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. First, we build a direct measure of cultural distance across countries based on answers to the World Values Survey. We show that bilateral cultural distances exhibit significant time variation: the standard deviation of changes in cultural distances over a 10 year period is almost equal to one third of the cross-sectional standard deviation. Second, using insights from other branches of social sciences, we build a model that ties culture to consumption. Our three main theoretical predictions are: (i) bilateral trade reduces bilateral cultural distance; (ii) the effect is strongest for more differentiated products; (iii) there is path-dependency. Third, we test the model using a sample of 79 countries over the 1980-2004 period. Using an instrumental variable approach and including various time and country-pair fixed effects, we find that a one standard deviation increase in bilateral trade openness translates into a 62% standard deviation decrease in bilateral cultural distance.

Keywords: culture, consumption, persistence, trade
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1. Introduction

What are the effects of globalization and market integration on culture? 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, regions and countries? These questions are at the heart of some of the current debates on globalization. For instance, the "persistence" view of culture is vividly illustrated by Samuel Huntington's provocative book "*The Clash of Civilizations and Remaking of World Order*" (1996) which emphasizes the resilience and lasting differences of cultural values between Western and non-Western civilizations, and the resulting economic, political and social tensions that this will create. On the other hand, the "cultural convergence" view is underlying the anti-globalization movements' and NGOs' claims that market integration erodes national cultures and individual identities, and leads towards world-wide homogenization. According to that perspective, Weberian rationalization and strive for economic efficiency lead to standardization of production and consumption and synchronization of cultural processes across the world. "*Mc Donalization*" and "*Coca-colonization*" as expanded for instance by the sociologist George Ritzer (1993, 2002) are typical variations on this theme. Taking a longer run historical perspective, other social scientists take a third "in-between" perspective recognizing cultural evolution as the result of constant mixing and recomposing. They acknowledge that globalization generates new cultural forms through a process of creolization, syncretism or metissage (Nederveen Pieterse 2004) or creative destruction (Cowen 2002).

While social scientists have abundantly discussed the possible effects of globalization on the evolution of cultural values, economists have been much less involved in these discussions. As a matter of fact, the standard economic perspective takes culture as exogenous and concentrates its focus on the implications of particular preferences or cultural profiles on the organization of economic activities and market institutions. Hence for instance, the recently fast growing literature on culture and economics enlights the role of *values* such as trust or religiousness on economic development and international trade (Guiso, Sapienza and Zingales 2007 , 2008a and 2008b) and the evolution of economic and political institutions (Tabellini 2007). Given its emphasis on the causality from culture to economic activities, this literature remains silent on the role of market integration on cultural persistence or convergence across nations.

The purpose of this paper is to fill this gap and to analyze the effect of international trade on the evolution of cultural values across individuals and countries. In this respect, we make three contributions to the literature on culture and economics. First, we provide a simple theory that embedds a standard international trade monopolistic competition model a-la-Krugman within a framework tying consumption patterns to cultural values, and their endogenous evolution across individuals and countries. The model generates two main implications: bilateral trade reduces bilateral cultural distance and the effect is strongest for more differentiated products.

Second, we build a direct measure of cultural distance across countries based on answers to the

World Values Survey and we show that bilateral cultural distances exhibit significant time variation.

Third, we test the implications of our model using a sample of 79 countries over the 1980-2004 period and find that bilateral trade openness contributes significantly to a reduction in bilateral cultural distance. The conclusion we draw from our analysis is that, unlike the premise of the existing literature on culture and economics, culture is not an exogenous factor shaped by chance and history. Our results instead 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. To the best of our knowledge, we are the first paper to both directly test the degree of persistency in values and culture and to try to identify some of its macroeconomic determinants[1]. Our paper therefore helps to fill the gap between economists and other social scientists who long recognized that shifts in the economic environment can cause long-run cultural changes.

Our theoretical framework has three main building blocks. First, we acknowledge the fact that individuals are endowed with different clusters of cultural values along which they define their identity and self concepts, and that these cultural values can be tied to consumption patterns. Building on the insights from the literature in Anthropology and Consumer Research, we assume that consumer goods have a significance that goes beyond their utilitarian character and functional characteristics. Indeed, consumer goods may also carry and communicate cultural and symbolic meaning, and individuals are more likely to consume goods that reflect their own values and self-image.

Second, we consider a standard Krugman-type supply side of the economy under which firms can produce differentiated products under monopolistic competition. Consistent with the marketing literature, we assume that firms instill symbolic meaning in their product/brand and can choose the value cluster on which to anchor their product in order to maximize profits. The market size of given cultural values cluster in society will therefore determine the number of products/brands of each cluster.

Finally, to analyze cultural convergence and persistence, we integrate this amended model of monopolistic competition into a dynamic model of cultural transmission. More precisely, building on the recent economic literature on cultural evolution, we model transmission of values as a dynamic micro-founded process of parental or peer socialization à la Bisin and Verdier (2001). Parents are altruistic with respect to their offsprings but can only imagine the welfare of their children through the filter of their own preferences/values, which provides them with incentives to socialize their children to their own preferences/values. Through this mechanism, the long-run distribution of values within the economy is determined in part by the supply of differentiated goods associated with each type. As a consequence, any supply shock driven by trade openness can have a long-run effect on values.

[1] Tabellini (2007) shows that lagged trust is an economically and statistically significant predictor of current trust. However, as suggested by our results, this finding does not suffice to conclude that "trust changes slowly over time". Guiso, Sapienza and Zingales (2007) identify microeconomic determinants of trust but do not investigate macroeconomic determinants of the time variation in the variable

In particular, goods market integration between two countries is shown to cause a decrease in the bilateral cultural distance as defined in our empirical analysis. The effect is shown to be larger for more differentiated products. Most strikingly, a temporary increase in trade openness in goods with low elasticities of substitution may have a permanent effect in the distribution of values in the economy.

Next, to empirically assess the pattern of cultural evolution internationally, we construct a direct measure of bilateral cultural distance across countries using responses to the World Value Survey. As the World Value Survey has been conducted for four different waves during the 1980-2004 period, our measure contains both a cross-sectional (up to 952 pairs of countries) and a time-series dimension. It is also significantly correlated with measures used in the literature on culture and economics briefly surveyed above. Thanks to the panel nature of our data, we are able to compare directly the extent to which cultural distance vary through time for a same pair of country to the extent to which cultural distances vary across countries for a same time period. Our results point toward significant time variation in bilateral cultural differences: the standard deviation of changes in cultural distances over a 10 year period is equal to 31% of the cross-sectional standard deviation. Put differently, this suggests that it may take only slightly more than 30 years for the two countries furthest away from each other in our sample (Tanzania-Denmark) to become as close as are today the two countries closest to one another (Sweden-Denmark).

These numbers suggest that culture and values exhibit significant time variation and point to the possibility that this time variation is driven by economic determinants. That is, the possibility of reverse causality, from economics to culture rather than from culture to economics. To investigate this issue and the empirical implications of our theoretical framework, the following section of our paper aims to test the causal link from trade integration to reduction of bilateral cultural distance using panel data estimation. To properly capture the causal link from trade to culture, we implement an Instrumental Variable strategy using economic remoteness at the country-pair as an instrument for trade. We control for fixed country-pair and time effects. We also control for information flows across country using data from the International Telecommunications Union (ITU).

Our points estimate suggest that a one standard deviation increase in bilateral trade openness translates into a 62.2% standard deviation decrease in cultural distance. We next test the prediction of our theoretical model about the role of product differentiation in the impact of trade on culture. Using the Rauch (2001) classification between homogenous vs differentiated products, we show that the impact of trade on culture is solely driven by trade in differentiated products. Finally, we provide evidence suggesting that the effect of trade openness on culture displays non-linearities and histeresis, as predicted by the model.

From a theoretical economics standpoint, our work is related to work by Van Ypersele and François (2001), Bala and Van Long (2004), Janeba (2004) and Rauch and Trindade (2005) who study the optimal trade protection in presence of heterogenous preferences over differentiated goods (interpreted

as cultural diversity) in a context of imperfectly competitive markets. All these papers however 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 that, the model in this paper is closest to Olivier, Thoenig and Verdier (2008), from which it differs in that Olivier, Thoenig and Verdier focus on the properties of a perfectly competitive trade in cultural goods, where cultural goods are defined as goods that can be used to build social networks.

At a more general level, this paper provides also 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 approach, 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 school of thought emphasizes instead the role of culture, and more specifically the role of *values* such as trust, social capital or religiousness. Representative papers of that second school are Guiso, Sapienza and Zingales (2006, 2008a, 2008b). 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. However, cross-sectional regressions are especially sensitive to endogeneity and missing variable biases[2]. Our results point out that cultural values can also be significantly and quickly endogenous to economic activities and supply side shocks of the economy. All in all, this suggests that the long run pattern of economic performances, cultural values and institutions can perhaps be best viewed as a co-evolutionary 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. Reviewing first some anthropology, consumer and marketing research on the topic, we discuss in section 2 our basic assumption that consumer products have cultural meaning which can be framed by firms to be in congruence with consumers' self-concepts and identity perceptions. Then, we propose a simple model of time-varying culture in Section 3, where we derive testable implications on the impact of trade on culture. We present the data and show evidence of time variation in culture and values in Section 4. We test the implications of the model using panel data analysis in Section 5. Finally, we conclude in Section 6.

[2] 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.

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 consumer goods. These ideas build on a well established tradition in Anthropology and Consumer Research 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). Salhlin's influential work (1976) of the symbolism of North American consumer goods shows for instance how consumption of food and clothing items can be directly related to specific cultural categorizations of individuals going beyond pure functionality. As noticed by Holman (1981), and Solomon (1983), products are symbols by which individuals convey information about themselves to themselves and to others.

Similarly, 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. According to him, the initial location of cultural meaning resides in a "*culturally constituted world*" that provides the set of abstract patterns through which culture helps human beings get meaning from the experiences in which the phenomenal world presents itself to their senses. Two major concepts then characterize cultural meaning: "cultural categories" and "cultural principles". "Cultural categories" represent the basic distinctions and discrete parcels that a culture uses to divide up the phenomenal world. Hence for instance in most cultures, categories of time, space, nature and person provide a system of distinctions that allow individuals of a specific group to have a vision of the world. "Cultural principles" on the other hand define organizing values and ideas by which cultural categorizations have to be distinguished, ranked and interrelated. Together, "cultural categories" and "cultural principles" determine how human beings get an intelligible sense of their phenomenal world and help them organize and construct their actions in this world. They are however abstract concepts and need to be substanciated through materialization. In this respect, material goods are seen as opportunities to express the categorical and organizational schemes established by a given culture.

As noticed by Mc Cracken (1986a), the transfer of cultural meaning from the "*culturally constituted world*" to consumer products may occur through advertising and product design. More specifically, advertising is viewed as a process that ties a consumer good to a representation of the "*culturally constituted world*" in such a way that the individual glimpses an essential similarity between them. When associated to characteristics perceived as positive in the *"culturally constituted world"*, this association increases the propensity to consume the product.

On a more quantitative side, marketing research has also dealt with the causal links between consumption patterns and values and culture. Since the seminal paper of Belk (1988), researchers on consumer behavior have investigated what is called the "extended self", that is the notion that "who we are is what we have" and found evidence for the fact that agents use their consumption patterns not only as a way to satisfy their desires, but also as a way to signal and define their identity across

different consumption domains (Berger and Heath 2007).

