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Product-based cultural change: Is the village global?☆

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ABSTRACT

We provide a model of product-based cultural change where trade integration leads to cultural convergence. A standard trade model of Dixit–Stiglitz monopolistic competition is coupled with a micro-founded model of cultural dynamics. We show that access to varieties that are attached to a global cultural type changes the incentives of parents to socialize their children and transmit their type. The resulting increase in agents of the global cultural type leads to a magnification of the initial shock. A striking feature of the model is that even temporary shocks to openness may have permanent effects through the changing distribution of preferences in the economy.

1. Introduction

Words like culture or values have long been absent from the vocabulary of economists. A new and rapidly influential strand of literature has remedied this absence and demonstrated the importance of such variables to explain the cross-section of a wide array of economic outcomes. This literature has however largely left aside the delicate topic of the endogenous determination of cultures and, therefore, issues that are the subject of intense debate among political scientists and sociologists such as: what is the impact of globalization on values and preferences; do cultural values get progressively homogenized and converge towards common patterns over the world, or is there an irreducible persistence of cultural specificities across communities?[1] The objective of this paper is to fill the gap between the two literatures and to argue that cultural values and economic outcomes are jointly determined.

The new channel we propose, which complements the channel identified in the existing literature on culture and economics, arises from the view that the consumption of differentiated goods – such as movies, music, books, cars, clothes, cosmetics, food, beverages, jewelry, etc. – conveys symbols that are valued differently by agents belonging to different cultures. As a consequence, trade-related supply shocks on these goods change the relative benefits of belonging to different cultures and thus affect the long-run distribution of values and preferences. An example of such product-based cultural change is the post-world war link identified by sociologists between the rise in mass consumption on the one hand, and the declining trend in religiousness and the

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[1] The case for cultural persistence is most vividly made by Samuel Huntington (1996) who emphasizes the lasting differences of values between Western and non-Western civilizations and the resulting geopolitical tensions. Sociologists, such as Ritzer (1993), argue instead that the strive for economic efficiency leads to standardization of production and consumption across countries. A third view is that globalization generates new cultural forms through a process of creolization (Nederveen Pieterse, 2004) or of creative destruction (Cowen, 2002).

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erosion of traditional social norms experienced by Western countries on the other hand.[2]

Building on this example, Fig. 1 illustrates the link between trade and convergence of values we have in mind. We look here at attitudes towards religious denomination retrieved from the World Values Survey (WVS).[3] The units of observation for the histogram on the left of Fig. 1 are country-pairs for which we report the time evolution of an index of bilateral fractionalization of opinions, that is the probability that one individual drawn randomly in country *i* and another individual drawn from country j disagree on the WVS question about their affiliation to a religious denomination. The histogram suggests that while many country pairs have seen very little change in that probability of disagreement over the 1989–2000 period, there has also been a significant number of country pairs for which the probability of disagreement has gone down substantially but very few country pairs for which it has gone up substantially. More precisely the probability of disagreement has decreased on average by 1.9 percentage points over the 1989–2000 period, to be compared with the cross-country pair standard deviation of this probability of around 19 percentage points in 1989. We interpret this finding as suggestive of cultural convergence. The graph on the right of Fig. 1 illustrates in the panel dimension how part of this convergence process is potentially driven by international trade. Indeed this scatter plot represents the unconditional correlation between changes in bilateral trade openness and changes in bilateral fractionalization of attitudes towards religion. The correlation coefficient is highly significant and is economically large as the change in attitudes towards religion implied by the average increase in bilateral trade openness over the 1989–2000 corresponds to 83% of the convergence of attitudes towards religion observed during that period.

The short empirical section of the paper extends the results of the Fig. 1 to a wide set of opinions. We construct a measure of bilateral cultural distance based on country-pair fractionalization of opinions. We observe significant time variation in bilateral cultural distances over our sample period and a general pattern towards convergence. We then document that the time variation in bilateral cultural distances is correlated with variations in bilateral trade flows even after controlling for migration, information flows and country pair and time fixed effects.

The bulk of our analysis is dedicated to a simple theory of product-based cultural change which can rationalize these stylized facts. We borrow insights from psychology and the branch of marketing called consumer research and incorporate them into an otherwise standard economic model. Our theoretical framework has three building blocks. The first block corresponds to a standard economic model where firms produce differentiated products under monopolistic competition (Krugman, 1979; Helpman and Krugman, 1985). The second building block ties products to culture. We assume that (i) upon entry, firms anchor their products to a specific cultural type; (ii) agents have preferences which overweight consumption of products that convey symbols associated with their cultural type. The third block is a micro-founded model of cultural transmission *à la* Bisin and Verdier (2001, 2011).

The key insight of our theory is that the distribution of cultural types and the supply of (differentiated) consumption goods are co-determined at the equilibrium. Cultural types drive the demand for consumption goods but the supply of consumption goods has a feedback effect on cultural types. Hence any exogenous supply shock may have both short-run and long-run effects on culture. Focusing on the case of a product market integration shock, we show that integrating two countries simultaneously generates a continuous increase in trade volume and a continuous decrease in bilateral cultural distances as observed in the data. This is because the removal of trade barriers increases the incentives of firms to anchor their products to cultural types common to the two countries and because of the two-sided interaction between supply of goods and distribution of types. We also show that the long-run effect of trade integration onto culture is larger when traded goods are more differentiated. This is because product differentiation drives the strength of the feedback effect. Finally, we show that a temporary increase in trade openness may have a permanent effect on the distribution of cultural types in the economy. This lock-in effect arises when multiple long-run equilibria exist under autarky but there is only one unique equilibrium under free-trade.

