007) cultural goods are defined according to the UNESCO definition as printed matter, literature, music, visual arts, cinema, photography, radio, television, games and sporting goods. Relying on Comtrade, Disdier et al. identify these cultural goods at the most detailed level of the classification, namely the Harmonized System at the six digit level. The cultural goods can be grouped within seven categories: cultural heritage goods (e.g. Antiques); Books; Newspapers; Other printed matter (e.g. photographs); Recorded media (e.g. CDs); Visual arts (e.g. paintings); Audiovisual media (e.g.video games). It must be stressed that this definition comprises reproducible as well as nonreproducible goods, that musical instruments, radio receivers and other devices related to cultural goods are not taken into account, and lastly that trade in services is not taken into account.

The sample size is reduced by over a third but the coefficient of bilateral openness remains negative and significant at the 5% level. Next, we control for the country-pair level of generalized trust[28] in column 4. This additional control is motivated by recent work by Guiso et al. (2009) which shows that trust and trade openness are positively correlated. As can be readily observed by comparing column 4 with the benchmark, controlling for the level of generalized trust leaves both the coefficient of bilateral openness and its standard deviation virtually unchanged. Finally, in column 5 we estimate the country-pair fixed effects using a within estimator rather than a first-difference approach. We observe that the point estimate of the main coefficient is left unchanged and is estimated with even more precision (t-statistics going up from a bit less than 4 to a bit more than 5).

Columns 6 to 11 entertain several alternative definitions of our measure of bilateral cultural distance. In column 6 we consider the weighted cultural distance instead of the unweighted distance used elsewhere in the paper. In other words and as explained in Section 3 of the paper, it uses a measure of cultural distance which is corrected for possible correlations of questions in our sample. This correction is observed to make very little difference to the point estimate of bilateral openness, which remains significant at the 1% level. In columns 7 and 8 We use measures of cultural distance based on a larger set of questions than for our benchmark regression. In column 7 (resp. 8), cultural distance is based on the set of 30 (resp. 50) questions from the WVS offering the best statistical coverage. The immediate consequence of enlarging the set of questions is a drop in sample size due to imperfect coverage of the WVS. This drop is moderate in column 7 and more severe (close to one half) in column 8. This leaves the sign and the magnitude of the point estimates of our main variable unchanged but affects the precision of our estimates in the expected direction. We take the opposite view in columns 9 to 11 by building a measure of cultural distance based on a single question. For this purpose, we choose questions corresponding to values that received a lot of recent attention in the literature and culture and economics, namely *generalized trust* in specification 9; *feeling of happiness* in specification 10; and *belonging to a religious denomination* in specification 11. While the magnitude of the effects of trade on each of these values is found to vary sharply (largest for religion and weakest for trust), the coefficient is always negative and significant at least to the 5% level.

The overall picture we draw from this section is that our earlier finding of a causal relationship from trade to culture seems to be driven neither by our econometric specification nor by our specific measure of cultural distance.

4.7. Differential Impact Across Subgroups

We investigate in this section the differential impact of trade openness on culture across various subgroups of the population. The reason why we do this is that it provides us with a third strategy for identifying the causal impact of trade on culture. This follows a line of argument first used by Rajan and Zingales (1998) when estimating the impact of financial development on growth. The key idea

[28] This is obtained from the answers to question a0165 of the WVS.

is to isolate groups of individuals who are likely to be more affected by the cultural impact of trade than the rest of the population. This differential impact may occur either because these groups are more exposed to the treatment (ie. trade openness) or because they are likely to overreact in terms of cultural change.

Exploiting the household characteristics available in the WVS, we rebuild measures of cultural distances for certain groups of individuals. More precisely, within the population of one given country i (resp. j), we select a group g (resp. g') of individuals for which we suspect that cultural change is affected differently by trade openness than the rest of the population. For each pair of countries (i, j) we build the bilateral cultural distance between the groups g and g': the procedure is similar to equation (4.2) except that here inter-individual distances are averaged across individuals belonging to (g, g'). We similarly build the bilateral cultural distance between the populations of individuals who do not belong to g and g'. Hence we get two bilateral cultural distances.for each pair of countries (i, j). We define $1_{g,g'}$, a dummy variable which is equal to 1 (resp. 0) when the bilateral distance D_{ijt} relates (resp. do not relate) to the two groups (g, g').

We are now equipped to estimate the following regression:

$$D_{ijt} = \beta_1 \cdot \ln OPEN_{ij,t} + \beta_2 \cdot 1_{g,g'} \times \ln OPEN_{ij,t} + \beta_3 \cdot 1_{g,g'} + \mathbf{CONTROL} \cdot \boldsymbol{\beta} + \mathbf{FE} + \varepsilon_{cc't} \quad (4.7)$$

This specification is similar to our main specification (4.4) except that now our coefficient of interest is β_2, corresponding to the interaction term between trade openness and the dummy variable. It captures the differential effect of trade openness on cultural distance for the groups (g, g') relative to the impact of trade on cultural distance for the rest of the population.