In particular, two findings from the marketing literature are worth stressing. First, it is well established that with respect to the symbolic meaning of products, self-congruence is an important factor in directing consumer preferences. Motivated by self-consistency, consumers prefer products that have a symbolic meaning ("product user- image") consistent with their identity, values and self-concepts. Hence for instance the so-called Self-congruity theory (Sirgy 1982) that suggests that consumers compare their self-concepts with the product-user image of a product, has found supporting evidence in various domains (Ericksen and Sirgy 1989, Heath and Scott 1998, Hong and Zinkhan 1995, Malhotra 1988).

The self congruence effect goes beyond the consistency with product user-image, and has also been found with respect of "brand personality" and "product personality"; that is consumers prefer brands or products which share their "personality" characteristics as framed by firms (Aaker 1997, Govers and Schoormans 2005). This has obviously consequences for brand image management. It suggests that firms tend to take this dimension into account in their marketing strategies.

The literature on international marketing points to various elements in that direction. For instance, using a survey of marketing managers in the blue jean and athletic shoes sector covering 10 countries/60 regions, Roth (1995) examines the linkages between brand image strategies, cultural and socio-cultural factors and market shares in international markets. Applying Hofstede's (2001) influential classification of cross-cultural value systems along several components that can be related to consumer needs and brand images (power distance, uncertainty avoidance and individualism), the study emphasizes how international marketing performances are sensitive to the country specificities along the cultural "power distance" and cultural "individualism" dimensions[3] .

A second interesting point underlined by the marketing literature is the fact that with technological improvements and systematic quality controls across industries, the symbolic dimension of goods becomes also increasingly important. Citing Berger and Heath (2007): "*The symbolic meaning of products has become increasingly important. 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.*"

To summarize, our reading of the anthropological and marketing literature suggests that:

1) Consumer goods convey more than their functional value and are also associated to cultural meanings. They reflect symbols by which individuals convey information about themselves to themselves and to others.

2) The process of transfer of cultural meaning to consumer products goes through advertising and product design. It is all the more important that goods can be differentiated along dimensions that

[3]See also Lynn, Zinkhan and Harris (1993) for a another example of application of the Hofstede concepts to consumer behavior.

go beyond pure technical and functional characteristics.

3) Motivated by self-consistency, consumers prefer products that have a symbolic meaning consistent with their identity, values and self-concepts.

4) This self-congruence to personal values is influencing the pattern of marketing strategies of firms in global markets.

In the next section, we include some of these elements in our model of trade and cultural evolution.

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. Following the insights from the literature in anthropology and marketing reviewed in the previous section, the second ingredient of our model is the assumptions that: a) different sets of values are embedded in different types of differentiated goods; b) that agents of a given culture have preferences which are biased toward the set of goods that conveys the values of their culture. Also we assume that: c) upon entry, firms do marketing and instill into products cultural meaning consistent with one particular set of values. Finally the last ingredient of our model considers preferences as evolving over time according to a process following the lines of micro-founded models of imperfect altruism.

3.1. Preferences, cultural meaning and technology

The Demand side:

We assume that individuals care about two things: consumption and cultural attributes. Consumption generates the standard functional economic utility. Cultural attributes derive from the conceptualizations of the "culturally constituted world" that each individual has. Following the marketing literature [4], we assume that one can decompose the space of the "culturally constituted world" along a finite set of cultural categorizations and/or cultural principles ("principal cultural components"). A particular "cultural profile" is then simply defined as a convex combination/cluster of these components. At each date t, we assume that there are two "cultural profiles" X and Y and two types of individuals in society associated to these profiles. At a date t, type X (resp. type Y) agents

[4] For instance, Hofstede (2001) provides a well known classification of culture systems. Studing attitude surveys from executives in the IBM corporation from all over the world, it considers a classification of cultural components along 4 main components that can explain the observed cultural variation: "power distance" (ie. conceptualizations of status, authority and inequality), "Uncertainty Avoidance" (ie.conceptualization of time and uncertainty), "Individualism and Collectivism" (conceptualization of the individual versus group relationships), "Masculinity and Feminity" (conceptualization of sex and gender relationships).

represent a share q_t of the population (resp. $1-q_t$). We introduce then our two basic assumptions on the demand side:

- a) *Cultural meaning assumption :* Each "cultural profile" can be embedded in a set of differentiated goods.

- b) *"Self congruence" assumption :* Agents associated to a given "cultural profile" have preferences which are biased toward the set of goods that is consistent with this "cultural profile".

Formally, we capture the "cultural meaning assumption" by assuming that there are two types of goods: X and Y. Goods of type X are associated with "cultural profile" X while goods of type Y are associated with cultural profile" Y.

The "self-congruence" assumption is captured by assuming that individuals have Cobb-Douglas preferences of the following type:

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

with $\omega \in (0,1)$, which implies that each individual has preferences biased toward the good of her type. 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. ω is a bias parameter that captures the strenght of the "self-congruence" assumption. The stronger "self-congruence", the larger ω.

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 (resp. p_y) is the price of a variety x of X (resp..y of Y) After standard computations, the solution of this problem provides:

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

where the aggregate price index for each composite good $c \in \{X,Y\}$ is given by: $P_c = (\int_0^{N_c} p_{c,i}^{1-\sigma} di)^{1/(1-\sigma)}$. Recalling that the current fraction of individuals of type X is equal to q, aggregate demands for a particular variety $x \in (0, N_X)$ and $y \in (0, N_Y)$ are given by:

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

The supply side:

We assume that the production of one unit of a variety of a good of either type requires one unit of labor, after a fixed labor cost F has been paid to start production. Monopolistic competition prevails on the product. We assume moreover that upon entry, firms decide how to do "marketing" that attaches to their product some cultural meaning consistent with one particular set of values X or Y[5]:

- c) *Marketing assumption*: After entry, firms tie their product to a cultural profile (X or Y) that maximizes their profits.

Finally, we also assume that entry and exit (and therefore the number of varieties N_X and N_Y that are tied to a particular "cultural profile") adjust instantaneously within each period t, such that profits are equal to zero, which captures in a stylized way the idea that the 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 of agents of type X, q_t. 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 (Boyd and Richerson, 1985, Cavalli-Sforza and Feldman, 1981). 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, over time the distribution of preferences across agents evolves and reaches a long run stationary state. In Appendix A we show that the law of motion of q_t is simply given by:

$$\dot{q}_t = q_t(1 - q_t)(\tau_X - \tau_Y) \tag{3.4}$$

where $(\tau_X - \tau_Y)$ is the differential between the optimal efforts of preferences transmission by parents of types X and Y. This effort has a convex cost that we assume quadratic $\tau^2/2$.

The process of preferences transmission results from the direct effort of parental transmission; but, in case of failure, it depends on indirect contamination from the rest of the society. More precisely with probability τ_c the offspring is directly socialized by her parent of type c; otherwise with probability

[5] We assume that the "marketing" cost is included in the fixed cost of entry and is the same across the different "cultural profiles" X and Y.

[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.

$(1-\tau_c)$ she remains naive and gets socialized by another old generation individual of type c by random matching with conditional probabilities $(q_t, 1-q_t)$. Consider now $V_t^{cc'}$, the expected welfare derived from the optimal consumption behavior of an agent of type $c' \in \{X, Y\}$ *as perceived through the preferences* of an agent of a type c. When offsprings are of a different cultural type c', parents of type c incur a utility cost, ΔV^c to see their kids different from them which is equal to: $\Delta V_t^c = V_t^{cc} - V_t^{cc'}$. As a consequence each parent of type c chooses an optimal effort of transmission which is given by $\tau_c = \arg\max_\tau \{P_c V_t^{cc} + (1-P_c) V_t^{cc'} - \tau^2/2\}$ where $P_c = \tau_c + (1-\tau_c) q_t$ is the probability that a parent of type c successfully transmits her preference to her offspring. Solving this maximization problem yields the optimal efforts of transmission for parents of type X and Y :

$$\tau_X = \Delta V_t^X (1-q_t) \text{ and } \tau_Y = \Delta V_t^Y q_t \tag{3.5}$$

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 simple 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.

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 convergence in the long-run.

3.3.1. Product market equilibrium

Each monopolistic firm producing a given variety $i \in \{x, y\}$ is maximizing profits and imposing a constant mark-up on 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 also implies that firms at the equilibrium will be indifferent into marketing their product to the "cultural profile" X or Y. Combining this three expressions yield the equilibrium number of each variety X, Y at each date t :

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

The number of varieties N_X of cultural good X is increasing in the fraction q_t of individuals having a preference bias for that good. Conversely, the number of varieties N_Y of good Y is decreasing in this

fraction q. Intuitively, a larger q implies a larger market size for good X (resp. a smaller market size for good Y), which in turn help sustain more varieties of good X (resp. less varieties of good Y).

3.3.2. Phase diagram

From (3.5) we need to evaluate the utility costs functions ΔV^X and ΔV^Y in order to characterize fully the dynamics of preferences. Substituting the equilibrium price $p_i = \sigma/(\sigma-1)$ into the optimal consumptions (3.2) yields the equilibrium demands of agents each type. Substituting the equilibrium demands into the preference functions (3.1) then yields:

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

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

where $\bar{\omega} = \left(\frac{1+\omega}{2}\right)^{\left(\frac{1+\omega}{2}\right)}\left(\frac{1-\omega}{2}\right)^{\left(\frac{1-\omega}{2}\right)} - \left(\frac{1-\omega}{2}\right)^{\left(\frac{1+\omega}{2}\right)}\left(\frac{1+\omega}{2}\right)^{\left(\frac{1-\omega}{2}\right)}$ is a positive parameter

Collecting (3.4), (3.5), (3.7), and (3.8) (and recognizing the full dependence on time t) we can write down the dynamics of preferences as:

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

The interpretation of (CS) is straightforward: the dynamics of q_t result of the opposition of two forces. The first force, that we label *relative-variety effect*, is supply-driven: the larger is the relative supply of varieties of good X, the more "painful" it is for a parent of type X to see his child adopt preferences of type Y. This naturally raises the incentives of parents of type X to socialize their children, and has the opposite effect on parents of type Y. Thus, the larger is the ratio N_{Xt}/N_{Yt}, the larger is $\dot{q}_t$. The second force at play, that we label *cultural resistance effect*, is driven by the socialization process: if parents do not socialize their child, the choice of preferences by the child occurs by a process of imitation of other agents in the economy. The larger is the relative weight of agents of type X relative to agents of type Y, $q_t/(1-q_t)$, the more likely it is that a child left unsocialized by his parents adopts preferences of type X. As a consequence, the larger is $q_t/(1-q_t)$, the less (resp. the more) parents of type X (resp. of type Y) have incentives to socialize their children ex-ante, and therefore the lower is $\dot{q}_t$.

Insert Figure 1 and Figure 2

We are now able to 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 an equality in equation (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}.

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 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, due to the standard size effect as found in many monopolistic competition frameworks, an increase in q_t corresponds to a relative increase for the market of good X which translates into a relative increase in entry on the X market and implies that N_{Xt}/N_{Yt} has to increase.

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

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

It is straightforward to observe that $q = 1/2$ 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. This is because the *relative-variety effect* is stronger when the elasticity of substitution is small and agents have strong preferences for variety. Then, a small shock to the number of varieties has a large impact on incentives of parents to socialize their children, which in turn has a large impact on future demand, which causes further change in the demand of varieties. Consequently, the steady state $q = 1/2$ is unstable. There instead exist two stable steady-states corresponding to each type of agent becoming the majority type in the population. By way of contrast, if the elasticity of substitution is large enough, *relative-variety effect* is weaker than the *cultural resistance effect:* the effect on incentives of parents to socialize their kids caused by a shock to the number of varieties is compensated by an increase in free-riding. Consequently, the steady state $q = 1/2$ is the only stable steady-state.