From a theoretical standpoint, our work is related to Van Ypersele and François (2002), Bala and Van Long (2005), Janeba (2004) and Rauch and Trindade (2009). However, in all these papers, cultural diversity is considered as an exogenous and static feature of the economy. By way of contrast, our analysis is dynamic in nature and provides a general framework for analyzing the joint determination of cultural distance and economic equilibrium. A similar joint determination is studied in Olivier et al. (2008) but under perfect competition and for the specific case where goods can be used to shape social networks. The two models yield a different set of empirical implications; the evidence we report providing much stronger support for the model with imperfect competition but no social network. Finally a similar "lock-in" effect of temporary trade shocks as in our model can be observed in Staiger (1995) and Devereux (1997) but through very different mechanisms from ours: sector specific human capital depreciation in Staiger (1995) and learning by doing externalities in Devereux (1997).

Our paper also provides an additional perspective in the current debate among economists on the possible sources of long-run persistence in economic outcomes. Over the past few years, two schools of thoughts have provided contrasted views on the issue. The first school, led by Acemoglu et al. (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, led by Guiso et al. (2006, 2007, 2008, 2009), emphasizes instead the role of culture, and more specifically the role of values such as trust, social capital or religiousness. Distinguishing between the two hypotheses has proved delicate. For instance, Tabellini (2008a,b) provides a broad spectrum of cross-sectional evidence suggesting that the causality runs from values to institutions. Reciprocally, Alesina and Fuchs-Schündeln (2007), Landier et al. (2008) and Aghion et al. (2010) emphasize the impact of institutions on culture.[4] Our results point in a different and complementary direction: we show that cultural values can exhibit higher frequency variations as they react to supply side shocks of the economy such as trade integration. All in all, this suggests that the long run pattern of economic performances, cultural values and institutions can perhaps be best viewed as a coevolutionary process between the three components.

The remainder of the paper is organized as follows. We first review selected work in anthropology, psychology and consumer research in Section 2 which motivates our underlying hypothesis that products convey symbols which can influence agents' values and preferences. We present the data from the WVS and construct measures of bilateral cultural distance in Section 3, which we then use to document the empirical link between trade and culture. We propose a simple model of product-based cultural change in Section 4. We study the equilibrium under autarky in Section 5 and the case of trade integration with two

[2] Turner (2008) analyzes the struggle between consumerism and religiousness in all Western Europe over the 20th century. We interpret this episode as the fact that globalization increases the supply of secular goods. This tends to reduce the relative utility of being devout and finally induces over time a sharp decrease in the equilibrium fraction of religious agents. Regarding recent cultural evolution in India, Jones (2006) says: "There Rolex has replaced religion and a second unification is happening, in which the affluent young now define themselves by a shared consumer culture and not solely by caste, creed, and language. They are starting to marry within that subculture".

[3] Question f024: "Do you belong to a religious denomination?" The binary answer is "Yes" or "No".

[4] Spolaore and Wacziarg (2009) provide an intriguing third possibility: genetic distance seems to proxy for the missing persistent explanatory variable in cross-country income regressions. Desmet et al. (2011) 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 favor of a direct role of genetic diversity on economic outcomes.

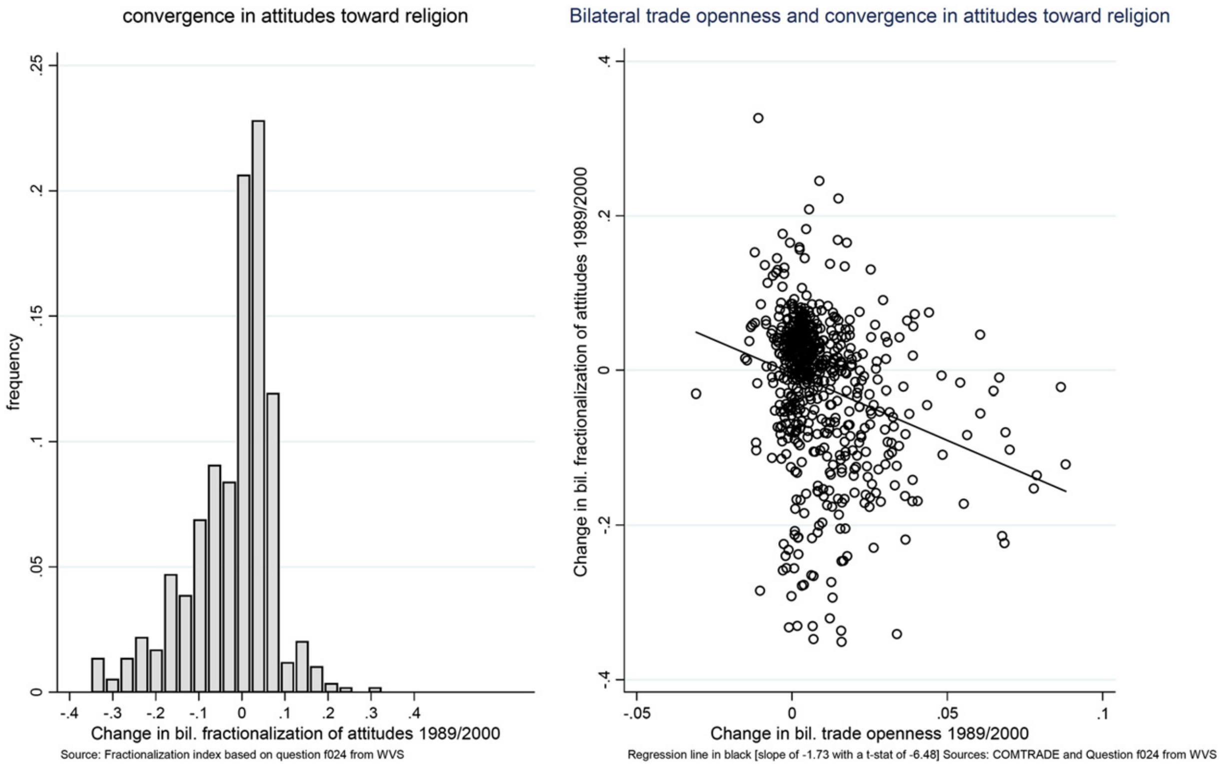

Fig. 1. Convergence of attitudes towards religion and trade openness.

countries in Section 6. We extend the model to a multiple country economy in Section 7. We discuss welfare and political economy implications in Section 8. We conclude in Section 9.