Insert Table 5 Here

We estimate three different specifications of (4.7) depending on the groups (g, g'). Each regression is reported in Table 5 and consists in the second stage of a 2SLS estimate of (4.7) where trade is instrumented in the same way as in our baseline regressions and where fixed effects are identified through the within estimator. In column 1 we consider a subgroup of reference called "*Young*" and composed of individuals that are between 15 and 29 years old. The hypothesis behind the choice of this subgroup is that values, preferences and consumption choices of young agents are more open to change than those of older agents. The results confirm this insight. Trade openness has a larger impact (in magnitude) on young individuals than on older ones. In fact, the overall effect on young, corresponding to $\beta_1 + \beta_2$ in equation (4.7), is twice as large as on old (given by β_1) and the difference is significant at the 1% level. In columns 2 and 3 we consider subgroups of references that are more likely to have access to imported differentiated goods either because of their income level (column 2) or because of proximity to distribution channels (column 3). A causal impact from trade to culture implies that groups more exposed to imported goods should see their values change more than groups that are less exposed to trade. This insight is again confirmed by regressions in Table 5: looking at the coefficient of the interaction variable between bilateral openness and the dummy variable corresponding to the subgroup of reference, we find that values of rich(er) agents are more affected by a change in bilateral trade than the values of poor(er) agents. We also find that the values of agents living in urban areas are more affected by the same change in bilateral trade than agents living in rural areas.

5. Conclusions

In this paper, we analyze the effect of product market integration on the evolution of cultural values across individuals and countries. We make three contributions to the literature. First, building on insights from marketing and consumer research, we provide a simple theory of product-based cultural change. To this purpose we embed a standard monopolistic competition model within a framework of endogenous cultural evolution tied to consumer products. Second, we build a direct measure of cultural distance across countries based on answers to the World Values Survey and we show that, on average, bilateral cultural distance decreased over the 1989-2004 period. Third, we successfully test three theoretical predictions: bilateral trade openness reduces bilateral cultural distance; the effect is stronger for more differentiated products; there is path dependency. These results support the view that culture and economic outcomes are co-determined, even in the medium-run and that product market integration contributes significantly to the convergence of cultural values across countries.

Obviously our analysis touches only the tip of iceberg and a number of important issues remain to be investigated. First, our empirical results are based on country-level panel data. While we find evidence of a pervasive impact at the aggregate level, we remain silent on the channels of transmission at the micro-level. Future works should look at more disaggregated trade flows and intra-country evidence. Similarly, on the theory side, an avenue for future research is the development a micro-founded theory of the embodiment of cultural values in goods through advertising, product design or R&D and its implications for global market competition and cultural evolution. Another interesting angle for future research is the political economy dimensions of global cultural convergence. Is this process associated with resistance efforts and frictions across civilizations? Or is cultural convergence reducing conflicts and facilitating the worldwide diffusion of stable, efficient and tolerant institutions? These are, we believe, crucial issues in an increasingly globalized world.

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Appendices

A. Foundations of equation (3.5)

We assume that the process of intergenerational cultural transmission is characterized by transition probabilities $P_{ij,t}$ that a parent of type $i \in (X, Y)$ has a child adopting a preference of type $j \in (X, Y)$ given by :

$$\begin{cases} P_{X,X,t} = \tau_X + (1-\tau_X)q_t \\ P_{X,Y,t} = (1-\tau_X)(1-q_t) \\ P_{Y,Y,t} = \tau_Y + (1-\tau_Y)(1-q_t) \\ P_{Y,X,t} = (1-\tau_Y)q_t \end{cases} \tag{A.1}$$

where τ_X (resp. τ_Y) denotes the endogenous probability that a parent of type X (resp. Y) socializes directly his own child. For instance, a child with a parent of type X can acquire the social preference of type X in two ways. With probability τ_X she may be directly socialized by her parent. Otherwise she remains naive and gets socialized by another old generation individual of type X by random matching with probability $(1-\tau_X)q_t$. Similar intuition can be given for the other transition probabilities

We assume that time is continuous and that between t and $t + dt$ a fraction λdt of the population dies. Before dying they give birth to one offspring that is socialized to a certain preference profile (X or Y) according to the process described in (A.1) Given these transition probabilities, the fraction q_{t+dt} of individuals of type X in the next generation at time $t + dt$ is given by:

$$q_{t+dt} = q_t(1-\lambda dt) + \lambda dt q_t P_{X,X,t} + \lambda dt(1-q_t)P_{Y,X,t}$$

which after substitution and the continuous time limit $dt \to 0$ leads to equation (3.5) where, without loss of generality, we assume $\lambda = 1$.

B. Proof of Proposition 1

Step 1:

Let define $\tilde{q}$ as a candidate for the steady state; by definition we have $P(\tilde{q}) = C(\tilde{q})$ where $P(.)$ and $C(.)$ are respectively the LHS and the RHS in equation (3.9). Inference on stability requires to study how P and C cross each other at the point $\tilde{q}$. This consists in computing the ratio of the tangent slopes. Straightforward computations show that:

$$\frac{C'(\tilde{q})}{P'(\tilde{q})} = \left[\frac{\sigma-1}{\omega}\frac{C(\tilde{q})}{\tilde{q}(1-\tilde{q})}\right] \times \frac{4\omega}{\left[1-2\omega\left(\tilde{q}-\frac{1}{2}\right)\right]^2}$$

Using the fact that $C(\tilde{q}) = P(\tilde{q})$ we get:

$$\frac{C'(\tilde{q})}{P'(\tilde{q})} = \frac{\sigma-1}{4\omega^2}H(\tilde{q}) \tag{B.1}$$

where we set

$$H(\tilde{q}) \equiv \frac{1+2\omega\left(\tilde{q}-\frac{1}{2}\right)}{\tilde{q}} \times \frac{1-2\omega\left(\tilde{q}-\frac{1}{2}\right)}{1-\tilde{q}}$$

Thus $H(\tilde{q})$ admits one and only one local minimun in $\tilde{q} = 1/2$. Indeed we have

$$H'(\tilde{q}) = \frac{2(1-\omega^2)\left(\tilde{q}-\frac{1}{2}\right)}{\left(\tilde{q}(1-\tilde{q})\right)^2}$$

It is straightforward to check that $H'(1/2) = 0$ and that $H'(\tilde{q}) > 0$ iff $\tilde{q} > 1/2$.