We formalize this intuition 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.

Note as well from proposition 1 that the likelihood of multiple long run cultural steady states is increased with the size of the parameter of "self-congruence" ω. The stronger the "self-congruity" effect of culture on consumption patterns, the stronger the *relative-variety effect* in the dynamics of cultural transmission, and the more likely that the economy will end up in a stable asymmetric long run equilibrium.

3.4. Trade Integration

We now consider trade integration between two identical economies, labelled as the domestic economy and the foreign economies. The foreign economy can produce two types of composite goods: X^* and Y. We assume that goods of type X^* (resp. X) are associated with some specific foreign (resp. domestic) "cultural profiles" while goods of type Y are associated to a "cultural profile" common to both countries[7].The size of each economy is normalized to 1.

We first consider the case where $\sigma \geq 1 + \omega^2$. Under this assumption, both economies have the same autarky steady state $q^{aut} = q^{*aut} = 1/2$. We assume that 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. The cultural dynamics in each country follow a process similar to the autarky case. The utility costs functions are unchanged and the law of motion of q_t is still characterized by equation (CS). Hence the cultural stationarity condition (CS) is unchanged.

Insert Figures 3 and 4 Here

The analysis of the product market equilibrium is considerably simplified by the assumption of complete symmetry of the two countries, which implies that we have at any date t: $q_t = q_t^*$. The aggregate demands of varieties of local goods in each country is similar to its autarkic value: $D_X = D_{X^*} = [1/2 + \omega(q - 1/2)]P_X^{(\sigma-1)}p_x^{-\sigma}$. The aggregate world demand for each variety of the global good Y takes the same form than in autarky except that now it is aggregated across both countries: $D_Y = 2[1/2+\omega(1/2-q)]P_Y^{(\sigma-1)}p_y^{-\sigma}$. Under constant mark-up on marginal cost, the free entry conditions on each market lead to the equilibrium number of varieties and this gives the counterpart of the Product

[7] Those are the minimum assumptions that allow us to discuss cross country convergence or persistence in a simple two-cultural trait dynamic model. To have a model that endogenously generates a mixed "cultural profile" common to both countries would imply a dynamic cultural model with at least three traits: one specific to each country and a mixed trait coming from the combination of the two specific ones. We leave this to future research.

Market (PM) condition[8]:

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

Where the "int" superscript refers to the integrated world equilibrium. Comparing (PM') with (PM), one can directly observe that, *for a given* q_t, the relative number of varieties of the good Y compared to good X is larger after trade integration than under autarky. This is due to the usual market size effect present in trade models à la Krugman (1979). Here however, this effect is reinforced by a feedback effect on the distribution of preferences in the economy and thus on aggregate demand. As represented on Figure 3, the downward shift of the product market curve from (PM) to (PM') induces a shift in the incentives for parents of each culture to socialize (more incentives for parents who have preferences biased toward the "common" goods, less for parents with preferences biased toward the "local" goods) and thus brings down the steady-state value of q_t. As can be easily seen on Figure 3 as well, the effect of trade integration on the long-run distribution of preferences depends on the slope of the (CS) curve around the point $q_t = 1/2$. The value taken by this slope can in turn be tied to the value of the elasticity of substitution σ. This observation drives the following proposition:

Proposition 2*: Suppose* $\sigma \geq 1+\omega^2$. *Then:*
(i) Trade openness brings down q
(ii) *The elasticity of q to trade openness decreases with* σ *as we have:*
$\mid q^{int}/q^{aut} - 1 \mid \simeq [4(\sigma-1)/\omega - 4\omega]^{-1}$

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 the elasticity of substitution, the stronger is the relative variety effect and the more a given shock to the available number of varieties of good Y reinforces the incentives of parents of type Y to socialize the children. Thus, the more differentiated are the traded products, the more trade will weaken the local culture.

The most extreme case is the case where σ is so low that the condition $\sigma \geq 1+\omega^2$ fails to apply. We have shown in the previous section that this case corresponds to the case where we have multiple equilibria under autarky. Two possibilities must then be considered. Either the economy had converged to the low q steady-state or it has converged to the high q steady-state under autarky. As depicted in Figure 4 below, the two possibilities imply qualitatively different effects of trade openness on culture. Trade openness implies that the (PM) curve shifts to the (PM') curve. If the economy was initially in the low q equilibrium, then trade openness implies a continuous decrease in q, as

[8] With trade integration, firms may choose to instill cultural meaning consistent with the home specific "cultural profile" X , the foreign specific "cultural profile" X^* or the "common" "cultural profile" Y. In equilibrium with free entry, it is again easy to see that they will be indifferent between the three options as $\pi_X = \pi_X^* = \pi_Y = F$. These conditions in turn provide the equilibrium number of product or brands $N_{Xt} = N_{X^*t}$ and N_{Yt} tied to the three "cultural" profiles X, X^* and Y.

described in Proposition 2. If the economy was initially in the high q equilibrium however, then trade openness implies a discrete jump to the low q equilibrium, which constitutes the only equilibrium of the integrated world.

These observations have a number of intriguing implications. First, it reinforces our previous conclusion that the more differentiated the products, the more trade openness will weaken local cultural profiles. It indeed suggests a strong non-linearity in that relationship. Second, our analysis suggests that the relationship between trade openness and culture exhibits histeresis: once an economy has opened to trade and shifted to a low q equilibrium, stability of that equilibrium ensures that the economy will stay "trapped" in this equilibrium even if it were to close to trade.

3.5. Testable implications

The central variable in the empirical analysis that follows is the bilateral cultural distance, defined as the probability that two randomly picked up individuals in two different countries do not share the same cultural traits. This variable can be easily mapped to variables of the model. In our model indeed we have 3 different types of preference profiles in the world (one preference profile biased towards each local cultural good X and X^* and the preference profile biased towards the "common" cultural good Y). Two individuals from two different countries will share the same cultural profile if and only if they are both of type Y. The index of bilateral cultural distance D_t thus corresponds to the probability of the complement event, that is:

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

From this definition and from the results of 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 histeresis.

4. Empirical evidence

In this section we present empirical evidence supporting our view that trade openness reduces cultural distance. In a first step we build a time-varying measure of cultural distance and we provide some descriptive statistics. In a second step we implement several econometric tests of our main theoretical predictions.

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, 267,870 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). For each wave, representative samples of different countries were surveyed, using a harmonized questionnaire[9]. In line with our microfounded models of cultural transmission we retrieve from the WVS all the questions related to intergenerational transmissions of values from parents to children. This consists of a set of 12 questions that are presented in details in Appendix F. 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.[10]

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 a subsample composed of 17 countries for wave 1; 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. On average each country is present in 2.2 different waves; 52 countries are observed in at least two different waves; 7 countries are observed in the four waves[11]. The statistical coverage is good in the cross-country dimension but less so in the time-series dimension. Nevertheless our econometric analysis (see below) 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 (distance, contiguity, colonial links) come from the CEPII bilateral distance database

[9] This data base is available at www.worldvaluessurvey.org/. The sample size varies across countries and across waves: In the first wave, the US has 2325 individual observations, while Malta only 467. These outliers aside, sample size was between 1000 and 1400 for the remaining countries. In the fourth wave, there is a little more dispersion: most countries have between 1000 and 2000 data points, the Ukraine has 2811.

[10] Due to a poor statistical coverage we decide 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.

[11] 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)

(www.cepii.fr/anglaisgraph/bdd/distances.htm). The ethnic, linguistic, cultural and religious fractionalization come from Alesina et al. (2003) and Fearon (2003). The migration data are collected by the UN DESA while the data on genetic distance come from Spolaore and Wacziarg (2006). The internet data come from the International Telecommunication Union. See Appendix G 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

Relying on the set of 12 values retrieved from the WVS we aim to build a measure of bilateral cultural distance at the country level. To this purpose we adapt to our context 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. In the existing literature these indices of fractionalization relate to only one observable dimension - such as the ethnic, linguistic or religious group. Here we must construct a multidimensional index as we compare individuals across different characteristics (i.e. 12 values). An additional feature is that those characteristics are correlated with each other.

Our method is simple. We first construct cultural distances at the individual level. Then we average those distances at the country level. For each country i, there is a population of agents $a = (1, ..., N_i)$ with a random vector $\mathbf{q}_a$ of 12 values $(q_{a,1}, ..., q_{a,12})^T$ where each value is measured by $q_{a,k}$, 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:

$$d_{ab} \equiv (\mathbf{q}_a \ominus \mathbf{q}_b)^T \frac{\Omega^{-1}}{sum(\Omega^{-1})} (\mathbf{q}_a \ominus \mathbf{q}_b) \tag{4.1}$$

where $(\mathbf{q}_a \ominus \mathbf{q}_b)$ corresponds to the vector of "ordinal differences" defined as: $\forall k \in (1, 12), (q_{a,k} \ominus q_{b,k}) = 1 \; if \; q_{a,k} \neq q_{b,k}$ and 0 otherwise. The weighting matrix Ω^{-1} corresponds to the inverse of the matrix of polychoric correlations [12]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.

The definition of d_{ab} corresponds to the Mahalanobis distance between the random vectors $\mathbf{q}_a$ and $\mathbf{q}_b$. This is a measure of dissimilarity widely used in statistics; in particular in discriminant analysis. It is a generalization of the Euclidean distance to the case of correlated random vectors.

With this definition we see that d_{ab} is akin to the probability - corrected for cross-values correlation - that two randomly picked individuals do not share the same value. Note that in the case of independent values, $\Omega^{-1} = I_{12}$ and $sum(\Omega^{-1}) = 12$, the interpretation of d_{ab} is straightforward : It corresponds to the fraction of the set of 12 values which individuals a and b disagree upon. If there is only one value, the definition of d_{ab} corresponds to a standard fractionalization index.

[12] 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).

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

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

An important point needs to be made at this stage about the interpretation of bilateral cultural distances. A very 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. This is indeed the only scenario under which two individuals taken randomly from each country disagree with one another with very high probability. Similarly, a very low value is consistent only with homogeneous countries very close from one another. On the other hand, 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 an *internal* cultural distance as:

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

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. Because of dimensionality issues, building these measures is computer intensive. In the WVS, there are more than $200,000$ individual observations. This corresponds roughly to $2 \cdot 10^{10}$ pairs of individuals and inter-individual distances. Reducing the dimensionality of this system is thus crucial. We show in Appendix E how to deal with this issue.

4.3. Summary statistics

We first present some important descriptive statistics based on the wave 2000-2004 (which has the best statistical coverage). In particular we want to test: (i) whether our measure of cultural distance based on values retrieved from the WVS is empirically relevant; (ii) how the weighting procedure by Ω^{-1} in equation (4.1) affects this empirical performance.

As mentioned in the previous section, our measures of bilateral and internal cultural distances can be interpreted as a probability of disagreement between two randomly picked individuals. The sample average and standard deviation computed on the wave 2000-20004 are respectively equal to 0.31 and 0.03 for bilateral cultural distance; and 0.25 and 0.03 for internal distance. Quite naturally internal distance is on average smaller than bilateral distance. Tables 1A and 1B report extreme values for bilateral and internal cultural distances. The interpretation is simple: with a probability of 19% a Dane and a Swede will *not* share the same value whereas this probability jumps to 45% when we consider a Dane and Tanzanian. At the internal level, the probability to disagree is the highest in Ireland or in Great Britain. Conversely, Scandinavian countries have the smallest internal cultural distances.