2. The cultural meaning of consumer goods

Our analysis departs from conventional economic theory by assuming that individuals are endowed with different clusters of cultural values and that these cultural values can be tied to consumption. These ideas build on a well established tradition in anthropology, psychology and marketing emphasizing the fact that products have a significance that goes beyond their functional utility, which can be altered through well-designed marketing or advertising campaigns and which can in turn explain why marketing expenditure is an important driver of consumer demand, along with the more familiar variables of price and income.

Said differently, people buy products not only for what they do but also for what they symbolize (Levy, 1959) and prefer to consume products that have a symbolic meaning consistent with their own identity and values (Sirgy, 1982). These products include not only standard cultural goods (books, movies, music…) but also various differentiated consumption goods (food and beverages, fashion clothes, cars, cosmetics, jewelry and other conspicuous goods…). Agents use their consumption patterns to define their own identity by signaling information to their self and to other agents (Holman, 1981; Solomon, 1983; Berger and Heath, 2007). With technological improvements and systematic quality controls across industries, the symbolic meaning of goods becomes increasingly important. Citing Berger and Heath (2007): "Nowadays, differentiating products based on their technical functions or quality is difficult. 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."

As a consequence, firms take the symbolic dimension into account in their marketing strategies and brand image management (Aakert, 1997; Govers and Schoormans, 2005). Mc Cracken (1986a, 1986b, 1988) provides a detailed description of the process by which cultural values and symbols transit into consumer products through advertising and product design. More specifically, advertising is viewed as a process that ties a consumer good to a set of representations and beliefs in such a way that the potential consumer perceives some similarity between them. When associated to characteristics perceived as positive, this association increases the propensity to consume the product. Recent studies in experimental psychology and neurosciences have provided confirming evidence that marketing actions can successfully affect consumers' decision by manipulating non-intrinsic attributes of goods.[5]

To summarize, the literature in anthropology and in consumer research suggests that consumption goods convey symbols that shape the identity of consumers, that firms manage to anchor their products to a specific cultural type through marketing policy, advertising and product design, which have an impact on consumer demand.

3. Motivating evidence

In this section we derive some stylized facts linking cultural change and international trade that we use to motivate our theoretical analysis. We first present the data and report some summary statistics. We then provide a simple econometric analysis.[6]

3.1. Data and construction of the index of cultural distance

The World Value Survey (WVS) is a widely used dataset in the growing field on culture and economics. It is an opinion survey which conveys information on attitudes, beliefs and values at the household level. In

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

[6] We refer the reader to the working paper version of the paper (Maystre et al., 2009) where we provide a comprehensive empirical analysis with additional results.

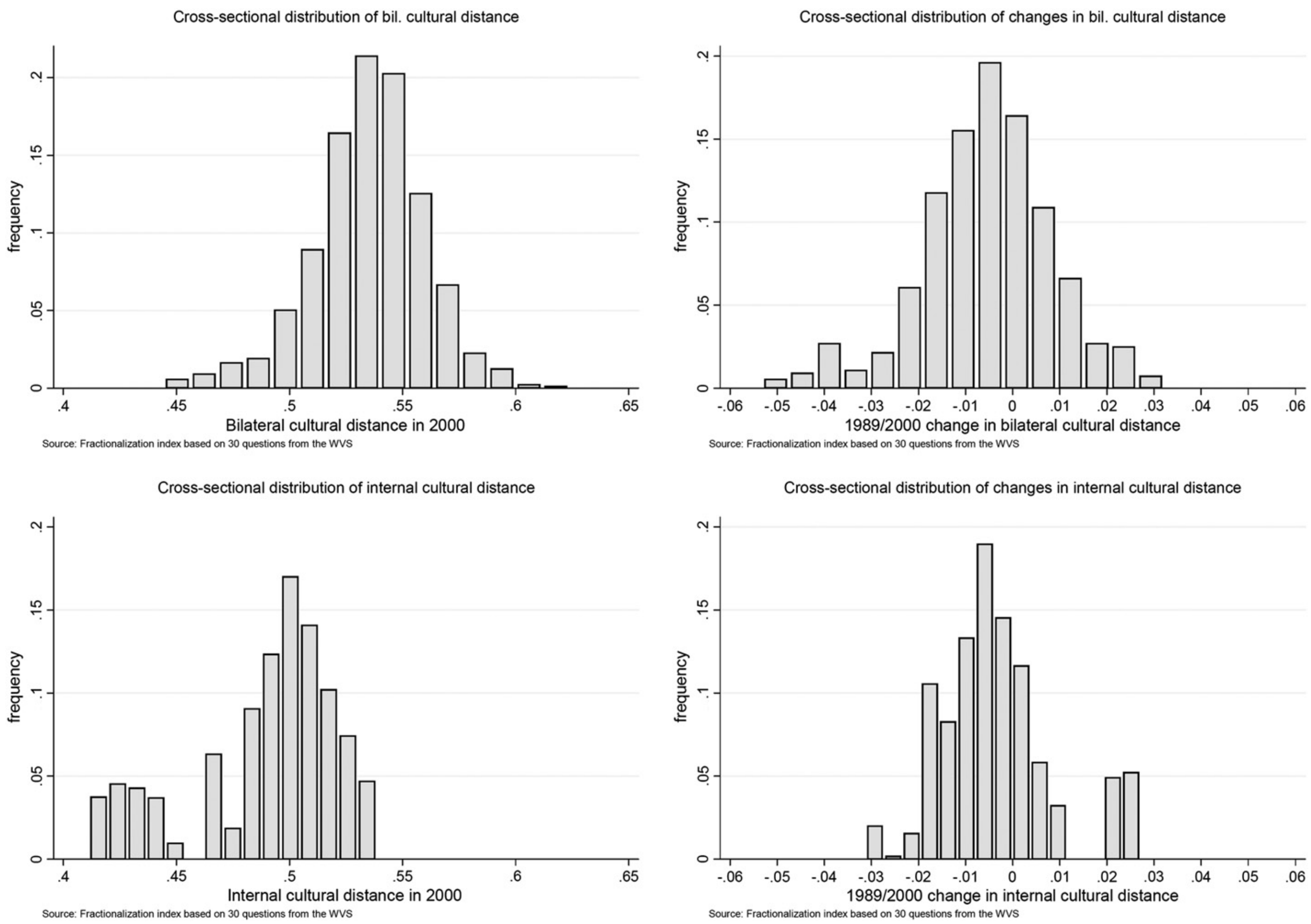

Fig. 2. Cross-sectional distributions of the level and change in cultural distance.