Thus $H(\tilde{q})$ is decreasing for $\tilde{q} \in [0, 1/2]$ and increasing for $\tilde{q} \in [1/2; 1]$. And we get from (B.1):

$$\forall \tilde{q}, \frac{C'(\tilde{q})}{P'(\tilde{q})} \geq \frac{C'(1/2)}{P'(1/2)} = \frac{\sigma - 1}{\omega^2} \tag{B.2}$$

Step2: case where $\sigma - 1 \geq \omega^2$

From (3.9) it is clear that $q = 1/2$ is a steady state. From (B.2) we get that $C'(1/2) \geq P'(1/2)$. Hence 1/2 is a stable steady state. Moreover from (B.2) we get that any alternative steady state $\tilde{q}$ should also be stable. Because of C^1 differentiability of $P(.)$ and $C(.)$ on the support $(0, 1)$, this implies that there is no such alternative steady state; and so $q = 1/2$ is the unique steady-state.

Step3: case where $\sigma - 1 < \omega^2$

From (3.9) it is clear that $q = 1/2$ is a steady state. From (B.2) we get that $C'(1/2) < P'(1/2)$. Hence 1/2 is not stable. Moreover from C^1 differentiability of $P(.)$ and $C(.)$ we get:

$$\left.\begin{array}{c} P(0) > C(0) \\ P(1/2) = C(1/2) \\ P'(1/2) > C'(1/2) \end{array}\right\} \Longrightarrow \exists q_0 \in]0, 1/2[\text{ such that } \left\{\begin{array}{c} P(q_0) = C(q_0) \\ P'(q_0) < C'(q_0) \end{array}\right.$$

The fact that $H(\tilde{q})$ is decreasing on $(0, 1/2)$ implies that $C'(\tilde{q})/P'(\tilde{q})$ is decreasing on $(0, 1/2)$; and this implies that q_0 is the only steady state on the interval $(0, 1/2)$.

By symmetry we get that there exists a unique steady state q_1 on the interval $(1/2; 1)$. And q_1 is stable.

C. Proof of Proposition 2

Equating (PM') and (CS), we obtain that the international equilibrium is given by:

$$\frac{1}{2}\frac{1 + 2\omega\left(q^{int} - \frac{1}{2}\right)}{1 - 2\omega\left(q^{int} - \frac{1}{2}\right)} = \left(\frac{q^{int}}{1 - q^{int}}\right)^{(\sigma-1)/\omega} \tag{C.1}$$

we get from (3.9) and (C.1) that the autarkic and international equilibria (q^{aut}, q^{int}) are such that:

$$C(q) = kP(q) \tag{C.2}$$

where the scaling factor $k = 1$ for q^{aut} and $k = 1/2$ for q^{int}.

Differentiating (C.2) we get at the first order:

$$\Delta q \simeq \Delta k \frac{P(q)}{C'(q) - kP'(q)}$$

Hence the elasticity is given by:

$$\frac{\Delta q}{q} \simeq \frac{\Delta k}{q} \frac{1}{C'(q)/C(q) - kP'(q)/P(q)}$$

As we know that $q^{aut} = 1/2$, $k = 1$, $\Delta k = -1/2$ we can rewrite the previous equation as:

$$\begin{aligned} \frac{q^{int} - q^{aut}}{q^{aut}} &\simeq -\frac{1}{C'(1/2)/C(1/2) - P'(1/2)/P(1/2)} \\ &\simeq -\frac{1}{4\omega}\frac{1}{(\sigma-1)/\omega^2 - 1} \end{aligned}$$

D. Weighted cultural distance

We define d_{ab} the inter-individual cultural distance between a and b as :$d_{ab} \equiv (\mathbf{v}_a \ominus \mathbf{v}_b)^T \frac{\Omega^{-1}}{sum(\Omega^{-1})}(\mathbf{v}_a \ominus \mathbf{v}_b)$

where $(\mathbf{v}_a \ominus \mathbf{v}_b)$ corresponds to the vector of "ordinal differences" defined as: $\forall k \in (1, 12), (v_{a,k} \ominus v_{b,k}) = 1 \; if \; v_{a,k} \neq v_{b,k}$ and 0 otherwise. The weighting matrix Ω^{-1} corresponds to the inverse of the matrix of polychoric correlations [29]between values computed on the full sample of individuals. The rescaling parameter $sum(\Omega^{-1})$ corresponds to the sum of all the elements of the matrix.

This definition of d_{ab} corresponds to the Mahalanobis distance between the random vectors $\mathbf{v}_a$ and $\mathbf{v}_b$, which generalizes the Euclidean distance to the case of correlated random vectors.