Table 2 provides raw correlations between time-invariant proxies for cultural distance as standardly used in the empirical literature and our two measures of bilateral cultural distance (upper panel) or internal cultural distance (lower panel). Existing proxies are mainly computed at the country level and correspond to ethnic, religious, or language fractionalization (retrieved from Alesina et al. 2003; Fearon 2003). At the bilateral level, there is no direct proxies available for a large panel of countries (see Felbermayr and Toubal 2008 for a proxy computed on a subset of European countries) such that the empirical literature usually proxies culture with geographical distance and genetic distance (see Giuliano, Spilimbergo and Tonon, 2006 and Spolaore and Wacziarg 2008). Within each panel the different columns correspond each to a different calibration of the weighting matrix Ω^{-1} in formula 4.1: In the first column, Ω is given by the inter-individual polychoric correlations between the set of 12 values (see appendix F2); in the second one, Ω corresponds to inter-individual raw correlations (instead of polychoric correlations); in column 3, Ω is the identity matrix (meaning that all values are equally weighted). All the correlation coefficients have the expected sign. We observe that the weighting procedure with the polychoric matrix (column 1) generates a measure of cultural distance which is more strongly correlated with measures of cultural distance used in the existing literature in culture and economics. As a consequence, we use that measure as our main measure of bilateral cultural distance in the regression analysis performed in the remainder of the paper[13].

Insert Figure 5 Here

Figure 5 depicts the time evolution of bilateral cultural distance (left panel) and internal cultural distance (right panel) over the 1989-2004 period. For each panel the horizontal axis represents distances for the 1989-1993 wave and the vertical axis represents distances for the 2000-2004 wave ; hence all the points located below the red 45° line correspond to pairs of countries (left panel) or countries (right panel) which experienced a decrease in cultural distance over the period. We observe a slight tendency for both measures to decrease over time[14]. In the case of bilateral cultural distance, the decrease is close to 0.6 percentage point (ie. from 30.1% to 29.5%) and is significant at the 1% level. By way of comparison, the decrease in the case of internal distance is closer to 0.3 percentage point and is not statistically significant even at the 10% level. Thus, Figure 6 highlights a clear pattern of cultural convergence at the World level during the nineties.

A simple inference of the speed of cultural change consists in computing the ratio of the time-series standard deviation of bilateral cultural distance over its cross-sectional standard deviation. This ratio is equal to 0.31. This clearly shows that the pace of cultural change was pretty large during the

[13] Most of the signs and statistical significance of our econometric results do not depend on the assumed weighting matrix. However their magnitude does.

[14] Considering the first wave of the WVS (1980-1985) instead of the second wave (1989-1993) does not change this pattern but reduces the sample size by overselecting rich countries (mainly OECD).

nineties. According to this figure a complete reversal of the world distribution of bilateral cultural distance could theoretically happen in a bit more than 30 years.

4.4. Empirical strategy

In this section, we assess the causal link from international trade openness to bilateral cultural distance. To our knowledge this issue has never been studied, neither in the sociological nor in the economic literature.

For a given pair of countries (i, j) at a given year t, the basic specification consists in regressing D_{ijt} , our index of bilateral cultural distance, on the log of bilateral trade openness defined as $\ln OPEN_{ijt} \equiv \ln\left(M_{ijt}/GDP_{it} + M_{jit}/GDP_{jt}\right)$ 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 explain now how we deal with those two issues.

4.4.1. Control variables and fixed effects

We include country-pair fixed effects in order to control for unobserved time-invariant or slow-moving codeterminants of trade and cultural distance. 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 be noticed that including country-pair fixed effects is very demanding given the short time series dimension of our sample.

Regarding time-varying codeterminants of trade and culture, we systematically include year dummies in order to filter out from our bilateral specification the potential impact of worldwide time trends in cultural change and international trade. We also control for alternative channels which are likely to affect trade and culture. We first 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. Secondly we control for the *differential in GDP per capita* measured as $\ln|GDP_{it} - GDP_{jt}|$. Indeed the post modern view in sociology (Baker and Inglehart, 2000) claims that economic development drives a cultural shift from traditional to

postmodern values. Given that trade openness is also affected by economic development, it is crucial to control for the GDP differential. A third time-varying channel corresponds to information flows. Those are likely to decrease bilateral cultural distance and to commove with trade in goods. To this purpose we control for *country-pair internet access* which corresponds to the probability that two randomly picked individuals in the pair of countries i and j do both have an access to internet; we also control for *country-pair phone call outflows per capita* also measured as the probability that the two individuals do both phone abroad. A fourth time-varying codeterminant of trade and cultural distance is migration; we thus control for the *log of bilateral migration* that 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 only; however the unobserved heterogeneity in the stocks of migrants is mainly captured by the country-pair fixed effect. Our last control variable is the *log of the sum of FDI* as trade flows and FDI tend to be substitute at the aggregate level. Finally, in one specification, we also include (*country* $\times$ *year*) fixed effects. This very demanding specification filters out all the unobserved, country-specific but time-varying, codeterminants of trade and culture.

4.4.2. Instrumental variables

In order to control for the reverse causality link from cultural distance to trade, we implement an instrumental variable strategy. This 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 (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:

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

We systematically include country-pair fixed effects and year dummies in all our IV regressions. Indeed, the purely geographical part of the remoteness index is time invariant and could be linked to cultural history between the two countries (through past conflicts or immigration waves,etc.). Controlling for country-pair fixed effects eliminates this source of endogeneity. So our interest in $REMOTE_{ijt}$ is that it varies in the time dimension because of the variations in GDP growth for countries k outside the country-pair (i, j); therefore it is not affected by the bilateral relation of the two countries for which

we want to estimate the index of cultural distance. An increase in $REMOTE_{ijt}$ is expected to increase bilateral trade openness within the pair of country.

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 for a given pair of countries, their bilateral trade 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 some contagion effect of FTAs. Using the definition [15] by Baldwin and Jainovic (2008) we consider the following bilateral index of contagion:

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

where FTA_{jkt} is a dummy variable coding for the existence of a FTA between j and k at date t; and $[M_{ki0}/GDP_{k0}]$ is the share of imports by country k from country i the year the FTA between j and k was signed. In words, this represents for a given year t the accumulated sum of the FTAs signed by j with the countries outside the pair in the past years, weighted by the commercial importance of the third countries to i, measured as the share of total imports from this country. Hence the time variation of the contagion index is not affected by the bilateral relation between countries i and j. And 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 separately the IVs offer two independent identification strategies. In our main table of results (table 3) we present 2SLS estimates of equation (4.4) where openness is instrumented with the two IVs: this allows to perform some overidentification test. However, in our robustness checks (table 5) we present a 2SLS estimate where openness is instrumented with remoteness only and a 2SLS estimate where openness is instrumented with contagion only. Both drive similar results making us confident in the statistical relevancy of our instrumentation strategy.

4.4.3. Testing 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 would not generate a reversion (ie. an increase) in cultural distance. We propose a simple and direct empirical test of this theoretical prediction. It consists in estimating a first-difference version of the econometric equation (4.4) on the subsample of country-pairs experiencing an increase in trade openness and on

[15] We thank them for providing us with their data.

the subsample of country-pairs experiencing a decrease in openness. If we find that β_1, the coefficient of openness, is larger (in magnitude) for the first subsample, this points out to the existence of path-dependency.

4.5. Econometric Results

Results are reported in table 3. Columns 1 and 2 present OLS estimates of equation (4.4) while columns 3-10 present 2SLS estimates. The corresponding first stage regressions are reported in table 4. In all specifications, time dummies are included and error terms are clustered at the country-pair level.

Column 1 reports the cross-country evidence. The coefficient of our variable of interest, *bilateral openness in all goods*, is negative and significant at the 1% threshold. This confirms our main theoretical prediction. Geographical distance has a positive and significant impact on cultural distance. This captures a myriad of long run bilateral influences, from past wars to immigration waves. However the effect is modest as a tenfold increase in geographical distance translates into an increase in cultural distance of 0.89 percentage point (approx. 1/3 standard deviation). More surprisingly the effect of having common legal origins is to decrease cultural distance by 1.33 percentage point; this is compatible with the view that institutions shape culture and values (see Alesina and Fuchs 2007; Landier et al., 2008). As expected from our discussion in the previous section, the coefficients for internal cultural distance and GDP differential are positive and significant at the 1% threshold.

In column 2, we include country-pair fixed effects in order to control for unobserved slow-moving codeterminants of trade and cultural distance. With respect to column 1, the sample size shrinks because many country-pairs are observed only once in the panel dimension. We also include our time-varying control variables for information flows, FDI and migration; all their coefficients have the expected sign. It is important to notice that the coefficient of GDP differential is not significant anymore and drops sharply with respect to its cross-country estimates in column 1. This shows that the postmodern view of cultural change is weakly supported by the panel evidence. All in all the coefficient of trade openness is robust to the inclusion of all these control variables and remains negative and significant at the 1% level.

In column 3, we report the second stage of a 2SLS specification where *bilateral openness* is instrumented with *bilateral remoteness* and *bilateral contagion*. From the first stage results (reported in table 4, col. 1) we see that, as expected, remoteness and contagion impact positively bilateral openness. The instruments do not suffer from statistical weakness as their coefficients are significant at the 1% level and the F-test on the joint effect of IVs reject the null hypothesis and exceed the threshold of 10 recommended by Staiger and Stock (1997). The second stage results (table 3, col.3) 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 three times larger - a result that is confirmed

by our robustness analysis in table 5. This threefold increase is due to a composition effect. Indeed our two IVs impact bilateral openness mostly by affecting trade in differentiated goods leaving trade in homogenous goods fairly unchanged[16]. But, as it is clear from our theoretical predictions and from our empirical results in columns 9 and 10, only trade in differentiated goods affect cultural distance[17].

With two instruments for one endogenous variable we can perform a Sargan test for overidentification. The test reveals a P-value of 0.545, stating that the exogeneity hypothesis on our instruments cannot be rejected. As discussed in the previous section, we are confident that this 2SLS panel specification with country-pair fixed effects convincingly controls for the omitted variable bias and the reverse causality issue. This constitutes our preferred specification.

The effect is sizeable, as one standard deviation increase in bilateral trade openness translates into a 62.2% standard deviation decrease in bilateral cultural distance. This effect is quantitatively important and dominates the effect of other control variables. By comparison, the impact of a one standard deviation increase in internet access, phone call outflows, FDI openness, bilateral migration, GDP per cap differential translates into a decrease of respectively 7.21%; 23.7%; 11.1%; 1.43% and 4.57% in standard deviation of bilateral cultural distance.

We control for $(country \times year)$ fixed effects in column 4. This captures all the unobserved, time-varying, country-specific heterogeneity[18]. Remarkably the coefficient of bilateral openness is robust to the inclusion of those very demanding controls: it decreases by one third with respect to its column 3 estimate but is still negative and significant at the 1% level. Beyond providing a robustness check, this result shows that the negative causal impact of trade openness on cultural distance is mostly channelized by bilateral interactions within the pair of countries (2/3 of the coefficient in column 3) and to a lesser extend by country-specific trends (1/3 of the coefficient). In other words, our econometric results cannot be entirely due to the fact that countries are converging toward the same "postmodern" worldwide cultural model characterized both by trade openness and by a specific set of values. In fact 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.