total, more than 200,000 individuals, above the age of 15, from 82 countries are surveyed in a repeated cross section that comes in four waves. We restrict the sample in two different ways. First, a highly unbalanced statistical coverage forces us to drop the first wave of the WVS (1981–1984). Second, in order to capture medium-run changes in values, we restrict our panel analysis to wave 2 (1989–1993) and wave 4 (2000–2004).[7] Trade flows data originate from the UN Comtrade dataset.[8] Country-level data such as population, GDP and FDI come from the World Bank WDI database. The internet and phone data come from the International Telecommunication Union. For all trade and economic variables of interest, we compute the country-level average over each wave of the WVS. The final sample consists in all country pairs for which we can observe all co-variates in addition to the cultural distances for waves 2 and 4 of the WVS. This makes for a list of 416 country-pairs representing 31 countries.[9]

We measure bilateral cultural distance with an index of fractionalization as commonly used in the economic literature (Fearon, 2003; Alesina et al., 2003). For a given pair of countries (i, j) this corresponds to the probability that two randomly picked individuals do not share the same observable value. In our context, each value corresponds to a specific question from the WVS. Let denote respectively $f_i(k)$ and $f_j(k)$ the shares of individuals respectively in countries i and j who choose the answer k to the question (out of a total of N possible answers). The probability that two randomly picked individuals do not give the same answer is equal to: $D_{ij} = 1 - \sum_{k=1}^{N} f_i(k) f_j(k)$. Similarly we can define internal cultural distance in the case $i = j$, where the two randomly picked individuals belong to the same country.

A key issue relates to the selection of the WVS questions. We choose to be agnostic about which question of the WVS corresponds to values most likely to be influenced by trade in differentiated products. We instead construct a measure of bilateral cultural distances corresponds to a multi-dimensional index of fractionalization based on the set of 30 WVS questions which offer the best statistical coverage. This strategy shields us from possible data mining concerns at the cost of a less transparent mapping between this multidimensional index and the nature of the goods which are likely to affect it. The list of questions in the multi-dimensional index is provided in the Appendix. We first build a one-dimensional fractionalization index for each country-pair and WVS question. We then compute the average across the 30 one-dimensional fractionalization indices for each country-pair, which we use as our multidimensional measure of bilateral cultural distance.[10]

Fig. 2 below depicts the distribution of internal and bilateral cultural distances in our sample. The leftmost graphs represent the distribution of cultural distances in 2000. The top graph represents the distribution

[7] The qualitative results are not affected by the inclusion or exclusion of Wave 3 in the sample (results are available upon request).

[8] Special thanks are due to Thierry Mayer for sharing the data from Disdier et al. (2010b).

[9] The list of countries present in the final sample is: Austria, Belgium, Bulgaria, Canada, Chile, China, Denmark, Estonia, Finland, France, Germany, Hungary, Iceland, India, Ireland, Italy, Japan, Latvia, Lithuania, Malta, Mexico, Netherlands, Nigeria, Poland, Portugal, Russian Federation, Slovenia, South Africa, Turkey, Uganda, and United States of America.

[10] A potential issue raised by this simple averaging procedure is that characteristics measured by the 30 questions picked from the WVS are potentially correlated with each other. In our working paper version, we implement a proper weighting averaging procedure that deals with this issue. Nevertheless the empirical results are very close to those obtained here with the unweighted averaging procedure. We also run as a robustness check regressions based on the 10 (instead of 30) WVS questions with the best statistical coverage and find our results unchanged.

of bilateral distances while the bottom graph represents the distribution of internal distances. As can be expected the average bilateral distance is significantly higher than the average internal cultural distance: the average bilateral cultural distance is equal to 0.53, with a standard deviation of 0.02, while the average internal cultural distance is equal to 0.48, with a standard deviation of 0.03. The rightmost graphs in Fig. 2 represent the cross-sectional distribution of the changes in cultural distances between Wave 2 and Wave 4 of the WVS. A look at the graphs confirms a clear pattern of cultural convergence both for internal and bilateral cultural distances. For instance, the absolute value of the decrease in bilateral cultural distance is equal to 0.5 percentage point. While this number may seem small at first sight, it is close to one fourth of the cross-sectional standard deviation of cultural distance, which is a meaningful time-change when regarding evolution of cultures over less than two decades. Our objective in this paper is to understand the trade-related determinants of such a change.

3.2. Trade and culture

We now investigate the conditional correlation between cultural change and trade openness.

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

$$D_{ijt} = \beta_1 \cdot lnOPEN_{ijt} + \mathbf{CONTROL}_{ijt} \cdot \beta + FE_{ij} + FE_t + \varepsilon_{ijt} \quad (1)$$

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

In all regressions but one we control for country-pair fixed effects in order to filter out all time-invariant (or slow moving) codeterminants of bilateral cultural distance and bilateral trade flows such as geography or past common history. We also control for time fixed effects in all regressions to filter out potential worldwide time trends in cultural change and international trade. Thus, our coefficient of interest, β_1, is identified in the within country-pair dimension, a fairly demanding specification.