From the definition of D_{ij} given by expression (4.2).

$$D_{ij} = \frac{1}{N_i N_j} \sum_{a,b} \left(\frac{1}{sum(\Omega^{-1})} (\mathbf{v}_a \ominus \mathbf{v}_b)^T \Omega^{-1} (\mathbf{v}_a \ominus \mathbf{v}_b) \right)$$

Notice that $(\mathbf{v}_a \ominus \mathbf{v}_b)^T = (1_{1,ab}, ..., 1_{k,ab}....1_{12,ab})$ where $1_{k,ab} = 1$ if $v_{k,a} \neq v_{k,b}$ and $1_{k,ij} = 0$ if $v_{k,a} = v_{k,b}$. Moreover considering the weighting matrix $\Omega^{-1} = [\omega_{k,k'}]$ we can rewrite the previous equation as:

$$\begin{aligned} D_{ij} &= \frac{1}{N_i N_j} \sum_{a,b} \left(\frac{1}{sum(\Omega^{-1})} \sum_k \sum_{k'} \omega_{kk'} 1_{k,ab} 1_{k',ab} \right) \\ &= \frac{1}{sum(\Omega^{-1})} \sum_k \sum_{k'} \omega_{kk'} \left(\frac{1}{N_i N_j} \sum_{a,b} 1_{k,ab} 1_{k',ab} \right) \end{aligned}$$

For each country i and j, we denote $\mathbf{q}_k^i = (q_{km_k}^i)$ and $\mathbf{q}_k^j$ the vector of country-level frequencies for each question k. Denoting $\langle ., . \rangle$ the inner product we can rewrite the previous equation as:

$$\begin{aligned} D_{ij} &= \frac{1}{sum(\Omega^{-1})} \left[\sum_{k,k'} \omega_{kk'} - \sum_k \omega_{kk} \langle \mathbf{q}_k^i, \mathbf{q}_k^j \rangle - \sum_{k \neq k'} \omega_{kk'} \left(\langle \mathbf{q}_k^i, \mathbf{q}_k^j \rangle + \langle \mathbf{q}_{k'}^i, \mathbf{q}_{k'}^j \rangle \right) + \sum_{k \neq k'} \omega_{kk'} \langle \mathbf{q}_k^i, \mathbf{q}_k^j \rangle . \langle \mathbf{q}_{k'}^i, \mathbf{q}_{k'}^j \rangle \right] \\ &\approx 1 - \sum_k \frac{\omega_{kk}}{sum(\Omega^{-1})} \langle \mathbf{q}_k^i, \mathbf{q}_k^j \rangle - \sum_{k \neq k'} \frac{\omega_{kk'}}{sum(\Omega^{-1})} \left(\langle \mathbf{q}_k^i, \mathbf{q}_k^j \rangle + \langle \mathbf{q}_{k'}^i, \mathbf{q}_{k'}^j \rangle \right) \end{aligned} \quad \text{(D.1)}$$

From the previous equation we can first conclude that it is selfconsistent to consider as a rescaling parameter the term $sum(\Omega^{-1}) \equiv \sum_{'} \omega_{kk'}$. Moreover computing D_{ij} with equation (D.1) exploits only the country-level information $\mathbf{q}_k^i$; this allows to considerably reduce computation time (by a factor

[29] Polychoric correlations are used for ordered category data when the latent variable that forms the basis of the rating can be viewed as continuous. See e.g. Olsson (1979) and Drasgow (1988).

$N_i N_j \sim 10^6$) with respect to the initial equation which requires to compute all the interindividual distances. We also see that in the case of independent questions, ie. $\Omega = \mathbf{I}_{12}$, we get: $D_{ij} = 1 - \sum_k \langle \mathbf{q}_k^i, \mathbf{q}_k^j \rangle / 12$, in which case bilateral cultural distance is simply the average across the twelve questions of their fractionalization index.

Appendix E: List of selected questions

Question	Definition	Modalities
a025	With which of these two statements do you tend to agree? - Regardless of what the qualities and faults of one's parents are, one must always love and respect them. - One does not have the duty to respect and love parents who have not earned it by their behavior and attitudes. - Neither	3
a026	Which of the following statements best describes your views about parents' responsibilities to their children? - Parents' duty is to do their best for their children even at the expense of their own well-being. - Parents have a life of their own and should not be asked to sacrifice their own well-being for the sake of their children. - Neither	3
	Here is a list of qualities that children can be encouraged to learn at home. Which, if any, do you consider to be especially important?	
a029	- Independence	2
a030	- Hard work	2
a032	- Feeling of responsibility	2
a034	- Imagination	2
a035	- Tolerance and respect for other people	2
a038	- Thrift, saving money and things	2
a039	- Determination, perseverance	2
a040	- Religious faith	2
a041	- Unselfishness	2
a042	- Obedience	2