We test for path-dependency in columns 5-7. To this purpose we estimate a version in first differences of our preferred specification of column 3; regarding the IVs we also consider their first differences. Column 5 presents the estimate on the full sample. The coefficient on bilateral openness is negative and significant at the 1% level but is slightly smaller than its within estimate in column 3; this is due to the reduction in sample size. In columns 6 and 7 respectively, we restrict the analysis to the subsample of country-pairs experiencing an increase in bilateral openness and to the subsample

[16] 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.

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

[18] Internal cultural distance being defined as a sum, its coefficient cannot be identified in this setting.

of pairs experiencing a decrease in openness. In the case of an increase, the coefficient on bilateral openness remains negative and significant at the 5% level; in the case of a decrease, the coefficient is not significantly different from zero. As discussed in the previous section, we interpret this asymmetry as evidence of path-dependency and lock-in effects: an increase in bilateral trade openness leads to a decrease in bilateral cultural distance while a decrease in trade openness has no effect. However it should be noticed that the reduction in sample size in column 7 makes the estimate less precise and forces us to drop bilateral contagion from the set of IVs due to statistical weakness.

In columns 8-10 we decompose trade flows with the aim of testing our theoretical prediction related to the relative impact of trade in (differentiated vs homogenous) goods on cultural distance. To this purpose we 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). For consistency reason, we rebuild our variable of *bilateral openness in all goods* using Comtrade trade flows rather than DoTS trade flows[19]. Because of lack of cultural data before 1988, we drop the first wave (1981-1984) of the WVS from our sample. In column 8 we re-estimate our preferred specification of column 3 with the Comtrade based measure of openness. The results are robust; we nevertheless observe a twofold increase in the coefficient of openness with respect to the DoTs estimate of column 3. This stems from the reduction in sample size and from the well-known discrepancy between Comtrade and DoTs dataset due to different collecting sources (see Denzau and Kimb (2006)).

In column (9) we include the measures of openness in homogenous goods and openness in cultural goods[20]: given these additional control variables the coefficient of *openness in all goods* must be interpreted now as the causal impact of trade in differentiated goods net of trade in cultural goods. The coefficient of *openness in all goods* is very close to its benchmark estimate of column 8. The coefficient of *openness in homogenous goods* is now reduced by 10 times (in absolute value). This finding validates our theoretical prediction stating that the impact on cultural distance is larger for trade in differentiated goods than for trade in homogenous goods[21]. Finally we see that the coefficient of *openness in cultural goods* is the largest (though not precisely estimated in this specification). This is in line with the common view that trade in cultural goods[22] is likely to be an important channel of

[19] In our sample the correlation between the Comtrade-based openness and DoTs-based openness is 0.86.

[20] 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* (see discussion of the results in column 3). This allows to perform overidentification tests. The drawback is the potential contamination of the coefficients of *bilateral openness cultural goods* and *bilateral openness cultural goods*

[21] 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.

[22] 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

bilateral cultural influences. However our results clearly show that trade in differentiated goods, net of cultural goods, has also a significant causal impact on cultural distance. Hence beyond cultural goods, differentiated goods do also vehicle elements of cultural transmission. In column (10) we estimate the model in first differences. The results are similar to column (9) estimates except that now the coefficient of *openness in cultural goods* is significant at the 5% level and three times larger than the coefficient on *bilateral openness in all goods*.

The conclusion we drive from this table is that trade in goods has a causal impact on cultural change. As such, these results support the view of a *product-based* cultural change, as suggested by the literatures in anthropology and in consumer research and as formalized in our theoretical model.

4.6. Robustness checks

In Tables 5 and 6, we perform numerous robustness checks of our preferred 2SLS panel regression (col. 3, table 3). For the sake of exposition, we report in these tables only the coefficients of our main variable of interest *bilateral openness in all goods*.

In table 5, column 1, openness is instrumented with bilateral remoteness only while in column 2 it is instrumented with bilateral contagion only. In spite of their low time-series correlation (0.22) both instruments lead to similar estimates; a feature that makes us confident on the empirical relevancy of our instrumental variable strategy. In column 3, we include country-pair coverage by cable TV as an additional control of information flows. The sample size is reduced but the coefficient is still negative and significant at the 10% level.

From columns 4 to 9, we consider several alternative definitions of our measure of bilateral cultural distance. In column 4 the distance corresponds to the unweighted index (ie. no weighting matrix Ω^{-1} in definition (4.1)). In column 5 cultural distance is based on the set of 30 questions (from the WVS) offering the best statistical coverage. In column 6 it is based on the set of 50 questions with the best statistical coverage; here the sample size shrinks but the coefficient is still negative and significant at the 10% level. From columns 7-9 we take the opposite view by building our measure of cultural distance on specific questions (in that case our measure is equivalent to a standard fractionalization index). We consider three alternative values studied in the economic literature: *trust* in column 7; *feeling of happiness* in column 8; and *belonging to a religious denomination* in column 9.

In table 6 we study whether our benchmark results - established with a set of 12 questions - are in fact driven by a small subset of questions. To this purpose we build 12 measures of cultural distance, each one based on only one question of the set. We see that the coefficient of bilateral openness is negative for 9 questions (and statistically significant in 7 cases) while it is positive for 3 questions (and statistically significant in 2 cases). Hence we see that our results are not driven by outliers.

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.

4.7. Differential Impact of Trade on Cultural Distance

In this section, we depart from looking at the average impact of trade on cultural distance; we rather investigate its differential impact across various subgroups of the population. This provides a third strategy for identifying the causal impact of trade on culture. To this purpose we 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 occurs for two different reasons: either because these groups are more exposed to the treatment (ie. trade openness); either because they are likely to overreact in term of cultural change. This strategy is akin to the celebrated one implemented by Rajan and Zingales (1998) when estimating the impact of financial development on growth.

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 a given 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 also build the bilateral cultural distance between the populations of individuals who do not belong to g and g'. Hence for each pair of countries (i, j) we have now two bilateral cultural distances; and 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').

Now we are equipped to estimate the following OLS 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.

In Table 7 we estimate four different variants of specification (4.7) depending on the groups (g, g') we select. In column 1, we consider *Young* the group composed of individuals that are between 15 and 29 years old (compared to older ones). In column 2, we consider *Local,* the group of individuals who declare (question *g001* in the WVS) that they belong first to one of those geographical groups: "locality", "region" or "country" (in opposition to "continent" or "world"). In column III, *Nationalist* corresponds to the group of persons that are "proud" or "very proud" of their nationality (in opposition to "not very proud" or "not at all proud" in question *g006* of the WVS). Finally, *Urban* defines the group of individuals that live in a city with more than 20'000 inhabitants (compared with people living in smaller town).

Table 7 reports the second stage of a 2SLS estimate of (4.7) where trade is instrumented by

bilateral remoteness[23] in the same fashion than specification 3 in Table 3. The results clearly point out that the effect of trade openness on cultural distance is far from being homogenous across groups of individuals. More precisely, column 1 shows that trade openness has a larger impact (in magnitude) on young individuals than on older ones. And 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). From column 2 we see that the overall impact of trade openness on cultural distance is null for the group of people who think they belong to more local geographic entities. In column 3, we get the same type of result: trade openness has a small negative effect (but still significant, p-value 0.04) on bilateral cultural distance for nationalist people; this is four times smaller than for non-nationalist people. Finally, column 4 shows that trade openness has a cultural impact on people living in a city twice as large as on individuals that lives in a city with less than 20,000 inhabitants.

5. Conclusions

In this paper, we analyzed the effects of international trade on the evolution of cultural values across individuals and countries. We made three contributions to the literature. First, building on insights from Marketing and Consumer research, we provided a simple theory that embedds a standard international trade 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 bilateral cultural distances exhibit significant time variation. Third, we test succesfully two implications of the model: bilateral trade reduces bilateral cultural distance and the effect is strongest for more differentiated products. 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 the convergence of cultural values across countries.

Obviously, while empirically we test successfully the negative correlation between trade and cultural distance; our analysis touches only the peak of iceberg and a number of important and interesting issues remain to be investigated. First of all, we do not identify in the data towards which "cultural profile" countries converge. Is it the emergence of a "global model" in the sense of Inglehart that emphasizes various global postmodern values? Is it the hegemony of one national or corporate model as suggested by Ritzer (2001) or the anti-globalization movements? Is it an "hybrid model" that combines various elements of local national cultures through cross-fertilization as promoted by Cowen (2002)? A global "postmodern" culture would suggest a convergence process rather independent from initial local cultures. A theory of cross-fertilization of cultural traits would rather imply a convergence path toward "bilateral cultures" which are mixed of the initial culture. Discriminating between the

[23] We instrument $OPEN_{c,c',t}$ and $1_{g,g'} \times OPEN_{c,c',t}$ with $REMOTE_{cc't}$ and $1_{g,g'} \times REMOTE_{cc't}$. To save space we report neither the first stage regressions of the 2SLS neither the non instrumented OLS regressions. They are all available upon request from the authors.

various theories is however crucial as it would present the process of convergence of cultural values with contrasting perspectives: death of local cultures and the associated political and social tensions that this would irremediably provoke; or dynamic cross-fertilization transformation and the gains from creativity, coordination and cooperation that this would entail.

On the theory side, an avenue for future research can also be to develop a micro-founded theory of how cultural traits can be endogenously embodied in goods [through advertising, product design or R&D] and what would be the implications of this for global market competition and cultural evolution. One could also explore 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 diffusion of stable, efficient and tolerant institutions across countries worldwide? Those are important questions that in an increasingly globalized world, will certainly need to be adressed in future research.

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Appendices

A. Foundations of equation (3.4)

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 (3.4) 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 (**??**). 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:

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

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

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

It is easy to see that $H(\tilde{q})$ admits one and only one (local) minimun in $\tilde{q} = 1/2$. Indeed we have

$$\begin{aligned} H'(\tilde{q}) &= 0 \\ &\Leftrightarrow \\ \frac{\omega - 1}{\left[1 + 2\omega\left(\tilde{q} - \frac{1}{2}\right)\right]\tilde{q}} &= \frac{\omega - 1}{\left[1 - 2\omega\left(\tilde{q} - \frac{1}{2}\right)\right](1 - \tilde{q})} \\ &\Leftrightarrow \\ \tilde{q} &= 1/2 \end{aligned}$$

As a consequence $H(\tilde{q})$ 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. Reduction of Computation Time

From the definition of D_{ij} given by expression (4.1).

$$\begin{aligned}D_{ij} &= \frac{1}{N_iN_j}\sum_{a,b}d_{ab} \\ &= \frac{1}{N_iN_j}\sum_{a,b}\left(\frac{1}{sum(\Omega^{-1})}(\mathbf{q}_a\ominus\mathbf{q}_b)^T\Omega^{-1}(\mathbf{q}_a\ominus\mathbf{q}_b)\right)\end{aligned} \tag{D.1}$$

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

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

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

$$\begin{aligned} D_{ij} &= \frac{1}{sum(\Omega^{-1})} \left[\sum_{k,k'} \omega_{kk'} - \sum_k \omega_{kk} \langle \mathbf{f}_k^i, \mathbf{f}_k^j \rangle - \sum_{k \neq k'} \omega_{kk'} \left(\langle \mathbf{f}_k^i, \mathbf{f}_k^j \rangle + \langle \mathbf{f}_{k'}^i, \mathbf{f}_{k'}^j \rangle \right) + \sum_{k \neq k'} \omega_{kk'} \langle \mathbf{f}_k^i, \mathbf{f}_k^j \rangle . \langle \mathbf{f}_{k'}^i, \mathbf{f}_{k'}^j \rangle \right] \\ &\approx 1 - \sum_k \frac{\omega_{kk}}{sum(\Omega^{-1})} \langle \mathbf{f}_k^i, \mathbf{f}_k^j \rangle - \sum_{k \neq k'} \frac{\omega_{kk'}}{sum(\Omega^{-1})} \left(\langle \mathbf{f}_k^i, \mathbf{f}_k^j \rangle + \langle \mathbf{f}_{k'}^i, \mathbf{f}_{k'}^j \rangle \right) \end{aligned} \tag{D.2}$$

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.2) exploits only the country-level information $\mathbf{f}_k^i$; this allows to considerably reduce computation time (by a factor $N_i N_j \sim 10^6$) with respect to the initial equation (D.1) 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: $D_{ij} = 1 - \sum_k \langle \mathbf{f}_k^i, \mathbf{f}_k^j \rangle / 12$. And bilateral cultural distance is simply the average across the twelve questions of their fractionalization index.