The set of time-varying controls includes:

(1) Within country heterogeneity: 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. In all specifications we thus control for the sum of internal cultural distances at the country-pair level.
(2) Information flows are likely to bring down bilateral cultural distance and to co-move with trade in goods. We proxy for information flows using country-pair internet access[11] and country pair phone outcalls.
(3) Migration: a potential time-varying codeterminant of trade and cultural distance is migration. We control for the log of bilateral migration, which we lag by five years to limit simultaneity concern. Due to a lack of panel data on bilateral stocks of migrants, we exploit data on bilateral migration flows. However, most of the unobserved heterogeneity in migration stocks is likely to be captured by the country-pair fixed effects.
(4) Income differences: we control for the differential in GDP per capita measured as the logarithm of $|GDP_{it} - GDP_{jt}|$. Indeed an important view in sociology (Baker and Inglehart, 2000) claims that economic development drives a cultural shift from traditional to postmodern values. Since trade openness is also affected by economic development, we need to control for GDP differential.
(5) Multilateral openness: two countries could become culturally closer either because they trade with one another as captured by our main control variable either because they each trade with a third common trading partner (e.g. the US) which is bringing them both culturally closer to the same "cultural model". We try to control for this indirect channel by including the log of country pair multilateral openness, where multilateral openness is defined as the sum of total trade flows of the two countries, excluding bilateral trade flows, divided by the sum of country-pair GDPs.[12]

Table 1
Bilateral trade openness and bilateral cultural distance.

Dependent variable	Bilateral cultural distance			
Estimator	OLS	OLS	OLS	OLS
Model	1	2	3	4
ln bil. openness [all goods]	−0.084*	−0.240***		
	[0.047]	[0.052]		
ln bil. openness [homogenous goods]			−0.102**	−0.025
			[0.044]	[0.075]
ln bil. openness [differentiated goods]			−0.206***	−0.287***
			[0.061]	[0.102]
ln ctry-pair multilateral openness	0.281*	−0.054	−0.016	−0.800*
	[0.155]	[0.252]	[0.277]	[0.468]
Sum of internal cultural dist.	0.248***	0.324***	0.424***	0.573***
	[0.068]	[0.080]	[0.079]	[0.075]
Differential of GDP per cap	0.797***	0.091	0.073	0.172
	[0.082]	[0.099]	[0.096]	[0.161]
Ctry-pair internet access (per capita)	−0.007	−0.045***	−0.036***	0.009
	[0.012]	[0.008]	[0.008]	[0.014]
Ctry-pair phone outcall (per capita)	−0.005**	−0.004*	−0.004*	−0.006*
	[0.002]	[0.002]	[0.002]	[0.003]
ln bil. migration	0.013	0.029	0.028	0.026
	[0.030]	[0.029]	[0.028]	[0.048]
Time dummies	yes	yes	yes	yes
Country pair FE	no	yes	yes	yes
# Observations	832	832	766	766
# Country-pairs	416	416	383	383
R2	0.28	0.39	0.375	0.426

Notes: **significant at 5%; ***significant at 1%. Constant is not reported. Standard errors clustered by country pair. For readability purposes, all coefficients are multiplied by 100. The dependent variable is our index of bilateral cultural distance based on the average of fractionalization indices across the set of 30 WVS questions offering the best statistical coverage in columns 1–3, the set of 10 WVS questions in column 4. Bilateral trade flows are retrieved from COMTRADE. Homogenous and differentiated goods are defined along the Rauch classification.

Results are reported in Table 1. The first column corresponds to a pooled regression without country pair fixed effect. Our coefficient of interest (bilateral openness) has the expected sign and is statistically significant at the 10% threshold. In Column 2 the country-pair fixed effects are included and the coefficient of bilateral openness increases threefold and is now statistically significant at the 1% threshold.

[11] The variable is defined as the probability that two randomly picked individuals in the pair of countries both have an access to the internet. Falkinger (2007) provides a nice theoretical discussion of the impact of information flows on cultural diversity while Disdier et al. (2010) offer some empirical evidence.

[12] Note however that the way to control for "third country effects" depends on the specific model of culture and trade one has in mind. In a world with only one global cultural type and many local types, multilateral openness as defined here makes sense: the more one country trades, the more its population acquires the global cultural type and the closer it gets to other countries which trade a lot. In a world with many global cultural types however, whom you trade with and what you trade (i.e. the degree of trade overlap with third country partners) may be as important as how much you trade. For instance, one could reasonably conjecture that a country which trades a lot with Canada will see its cultural distance with US go down but that the same may not be true for a country which trades a lot with Cuba. Such considerations could lead to introducing for each country pair (i, j) a weighted multilateral openness variable whereby trade flows between country i and country k different from j are weighted by (the inverse of) the cultural distance between country j and country k. This however goes beyond the scope of this paper if only for reasons of data coverage as the computation of weighted multilateral openness requires cultural distances with all trading partners, which we do not have in our dataset.

Columns 3 and 4 provide evidence on the specific role of differentiated goods. Those are the goods which convey symbolic and cultural markers that potentially reduce bilateral cultural distance. By contrast one should not expect trade in homogenous goods, for instance raw material, to have any impact whatsoever on cultural distances. To document this fact, we split in Column 3 our bilateral openness variable into two variables: openness in homogenous goods and openness in differentiated goods following the Rauch (2001) classification. Results of the regression are consistent with our intuition: the coefficient of openness in differentiated goods is larger than the coefficient of openness in homogenous goods. A further robustness check is run in Regression 4, where the specification is identical to that of Regression 3 but where the dependent variable is a measure of cultural distance based on the 10 questions (instead of 30 for Regressions 1–3) of the WVS with the best statistical coverage. Results are very much in line with those of Regression 3. In particular, bilateral trade in differentiated products is significant at the 1% level while bilateral trade in homogenous products is no longer significant.

The two stylized facts we derive from this section are that bilateral cultural distances exhibit significant time variation and that time variation in bilateral cultural distances is correlated with time variation in trade in (differentiated) goods even after controlling for "usual suspects".

We now present a simple theory consistent with the empirical evidence.