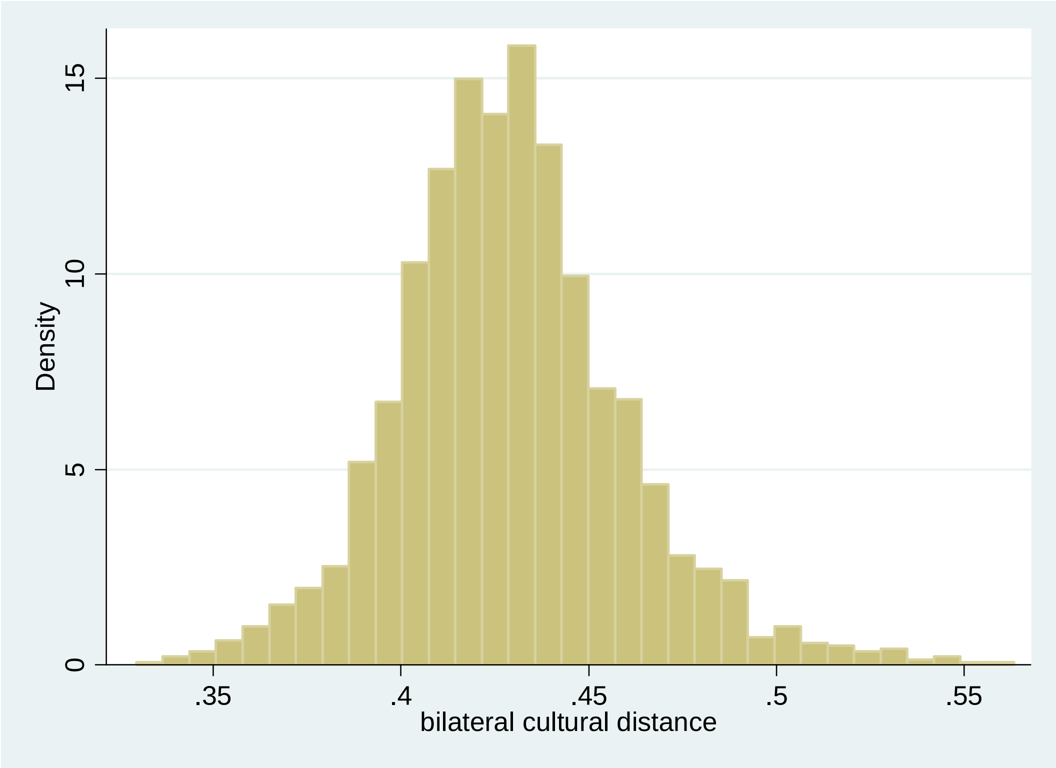


Table 1A: Sample Distribution of Bilateral Cultural Distance – 2000-2004

country pair	**Bilateral cultural distance**
NGA - ZWE	0.329
DNK - SWE	0.338
NGA -UGA	0.340
DZA - NGA	0.343
EGY - JOR	0.347
MAR - NGA	0.348
NLD - SWE	0.349
JOR - MAR	0.349
NGA -EGY	0.350
JOR - NGA	0.351
…	
JPN– DZA	0.531
JPN – UGA	0.532
JPN – ZWE	0.534
DNK – PAK	0.537
DEU – TZA	0.538
JPN – TZA	0.545
NLD – TZA	0.546
SWE – TZA	0.548
JPN – NGA	0.553
DNK – TZA	0.563

Table 1 B: the ten closest and most distant country pairs in the 4th wave of the WVS

Table 2: Impact of bilateral trade openness on bilateral cultural distance

	Dependent Variable: Bilateral Cultural Distance							
Estimator	OLS			2SLS				
Model	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ln bil. Openness [All Goods]	-0.100***	-0.182***	-0.118**	-0.518***	-0.434***	0.629	-1.213***	-2.736***
	[0.023]	[0.036]	[0.048]	[0.135]	[0.137]	[1.206]	[0.323]	[0.911]
ln bil. Openness [Cultural Goods]								-6.894***
								[2.524]
ln bil. Openness [Homogenous Goods]								0.271
								[0.155]
Sum of internal cultural dist.	0.303***	0.616***		0.615***	0.637***	0.638***	0.629***	0.584***
	[0.032]	[0.045]		[0.045]	[0.053]	[0.103]	[0.052]	[0.076]
Differential of GDP per cap	0.561***	0.077	0.117	0.209	0.233	0.109	0.237	0.380
	[0.039]	[0.134]	[0.123]	[0.158]	[0.182]	[0.220]	[0.197]	[0.270]
Ctry-pair phone call outflow (per capita)		-0.273***	-0.520***	-0.302***	-0.335***	-0.241	-0.296***	-0.242
		[0.086]	[0.170]	[0.089]	[0.102]	[0.183]	[0.095]	[0.133]
ln sum of FDI per capita		0.083	-0.001	0.122	0.149	0.158	0.097	0.110
		[0.128]	[0.233]	[0.129]	[0.158]	[0.199]	[0.147]	[0.179]
ln bil. migration		-1.174**	-0.856	-1.090**	-1.188**	-1.166	-0.834	0.683
		[0.547]	[0.548]	[0.548]	[0.557]	[1.952]	[0.515]	[0.818]
ln geo. distance	0.196***							
	[0.054]							
Common legal origins (dummy)	-1.512***							
	[0.103]							
Time dummies	yes	yes	yes	yes	yes	yes	yes	yes
Country pair FE (First Difference Estimator)	no	yes	yes	yes	yes	yes	yes	yes
Country*time FE	no	no	yes	no	no	no	no	no
# observations	3851	719	719	719	497	222	732	574
R^2 (within R^2 in columns 2 and 3)	0.239	0.228	0.565					
F-test on IV				19.7	16.8	7.73	23.1	9.86
Overidentifying Restrictions (P-value)				0.157	0.349		0.704	0.301