Tables and Appendices to
Product-based Cultural Change: Is the Village Global?
by Nicolas Maystre, Jacques Olivier, Mathias Thoenig and Thierry Verdier

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Appendix F1: 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

Appendix F2: Matrix of polychoric correlation Ω

	a025	**a026**	**a029**	**a030**	**a032**	**a034**	**a035**	**a038**	**a039**	**a040**	**a041**	**a042**
a025	1	0.31	0.21	-0.21	0.07	0.23	0.05	-0.12	0.11	-0.34	0.02	-0.24
a026	0.31	1	0.17	-0.03	0.05	0.09	0	0.02	0.11	-0.25	-0.01	-0.18
a029	0.21	0.17	1	-0.13	0.09	0.24	-0.09	-0.14	0.11	-0.26	-0.06	-0.34
a030	-0.21	-0.03	-0.13	1	-0.14	-0.17	-0.17	0.12	-0.08	0	-0.16	-0.01
a032	0.07	0.05	0.09	-0.14	1	0.03	0.07	-0.08	0.06	-0.22	-0.1	-0.28
a034	0.23	0.09	0.24	-0.17	0.03	1	-0.07	-0.14	0.1	-0.18	0.01	-0.19
a035	0.05	0	-0.09	-0.17	0.07	-0.07	1	-0.17	-0.02	-0.07	0.02	-0.13
a038	-0.12	0.02	-0.14	0.12	-0.08	-0.14	-0.17	1	-0.09	-0.05	-0.13	-0.01
a039	0.11	0.11	0.11	-0.08	0.06	0.1	-0.02	-0.09	1	-0.24	-0.01	-0.23
a040	-0.34	-0.25	-0.26	0	-0.22	-0.18	-0.07	-0.05	-0.24	1	-0.03	0.27
a041	0.02	-0.01	-0.06	-0.16	-0.1	0.01	0.02	-0.13	-0.01	-0.03	1	0.01
a042	-0.24	-0.18	-0.34	-0.01	-0.28	-0.19	-0.13	-0.01	-0.23	0.27	0.01	1

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

country pair	bilateral cultural distance
DNK - SWE	0.189
NLD - SWE	0.204
DNK - NLD	0.211
AUT - SWE	0.216
FIN - SWE	0.217
DEU - SWE	0.221
DNK - FIN	0.223
ISL - SWE	0.224
NGA - ZWE	0.225
JPN - SWE	0.225
…	
DNK – NGA	0.414
JPN – ZWE	0.415
AUT – TZA	0.417
DEU – TZA	0.42
DNK – PAK	0.421
JPN – TZA	0.424
NLD – TZA	0.425
SWE – TZA	0.435
JPN – NGA	0.437
DNK – TZA	0.447

Table 1 B: the ten smallest and biggest internal cultural distance in the 4th wave of the WVS

country	internal cultural distance
DNK	0.180
SWE	0.182
EGY	0.206
NGA	0.209
JPN	0.212
NLD	0.212
AUT	0.215
KOR	0.218
LVA	0.222
RUS	0.224
…	
ALB	0.287
BIH	0.287
CAN	0.288
ZAF	0.288
MEX	0.292
USA	0.292
IND	0.295
SAU	0.297
GBR	0.302
IRL	0.309

Table 2: Correlation table

Variables	bilateral cultural distance (weighted polychoric correlation)	bilateral cultural distance (weighted correlation)	bilateral cultural distance (unweighted)
log of weighted distance (pop-wt, km)	0.27*	0.25*	0.19*
Genetic distance (Spolaore and Wacziarg, 2008)	0.20*	0.19*	0.14*
Average Correlation	*0.24*	*0.22*	*0.17*
	within cultural distance (weighted polychoric correlation)	within cultural distance (weighted correlation)	within cultural distance (unweighted)
cultural fractionalization (Fearon, 2003)	0.18*	0.17*	0.13
ethnic fractionalization (Fearon, 2003)	0.30*	0.27*	0.16*
ethnic fractionalization (Alesina et al., 2003)	0.29*	0.26*	0.16*
language fractionalization (Alesina et al., 2003)	0.13*	0.11	0.05
religion fractionalization (Alesina et al., 2003)	0.01	0.04	0.08
Average Correlation - Fearon's variables	*0.24*	*0.22*	*0.14*
Average Correlation – Alesina et al. variables	*0.14*	*0.14*	*0.10*

Notes: *signifies that the correlation is significant at the 10% level.

Table 3: Impact of bilateral trade openness on bilateral cultural distance

	Dependent Variable: Bilateral Cultural Distance									
Estimator	OLS		2SLS		2SLS & first differences			2SLS		2SLS & first diff.
Model	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
ln bil. Openness [All Goods]	-0.141***	-0.215***	-0.749***	-0.466***	-0.358***	-0.323**	0.633	-1.661***	-1.904***	-2.558***
	[0.024]	[0.061]	[0.176]	[0.074]	[0.124]	[0.134]	[1.358]	[0.329]	[0.426]	[0.855]
ln bil. Openness [Cultural Goods]									-2.685	-6.110**
									[2.016]	[2.389]
ln bil. Openness [Homogenous Goods]									0.181	0.243
									[0.101]	[0.144]
Sum of internal cultural dist.	0.291***	0.560***	0.579***	-	0.521***	0.533***	0.543***	0.553***	0.531***	0.498***
	[0.035]	[0.052]	[0.051]		[0.051]	[0.063]	[0.124]	[0.063]	[0.067]	[0.084]
Differential of GDP per cap	0.429***	0.013	0.058	0.627***	0.184	0.220	0.103	0.155	0.192	0.332
	[0.040]	[0.133]	[0.125]	[0.071]	[0.148]	[0.179]	[0.216]	[0.149]	[0.158]	[0.258]
Ctry-pair Internet access		-0.235**	-0.344**	-1.434***	0.628***	0.625***	0.410	-0.434***	-0.474***	0.699***
		[0.117]	[0.141]	[0.336]	[0.130]	[0.192]	[0.327]	[0.150]	[0.155]	[0.219]
Ctry-pair phone call outflow (per capita)		-0.218***	-0.225***	-0.165**	-0.601***	-0.600***	-0.506***	-0.183***	-0.170***	-0.596***
		[0.044]	[0.058]	[0.072]	[0.105]	[0.129]	[0.191]	[0.057]	[0.059]	[0.165]
ln sum of FDI per capita		-0.236**	-0.185	0.007	0.050	0.109	0.050	-0.063	-0.066	0.087
		[0.103]	[0.128]	[0.145]	[0.128]	[0.156]	[0.206]	[0.137]	[0.141]	[0.171]
ln bil. migration		-0.306	-0.200	-0.056	-0.926	-1.025	0.125	-0.247	-0.083	0.691
		[0.502]	[0.404]	[0.356]	[0.547]	[0.556]	[1.931]	[0.426]	[0.452]	[0.785]
ln geo. distance	0.387***									
	[0.060]									
Common legal origins (dummy)	-1.335***									
	[0.107]									
Time dummies	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
country pair FE	no	yes	yes	yes	no	no	no	no	no	no
(country*time) FE	no	no	no	yes	no	no	no	no	no	no
# observations	4004	1741	1741	1741	719	497	266	1511	1511	574
# country pairs		803	803					685	685	
within R^2	0.310	0.205	0.140	0.617	0.161	0.167	0.099	-	-	-
F-test on IV			21.7	12.1	19.4	15.7	7.31	49.7	33.7	10.2
Overidentifying Restrictions (P-value)			0.545	0.386	0.169	0.425	-	0.507	0.437	0.517

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 Internet access* , *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. 1-7 and COMTRADE in col. 8-10. Columns 1 and 2 present cross-country and panel estimates. Columns 3,4,8,9 present 2SLS panel estimates. Columns 5-7 and 10 present 2SLS estimates of the model in first differences. The variable *ln bil. openness [All Goods]* is instrumented with *bilateral remoteness* and *bilateral contagion* (except in col. 7). First stage regressions are reported in table 2. In columns 6 and 7, the sample is restricted to country-pairs experiencing respectively a decrease or an increase in*ln bil. openness [All Goods]* .

Table 4: Impact of bilateral trade openness on bilateral cultural distance - First Stage IV regressions

	Dependent Variable: ln bil. Openness [all goods]							
Estimator	2SLS		2SLS & first differences			2SLS		2SLS & first diff.
Model	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
bilateral remoteness	1.673***	5.298***	3.482***	3.705***	-1.079***	1.490***	1.262***	1.013***
	[0.371]	[0.560]	[0.623]	[0.730]	[0.399]	[0.263]	[0.254]	[0.294]
bilateral contagion	0.185***	0.368***	0.137**	0.122		0.140***	0.117***	0.063**
	[0.040]	[0.027]	[0.065]	[0.078]		[0.026]	[0.025]	[0.032]
ln bil. Openness [Cultural Goods]							-1.808***	
							[0.508]	
ln bil. Openness [Homogenous Goods]							0.115***	
							[0.028]	
Sum of internal cultural dist.	0.051	0.000	0.054	0.071	-0.040	-0.012	-0.024	-0.021
	[0.032]	[0.000]	[0.039]	[0.045]	[0.045]	[0.019]	[0.018]	[0.020]
Differential of GDP per cap	0.060	0.072	0.293**	0.371**	0.020	0.137***	0.139***	0.121*
	[0.092]	[0.050]	[0.128]	[0.182]	[0.045]	[0.047]	[0.044]	[0.067]
Ctry-pair Internet access	-0.004	0.073	0.188**	-0.000	0.190***	-0.022	-0.044	0.068
	[0.045]	[0.163]	[0.081]	[0.104]	[0.050]	[0.035]	[0.035]	[0.060]
Ctry-pair phone call outflow (per capita)	-0.028	0.075**	-0.167**	-0.196**	-0.039	0.013	0.019*	0.011
	[0.021]	[0.036]	[0.078]	[0.096]	[0.067]	[0.012]	[0.012]	[0.046]
ln sum of FDI per capita	0.040	-0.133	-0.034	0.046	0.031	-0.049	-0.043	-0.086
	[0.061]	[0.117]	[0.100]	[0.136]	[0.058]	[0.048]	[0.044]	[0.056]
ln bil. migration	-0.017	0.344	-0.365	-0.933**	-0.214	0.028	0.132	0.473***
	[0.171]	[0.223]	[0.354]	[0.404]	[0.386]	[0.128]	[0.126]	[0.176]
Time dummies	yes	yes	yes	yes	yes	yes	yes	yes
country pair FE	yes	yes	no	no	no	no	no	no
(country*time) FE	no	yes	no	no	no	no	no	no
# observations	1741	1741	719	497	266	1511	1511	574
# country pairs	803					685	685	
within R^2	0.317	0.635	0.161	0.167	0.073	0.323	0.363	0.148
F-test on IV	21.7	12.1	19.4	15.7	7.31	49.7	33.7	10.2
Overidentifying Restrictions (P-value)	0.545	0.386	0.169	0.425	-	0.507	0.437	0.517

Notes: * significant at 10%; ** significant at 5%; *** significant at 1%. Standard Errors clustered by country pair. This table reports the first stage estimates of the 2SLS specifications presented in table 1. For readability purposes, all coefficients are multiplied by 100 except for*ctry-pair Internet access* , *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. 1-5 and COMTRADE in col. 6-8.