4. A simple model of time-varying culture

Our model is composed of three ingredients. The first ingredient is a standard monopolistic trade model (Krugman, 1979; Helpman and Krugman, 1985) with a demand side of the economy characterized by agents with preferences that exhibit a love for variety over differentiated products, and a supply side characterized by free entry and a zero profit condition. The second ingredient of our model is composed of two assumptions on goods characteristics and cultural types, which capture in a stylized way the elements discussed in Section 2: (i) agents of a given cultural type have preferences which overweight products that convey symbols congruent with their own cultural type; (ii) upon entry, firms anchor their product to one particular cultural type. The last ingredient is dynamics of cultural type that arise endogenously through a micro-founded model of preference transmission. In our analysis preferences and cultural types are observationally equivalent so we use both terms indifferently.

4.1. Preferences, goods characteristics and technology

4.1.1. The demand side

We consider a non overlapping generation model in continuous time with a population size normalized to 1. We assume that there are two cultural types, X and Y. Associated to these cultural types are two types of goods and two types of individuals. Time is continuous and at a date t, type-X agents represent a share q_t of the population and type-Y agents a share of $(1 - q_t)$. Agents of type X and Y respectively have Cobb–Douglas preferences (U_X, U_Y) which overweight goods associated to their own cultural type:

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

with $\omega \in (0, 1)$. Each of the composite goods (X, Y) is differentiated into a time-varying mass $(N_{X,t}, N_{Y,t})$ of varieties in a Dixit–Stiglitz way:

$$\begin{cases} X = \left(\int_0^{N_{X,t}} (c_X(k)) \dfrac{\sigma-1}{\sigma} dk\right)^{\frac{\sigma}{\sigma-1}} \\ Y = \left(\int_0^{N_{Y,t}} (c_Y(k)) \dfrac{\sigma-1}{\sigma} dk\right)^{\frac{\sigma}{\sigma-1}} \end{cases} \qquad (3)$$

where $(c_X(k); c_Y(k))$ represents consumptions of each variety and $\sigma > 1$ is the elasticity of substitution.

Each agent supplies one unit of labor in a competitive labor market. The wage rate is taken as a numeraire $w_t \equiv 1$ for all date t. The problem of each agent of type $i \in \{X, Y\}$ is to maximize her preference function U_i (X, Y) under the budget constraint $\int_0^{N_{X,t}} p_{X,t}(k)c_X(k)dk + \int_0^{N_{Y,t}} p_{Y,t}(k)c_Y(k)dk = w_t$, where $(p_{X,t}(k); p_{Y,t}(k))$ are variety prices.[13] At the symmetric equilibrium those prices are constant across varieties of the same type, $p_{j,t}(k) = p_{j,t}$ for all k and $j \in \{X, Y\}$, and standard computation yields the consumption per variety:

$$\begin{cases} \text{For type X agents}: \ c_{X,t} = \dfrac{1+\omega}{2} P_{X,t}^{(\sigma-1)} p_{X,t}^{-\sigma} \ \text{and} \ c_{Y,t} = \dfrac{1-\omega}{2} P_{Y,t}^{(\sigma-1)} p_{Y,t}^{-\sigma} \\ \text{For type Y agents}: \ c_{X,t} = \dfrac{1-\omega}{2} P_{X,t}^{(\sigma-1)} p_{X,t}^{-\sigma} \ \text{and} \ c_{Y,t} = \dfrac{1+\omega}{2} P_{Y,t}^{(\sigma-1)} p_{Y,t}^{-\sigma} \end{cases} \qquad (4)$$

where the aggregate price index for each composite good $j \in \{X, Y\}$ is given by the following: $P_{j,t} \equiv \left(\int_0^{N_{j,t}} \left(p_{j,t}(k)\right)^{1-\sigma} dk\right)^{1/(1-\sigma)} = p_{j,t} \times \left(N_{j,t}\right)^{1/(1-\sigma)}$. For a given q_t, aggregate demands for varieties of type X and Y respectively, are given by:

$$\begin{cases} D_{X,t} = \left[\dfrac{1}{2} + \omega \times \left(q_t - \dfrac{1}{2}\right)\right] P_{X,t}^{(\sigma-1)} p_{X,t}^{-\sigma} \\ D_{Y,t} = \left[\dfrac{1}{2} + \omega \times \left(\dfrac{1}{2} - q_t\right)\right] P_{Y,t}^{(\sigma-1)} p_{Y,t}^{-\sigma} \end{cases} \qquad (5)$$

4.1.2. The supply side

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

4.2. Dynamics of preferences

At this stage, we have described preferences and production at a given date t, and therefore for a given fraction q_t of type-X agents. We now endogenize how the distribution of preferences evolves over time. Preferences may change as the outcome of either vertical socialization (e.g. from parents to children) or of horizontal socialization (e.g. from peers). One can think of the former driving low frequency cultural change while the latter drives medium to high frequency changes. In this section, we provide a simple micro founded process of intergenerational transmission of preferences in

[13] Our writing of the budget constraint already makes use of the symmetry of varieties associated to the same cultural type and of the fact that firms make zero profits at the equilibrium.

line with a growing and influential literature on the topic.[14] However, similar dynamics of q_t can be derived from a model of socialization by peers.

We assume that parents are imperfectly altruistic, or paternalistic, in the sense that they 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.[15]

Preference transmission partly results from the direct effort of parental transmission but it also depends on indirect contamination from the rest of the society in case of failure of direct transmission. More precisely, we assume that an effort τ exerted by parents of type $i \in\{X, Y\}$ results into a probability τ of the offspring being socialized by her parents and adopting their preferences. With probability $(1-\tau)$ the offspring remains naive and gets socialized by another old generation individual, of type X or Y, through random matching with conditional probabilities $(q_t, 1-q_t)$. As a consequence, a parent of type i and her offspring are from the same (resp. different) type with probability $\mathbb{P}^i_{i,t}$ (resp. $1-\mathbb{P}^i_{i,t}$) where $\mathbb{P}^X_{X,t}(\tau) \equiv \tau + (1-\tau)q_t$ and $\mathbb{P}^Y_{Y,t}(\tau) \equiv \tau + (1-\tau)(1-q_t)$. Effort has a convex cost that we assume quadratic $\tau_i^2/2$.