Notes: ** significant at 5%; *** significant at 1%. Standard errors clustered by country pair. For readability purposes, all coefficients are multiplied by 100 except for *ctry-pair phone call outflow* and *ln bil. migration* where the coefficients are multiplied by 1000. Time dummies are not reported. The sources for trade flows are DoTS in col. 1-6 and COMTRADE in col. 7-8. Columns 1-3 present OLS estimates. Columns 4-8 present 2SLS estimates. The variable *ln bil. openness [All Goods]* is instrumented with *bilateral remoteness* and *bilateral contagion* (except in col. 6). All the first stage regressions are reported in table 3. We control for country-pair fixed effects by estimating the model in first differences. In columns 5 and 6, the sample is restricted to country-pairs experiencing respectively an increase or a decrease in *ln bil. openness [All Goods]* .

Table 3: First Stage regressions

	Dependent Variable: ln bil. Openness [all goods]				
Model	(1)	(2)	(3)	(4)	(5)
bilateral remoteness	3.435***	3.776***	-1.155**	1.449***	1.020***
	[0.608]	[0.716]	[0.508]	[0.340]	[0.291]
bilateral contagion	0.120**	0.109*		0.069*	0.058**
	[0.053]	[0.064]		[0.038]	[0.030]
ln bil. Openness [Cultural Goods]					0.104***
					[0.022]
ln bil. Openness [Homogenous Goods]					1.020***
					[0.321]
Sum of internal cultural dist.	0.019	0.028	-0.028	0.009	-0.019
	[0.029]	[0.039]	[0.021]	[0.021]	[0.017]
Differential of GDP per cap	0.281***	0.368***	0.014	0.108	0.122*
	[0.104]	[0.137]	[0.075]	[0.075]	[0.063]
Ctry-pair phone call outflow (per capita)	-0.075	-0.199**	0.067	-0.003	0.043
	[0.068]	[0.082]	[0.061]	[0.048]	[0.036]
ln sum of FDI per capita	-0.010	0.059	0.048	-0.072	-0.080
	[0.087]	[0.112]	[0.067]	[0.062]	[0.050]
ln bil. migration	-0.425	-0.929*	-0.689	0.156	0.448*
	[0.500]	[0.538]	[0.827]	[0.362]	[0.259]
Time dummies	yes	yes	yes	yes	yes
Country pair FE (First Difference Estimator)	yes	yes	yes	yes	yes
# observations	719	497	222	732	574
R^2	0.233	0.276	0.041	0.077	0.088
F-test on IV	19.7	16.8	7.73	23.1	9.86
Overidentifying Restrictions (P-value)	0.157	0.349		0.704	0.301

Notes: * significant at 10%; ** significant at 5%; *** significant at 1%. This table reports the first stage estimates of the 2SLS specifications presented in table 2. For readability purposes, all coefficients are multiplied by 100 except for *ctry-pair phone call outflow* and *ln bil. migration* where the coefficients are multiplied by 1000. Time dummies are not reported. The sources for trade flows are DoTS in col. 1-3 and COMTRADE in col. 4-5.

Table 4: Robustness Checks

	Dependent Variable: Bilateral Cultural Distance											
							Bilateral cultural distance based on:					
	2SLS with ctry-pair FE (column 4, table 2)	IV: bil. remoteness only	IV: bil. contagion only	add. control: ctry pair cable TV and Internet access	add. control: general. Trust	2SLS with Ctry-pair FE: Within Estimator	Weighted index	30 questions	50 questions	*General. Trust* (WVS code: a0165)	*Feeling of Happiness* (WVS code: a008)	*Belong to a religious denomination* (WVS code: f024)
model	Benchmark	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
ln bil. openness	-0.518***	-0.488***	-0.773***	-1.725**	-0.517***	-0.535***	-0.462***	-0.309**	-0.731	-0.362**	-0.694**	-2.597***
	[0.135]	[0.134]	[0.261]	[0.827]	[0.137]	[0.101]	[0.134]	[0.141]	[0.526]	[0.181]	[0.320]	[0.652]
# observations	719	719	719	475	719	1778	719	507	364	920	719	804

Notes: ** significant at 5%; *** significant at 1%. Standard Errors clustered by country pair. All specifications correspond to robustness checks of our benchmark 2SLS panel regression (column 4, Table 2). For readability purposes, we report only the coefficient (multiplied by 100) of our main variable of interest *ln bil. openness* . Column 0 reports our benchmark result. The variable *ln bil. openness* is instrumented with *bil. remoteness* only in column 1; with *bilateral contagion* only in column 2. We control for *country-pair internet access* and *country-pair coverage by cable TV* in column 3; we control for *country-pair level of trust* in column 4. In column 5 the model is estimated using the Within estimator rather than a first diff. estimator. In columns 6-11, we consider alternative definitions of bilateral cultural distance.