Table 5: Robustness Checks

Dependent Variable: Bilateral Cultural Distance

					Bilateral cultural distance based on:					
	2SLS with ctry-pair FE (column 3, table 1)	IV: bil. remoteness only	IV: bil. contagion only	add. control: ctry pair cable TV	Unweighted index	30 questions	50 questions	*Trust* (WVS code: a0165) only	*Hapiness* (WVS code: a008) only	*Belonging to a religious denomination* (WVS code: f024) only
model	Benchmark	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
ln bil. openness	-0.749***	-0.798***	-0.668***	-1.104*	-0.729***	-0.451***	-1.225*	-0.348**	-0.025	-3.056***
	[0.176]	[0.207]	[0.206]	[0.661]	[0.121]	[0.102]	[0.671]	[0.177]	[0.064]	[0.600]
# observations	1741	1741	1741	1216	1741	1321	899	1778	1722	1738
# country pairs	803	803	803	590	813	622	439	813	785	793
Within R^2	0.140	0.127	0.158	0.158	0.137	0.182	0.089	0.178	0.197	0.061

Notes: * significant at 10%; ** 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 3, Table 1). 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 *ctry pair coverage by cable TV* in column 3. In columns 4-9, we consider alternative definitions of bilateral cultural distance.

Table 6: robustness checks

	Dependent Variable: Bilateral Cultural Distance based on												
	12 questions	Question a025 (WVS code)	Question a026 (WVS code)	Question a029 (WVS code)	Question a030 (WVS code)	Question a032 (WVS code)	Question a034 (WVS code)	Question a035 (WVS code)	Question a038 (WVS code)	Question a039 (WVS code)	Question a040 (WVS code)	Question a041 (WVS code)	Question a042 (WVS code)
model	Benchmark	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
ln bil. openness	-0.749***	-1.863***	-1.668***	-0.321	-1.327***	-0.414	-1.796***	0.214	-0.743***	-0.539***	0.743**	-1.711***	0.677**
	[0.176]	[0.273]	[0.361]	[0.389]	[0.514]	[0.272]	[0.396]	[0.163]	[0.216]	[0.148]	[0.356]	[0.340]	[0.304]
# observations	1741	1741	1741	1741	1741	1741	1741	1741	1741	1741	1741	1741	1741
# country pairs	803	803	803	803	803	803	803	803	803	803	803	803	803
Within R^2	0.140	0.219	0.223	0.066	0.010	0.175	0.200	0.376	0.178	0.123	0.174	0.200	0.179

Notes: * significant at 10%; ** 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 3, Table 1). 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. In columns 1-12, we consider alternative definitions of bilateral cultural distance.

Table 7: Impact of trade on bilateral cultural distance by sub-group of individuals

Dependent	bilateral cultural distance			
Estimator model:	2SLS (I)	2SLS (II)	2SLS (III)	2SLS (IV)
bilateral trade openness (from DoTS)	-0.34a [0.07]	-0.72a [0.10]	-0.52a [0.08]	-0.22a [0.08]
bilateral trade openness * *reference sub-group*	-0.35a [0.07]	0.78a [0.09]	0.38a [0.08]	-0.26a [0.08]
mean (internal cultural distance$_{it,jt}$)	0.59a [0.03]	0.31a [0.03]	0.65a [0.03]	0.41a [0.03]
ln (|GDPCAP$_{origin}$ - GDPCAP$_{destination}$|)	0.19b [0.08]	0.20c [0.12]	0.25a [0.09]	0.11 [0.10]
mean FDI per capita	-0.39a [0.06]	-0.43a [0.08]	-0.33a [0.07]	-0.05 [0.08]
mean Internet user	-0.17b [0.07]	-0.22b [0.10]	-0.09 [0.08]	-0.16c [0.09]
bilateral migration	-0.13 [0.30]	-0.23 [0.44]	0.17 [0.33]	-0.26 [0.34]
reference sub-group	-0.02a [0.00]	0.05a [0.01]	0.02a [0.00]	-0.02a [0.00]
reference sub-group	*young*	*local*	*nationalist*	*urban*
year FE	yes	yes	yes	yes
country pair FE	yes	yes	yes	yes
# observations	4186	3780	4080	2139
# country pairs	952	872	935	535

Notes: c significant at 10%; b significant at 5%; a significant at 1%. Robust standard errors in brackets. Coefficients of *bilateral trade openness* (from DoTS), *ln (|GDPCAP$_{origin}$ - GDPCAP$_{destination}$|)* and *mean FDI per capita* are multiplied by 100. Coefficients of *mean Internet user* and *bilateral migration* are multiplied by 1000. Reference sub-groups: Individuals belong to the sub-group:
- "young" if they are between 15 and 29 years old (=respond 1 for question x003r2)
- "local" if they think they belong first to one of these geographical groups: locality, region or country (=respond 1, 2 or 3 for question g001)
- "nationalist" if they are "proud" or "very proud" of their country (=respond 1 or 2 for question g006)
- "urban" if they live in a city with more than 20'000 inhabitants (=respond 5, 6, 7 or 8 for question x049)

Figure 1

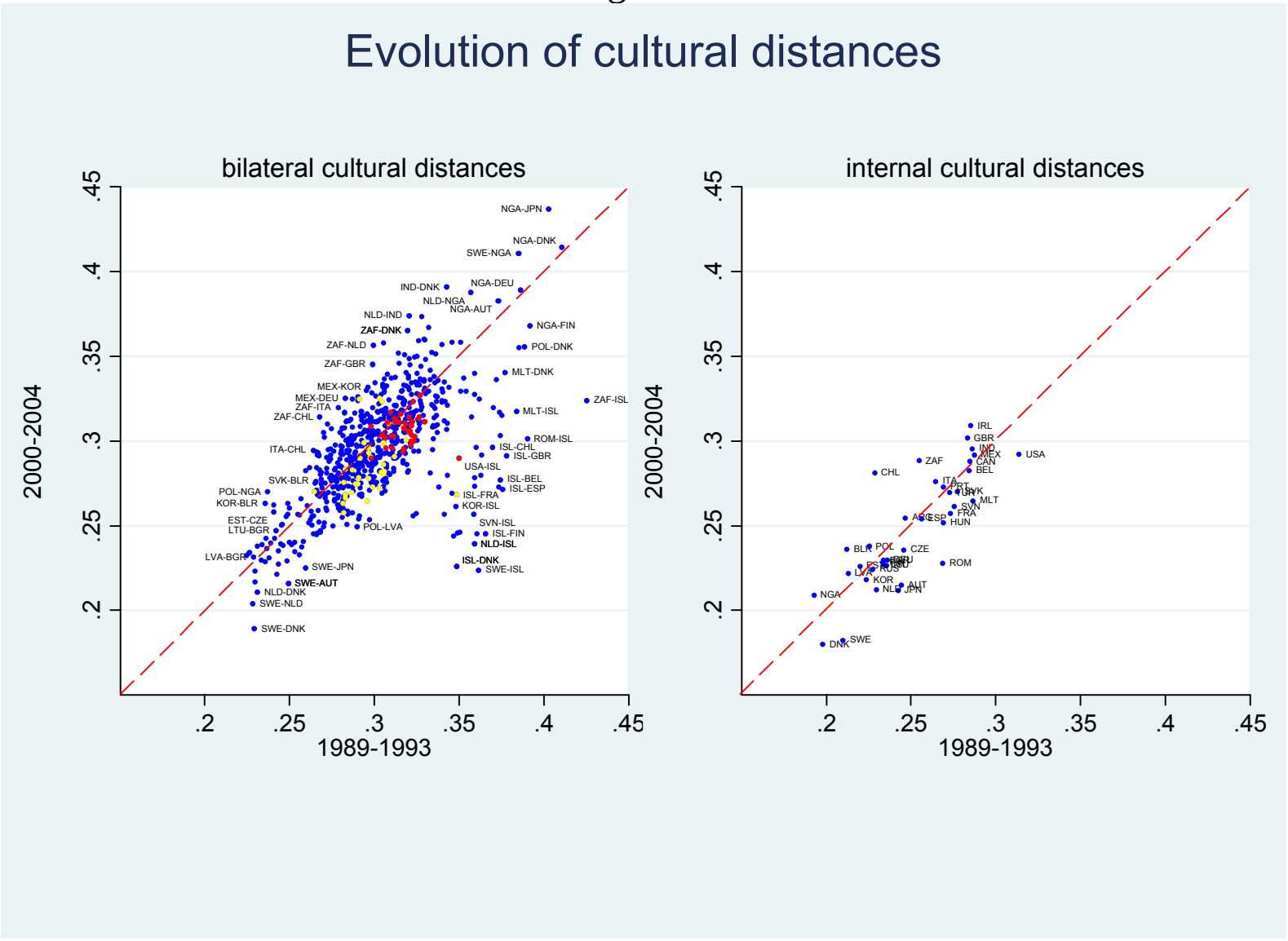
Evolution of cultural distances
bilateral cultural distances
internal cultural distances
2000-2004
1989-1993
.2
.25
.3
.35
.4
.45
NGA-JPN
NGA-DNK
SWE-NGA
IND-DNK
NGA-DEU
NLD-NGA
NGA-AUT
NLD-IND
NGA-FIN
ZAF-DNK
ZAF-NLD
POL-DNK
ZAF-GBR
MLT-DNK
MEX-KOR
MEX-DEU
ZAF-ISL
ZAF-ITA
ZAF-CHL
MLT-ISL
ROM-ISL
ITA-CHL
ISL-CHL
ISL-GBR
USA-ISL
SVK-BLR
ISL-BEL
ISL-ESP
POL-NGA
ISL-FRA
KOR-BLR
KOR-ISL
EST-CZE
SVN-ISL
LTU-BGR
POL-LVA
ISL-FIN
NLD-ISL
LVA-BGR
ISL-DNK
SWE-JPN
SWE-ISL
SWE-AUT
NLD-DNK
SWE-NLD
SWE-DNK
IRL
GBR
IND
MEX
USA
ZAF
CAN
CHL
BEL
ITA
PRT
SVK
MLT
SVN
FRA
HUN
BLR
POL
CZE
ROM
KOR
NLD
JPN
NGA
DNK
SWE