Consider now V^i_{jt}, the expected welfare derived from the optimal consumption behavior of a child of type j as perceived through the preferences of a parent of type i. When offspring are of a different cultural type than their parents, the parents incur a utility cost to see their kids different from them. This cost is equal to: $\Delta V^i_t \equiv V^i_{i,t} - V^i_{j,t}$. Each parent of type i chooses an optimal effort of transmission which is given by $\tau_{i,t} = argmax_\tau \{\mathbb{P}^i_{i,t}(\tau) \times V^i_{i,t} + (1-\mathbb{P}^i_{i,t}(\tau)) \times V^i_{j,t} - \tau^2/2\}$. Solving this maximization problem yields the optimal efforts of transmission for parents of type X and Y:

$$\tau_{X,t} = (1-q_t) \times \Delta V^X_t \text{ and } \tau_{Y,t} = q_t \times \Delta V^Y_t \tag{6}$$

For a parent of type X the optimal effort of transmission depends positively on the utility cost ΔV^X_t but negatively on the size of her community q_t. This externality effect is easy to interpret. The larger a given cultural community, the smaller the individual incentives of a parent of that community to spend resources socializing his offspring to his preference profile. Indeed, as the community increases in size, the larger the probability of the offspring to pick up a role model from that community and to adopt the community preferences. This provides stronger 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.

To sum up, the process of intergenerational cultural transmission is characterized by transition probabilities $P^i_{j,t}$ that a parent of type $i\in(X, Y)$ has a child adopting a preference of type $j\in(X, Y)$. These transition probabilities are given by:

$$\begin{cases} \mathbb{P}^X_{X,t} = \tau_{X,t} + \left(1-\tau_{X,t}\right)q_t \\ \mathbb{P}^X_{Y,t} = \left(1-\tau_{X,t}\right)(1-q_t) \\ \mathbb{P}^Y_{Y,t} = \tau_{Y,t} + \left(1-\tau_{Y,t}\right)(1-q_t) \\ \mathbb{P}^Y_{X,t} = \left(1-\tau_{Y,t}\right)q_t \end{cases}. \tag{7}$$

We assume that between t and $t+dt$ a fraction λdt of the population dies. Before dying each agent gives birth to one offspring that is socialized to a certain preference profile (X or Y) according to the process described in Eq. (7). 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:

$$q_{t+dt} = (1-\lambda dt) \times q_t + (\lambda dt) \times \left[q_t \mathbb{P}^X_{X,t} + (1-q_t)\mathbb{P}^Y_{X,t}\right].$$

The interpretation of the equation above is straightforward: the new mass of agents of type X is composed of the surviving parents of type X plus the fraction of children of parents of type X who inherited their parents type plus the fraction of children of parents of type Y who inherited a different type from their parents'. Without loss of generality, we assume $\lambda = 1$ Substituting the transition probabilities by their values given by Eq. (7), we get:

$$\begin{aligned} \frac{q_{t+dt} - q_t}{dt} &= -q_t + q_t\left(\tau_{X,t} + \left(1-\tau_{X,t}\right)q_t\right) + (1-q_t)\left(1-\tau_{Y,t}\right)q_t \\ &= q_t(1-q_t)\left(\tau_{X,t} - \tau_{Y,t}\right). \end{aligned}$$

Taking the continuous time limit $dt \to 0$ in the previous equation, we finally obtain the law of motion of q_t:

$$\dot{q}_t = q_t \times (1-q_t) \times \left(\tau_{X,t} - \tau_{Y,t}\right) \tag{8}$$

where $\tau_{X,t}$; $\tau_{Y,t}$ are given by Eq. (6) at the optimum.

5. Equilibrium under autarky

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

Each monopolistic firm producing a given variety associated to a cultural type $i\in\{X, Y\}$ is maximizing profits and imposing a constant mark-up over marginal cost: $p_{i,t} = \frac{\sigma}{\sigma-1}$. Equilibrium profit is easily computed as $\pi_{i,t} = D_{i,t} \times (p_{i,t} - 1)$ where the demand function $D_{i,t}$ is given by Eq. (5). Finally in a free entry equilibrium we necessarily have $\pi_{i,t} = F$ which implies that at equilibrium firms are indifferent between

[14] See e.g. Bisin and Verdier (2000a) for marriage and religion, Tabellini (2008a,b) for pro-social behaviors. Our contribution compared to the early literature is to propose a model where product market competition and preference dynamics interact and give rise to non-trivial price and market size effects. In this respect, our model is closer to Olivier et al. (2008) who analyze a model without product differentiation but with network externalities. The testable implications of the two models differ. The stylized facts presented in the empirical section however clearly point toward product differentiation as a driver of the impact of trade on culture rather than the mechanism that we proposed in our earlier work.

[15] Paternalism also differs from pure altruism in that parents derive utility from observing their children consuming goods they (meaning the parents) value but do not derive any indirect utility from their children themselves observing their own children consuming goods they value. From a technical standpoint, this assumption simplifies the solution of the optimization problem of the parents considerably as it does not require the knowledge of the entire path of $q_{\tau > t}$. From an economic standpoint, evidence supporting paternalism over pure altruism has been brought forward by Pollak (1988), who argues that paternalism is a natural explanation for tied intergenerational transfers (i.e. parents being willing to give money to their offspring only if used for a very specific purpose), and more recently by Jacobsson et al. (2007) in the context of healthcare, who provide experimental evidence that agents are more willing to donate nicotine patches to smoking diabetes patients than the equivalent amount in cash even though the agents are informed that the patients would not be willing to pay market prices to purchase nicotine patches on their own. Further simplification is achieved through the continuous time nature of the model. Parents indeed have to consider the expected future equilibrium values of consumption of their children between time t and $t+dt$. Such equilibrium values would normally depend on parents' rational expectations of the future state of the economy as characterized by q_{t+dt}. Given that we are considering a continuous time model of generations (i.e. $dt \to 0$), q_{t+dt} is not significantly different from q_t. See Bisin and Verdier (2000b) for an analysis of (different) cultural dynamics in a discrete time environment.