Table 5: Impact of bilateral trade openness by subgroups of individuals

Dependent variable	Bilateral Cultural Distance		
Estimator	2SLS		
The Subgroup of reference is:	*Young*	*Rich*	*Urban*
Model	(1)	(2)	(4)
ln bil. Openness [All Goods]	-0.33***	-0.33***	-0.31***
	[0.07]	[0.08]	[0.09]
ln bil. Openness [All Goods] * *Subgroup of Reference*	-0.32***	-0.31***	-0.19***
	[0.06]	[0.06]	[0.07]
Subgroup of reference	-0.02***	-0.02***	-0.02***
	[0.00]	[0.00]	[0.00]
Sum of internal cultural dist.	0.62***	0.67***	0.46***
	[0.03]	[0.03]	[0.03]
Differential of GDP per cap	0.10	0.10	0.21
	[0.09]	[0.09]	[0.12]
Ctry-pair phone call outflow (per capita)	-0.30***	-0.28***	-0.04
	[0.02]	[0.04]	[0.03]
ln sum of FDI per capita	-0.18**	-0.22**	-0.17
	[0.07]	[0.10]	[0.10]
ln bil. migration	-0.25	-0.43	-0.48
	[0.34]	[0.34]	[0.40]
Time dummies	yes	yes	yes
Country pair FE (Within Estimator)	yes	yes	yes
# observations	3720	3078	1805
Nb of country pairs	895	755	469
R^2 (within R^2 in columns 2 and 3)			
F-test on IV	122	98.9	62.2
Overidentifying Restrictions (P-value)	0.208	0.823	0.546

Notes: ** significant at 5%; *** significant at 1%. Standard errors clustered by country pair. For readability purposes, all coefficients are multiplied by 100 except for *ctry-pair phone call outflow* and *ln bil. migration* where the coefficients are multiplied by 1000. Time dummies are not reported. The variable *ln bil. openness [All Goods]* is instrumented with *bilateral remoteness* and *bilateral contagion* .
Reference sub-groups: Individuals belong to the sub-group:
- "young" if they are between 15 and 29 years old (=respond 1 for question x003r2)
- "rich" if they belong to the upper 50% of the income distribution (question x047)
- "urban" if they live in a city with more than 20'000 inhabitants (=respond 5, 6, 7 or 8 for question x049)