Figure 1: Phase Diagram in the case $\sigma > 1+\omega^2$

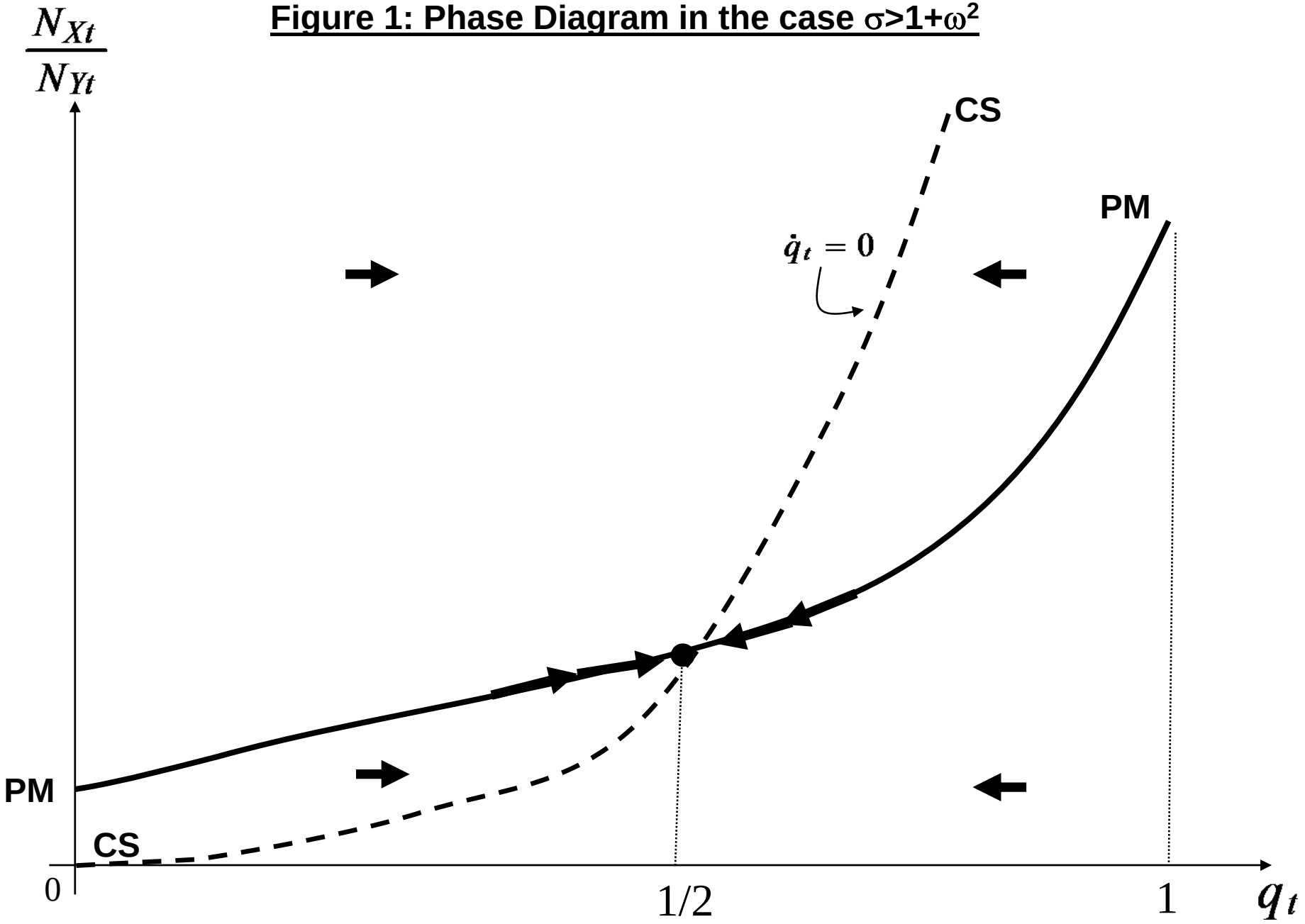

Figure 2: Phase Diagram in the case $\sigma<1+\omega^2$

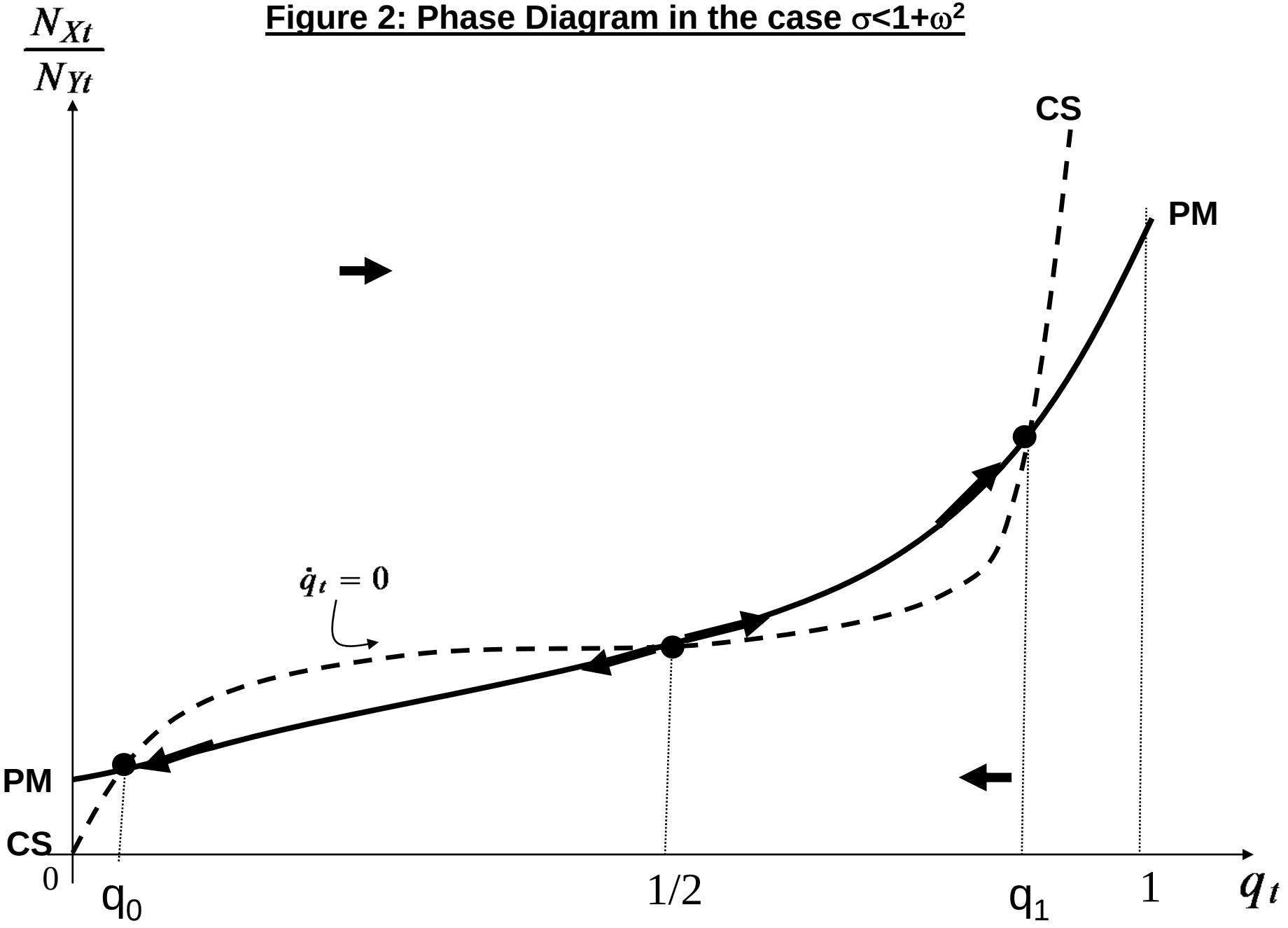

Figure 3: Trade Openness in the case $\sigma > 1+\omega^2$

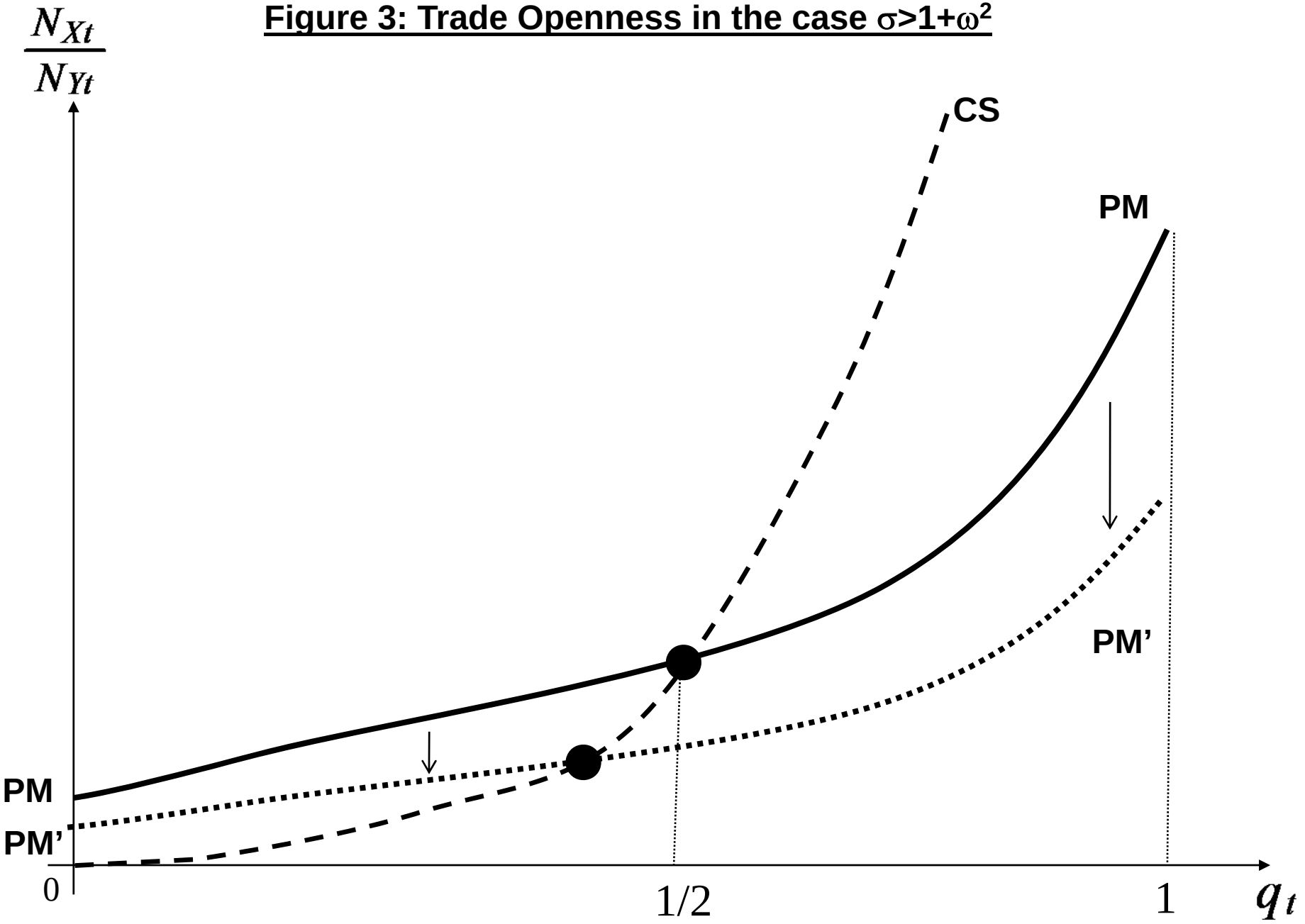

Figure 4: Trade Openness in the case $\sigma<1+\omega^2$