Figure 1: Phase Diagram in the case σ>1+ω²

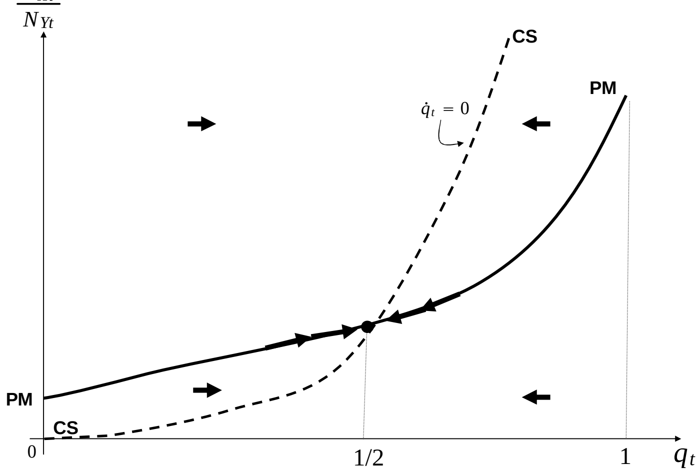


Figure 2: Phase Diagram in the case σ<1+ω²

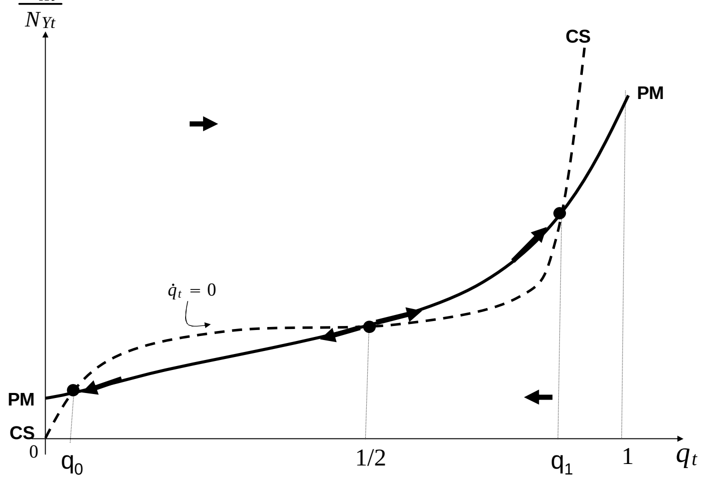


Figure 3: Trade Openness in the case σ>1+ω²

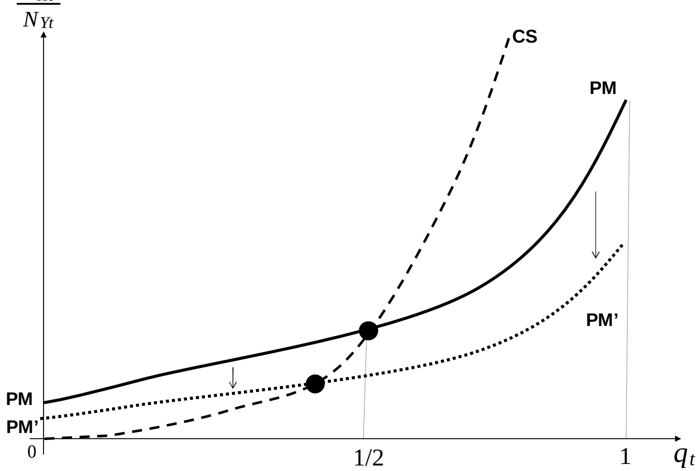


Figure 4: Trade Openness in the case σ<1+ω²

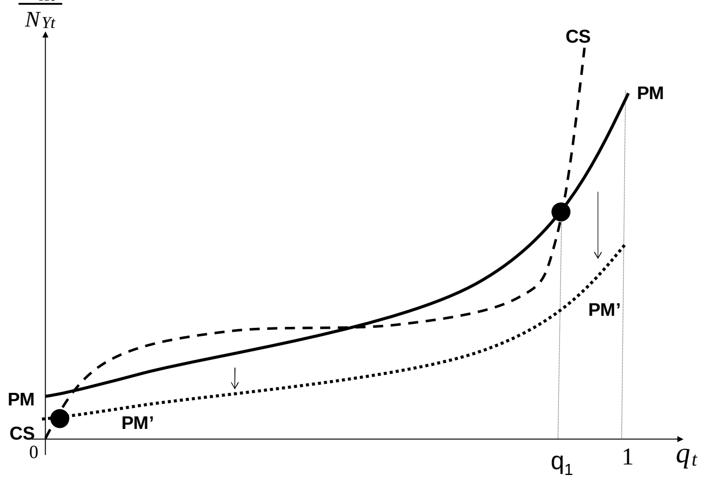
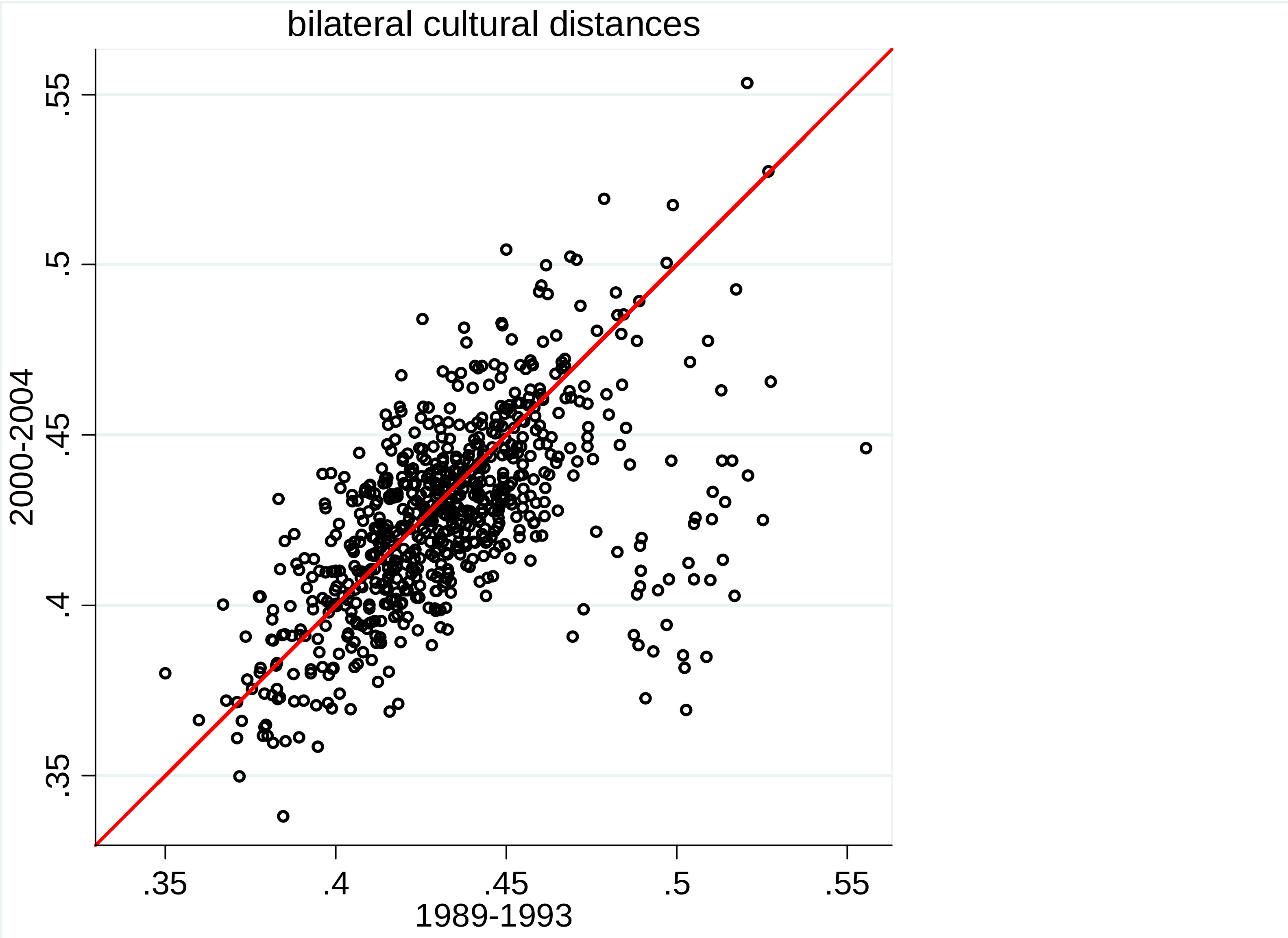


Figure 5



bilateral cultural distances
2000-2004
.35
.4
.45
.5
.55
.35
.4
.45
.5
.55
1989-1993