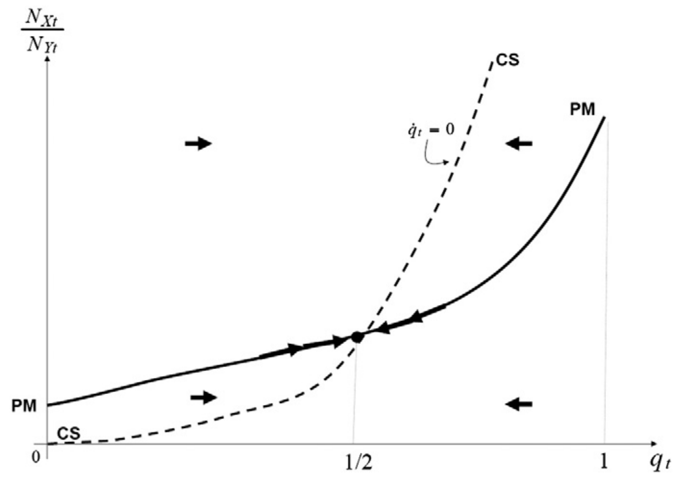

Fig. 3. Phase diagram in the case $\sigma > 1 + \omega^2$.

anchoring their product to the cultural type X or Y. Combining these expressions yields the equilibrium number of varieties at each date t:

$$N_{X,t} = (\sigma F)^{-1} \times \left[\frac{1}{2} + \omega\left(q_t - \frac{1}{2}\right)\right] \text{ and } N_{Y,t} = (\sigma F)^{-1} \times \left[\frac{1}{2} + \omega\left(\frac{1}{2} - q_t\right)\right] \quad (9)$$

From these two conditions, we derive the equation of the (PM) curve, where PM stands for equilibrium of the Product Market

$$\frac{N_{X,t}}{N_{Y,t}} = \frac{1 + 2\omega(q_t - \frac{1}{2})}{1 - 2\omega(q_t - \frac{1}{2})} \qquad PM.$$

The (PM) curve links q_t, the fraction of agents of type X at date t, to entry decisions on the product market for X: an increase in q_t leads to an increase in the relative market size of good X, which translates into more entry and thus an increase in $N_{X,t}/N_{Y,t}$. This reflects a standard market size effect as found in many monopolistic competition frameworks.

We now solve for the equilibrium dynamics of q_t. From Eq. (6) we need to evaluate the utility cost functions ΔV_t^X and ΔV_t^Y in order to characterize the dynamics of preferences. Substituting the equilibrium price $p_{i,t} = \frac{\sigma}{\sigma - 1}$ into the optimal consumptions Eq. (4) yields the equilibrium demands, which plugged into the preference functions Eq. (2) gives:

$$\Delta V_t^X = \overline{\varpi}\left[N_{X,t}^{(1+\omega)/2} N_{Y,t}^{(1-\omega)/2}\right]^{1/(\sigma-1)} \quad (10)$$

$$\Delta V_t^Y = \overline{\varpi}\left[N_{X,t}^{(1-\omega)/2} N_{Y,t}^{(1+\omega)/2}\right]^{1/(\sigma-1)} \quad (11)$$

where $\overline{\varpi} \equiv \left(\frac{\sigma-1}{\sigma}\right)\left[\left(\frac{1+\omega}{2}\right)^{\left(\frac{1+\omega}{2}\right)}\left(\frac{1-\omega}{2}\right)^{\left(\frac{1-\omega}{2}\right)} - \left(\frac{1-\omega}{2}\right)^{\left(\frac{1+\omega}{2}\right)}\left(\frac{1+\omega}{2}\right)^{\left(\frac{1-\omega}{2}\right)}\right]$ is a scaling parameter.

Collecting Eqs. (6), (8), (10), and (11) we get:

$$\dot{q}_t \gtreqless 0 \text{ if and only if } \frac{N_{X,t}}{N_{Y,t}} \gtreqless \left(\frac{q_t}{1-q_t}\right)^{\frac{(\sigma-1)}{\omega}} CS.$$

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

Fig. 3 represents a simple phase diagram summarizing the entire dynamics of q_t. At any date t the equilibrium relative number of varieties must lie on the bold (PM) curve. The dashed curve (CS) represents the locus of Cultural Stationarity corresponding to $\dot{q} = 0$. It is an upward sloping curve, which represents the set of $(q_t; N_{X,t}/N_{Y,t})$ such that the two forces at play in the dynamics of q_t exactly counterbalance each other. From (CS), we get that $\dot{q}_t > 0$ if the economy lies to the left of the (CS) curve, that is when the free-riding driven by q_t is small relative to the incentives provided by the relative supply of varieties of type X, $N_{X,t}/N_{Y,t}$.

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

$$\frac{1 + 2\omega(q - \frac{1}{2})}{1 - 2\omega(q - \frac{1}{2})} = \left(\frac{q}{1-q}\right)^{\frac{(\sigma-1)}{\omega}}. \quad (12)$$

Due to symmetry, $q = 1/2$ is a root of Eq. (12) and thus clearly a steady-state. The following proposition shows that under some conditions we discuss below, it is the unique cultural steady state under autarky.

Proposition 1. Unique cultural steady state under autarky

Suppose $\sigma \geq 1 + \omega^2$ then:

(i) *The value $q^a = 1/2$ is the unique cultural steady state which satisfies Eq. (12).*
(ii) That steady state is globally stable.

Proof. See Appendix B.1.

The phase diagram corresponding to Proposition 1 is depicted in Fig. 3: whether the economy starts to the left or to the right of $q^a = 1/2$ it converges monotonically towards this point along the (PM) curve. The cultural dynamics reflects the combination of two opposite forces on the transmission process: the relative-variety effect and the cultural free riding effect. The first effect tends to tilt the cultural dynamics towards the larger group while the second one on the contrary is more favorable to the minority group. Given the symmetry of the problem, at $q^a = 1/2$ both the relative variety effect and the cultural free riding effect are equilibrated between the two cultural groups. Hence $q^a = 1/2$ is a steady state.

The fact that $q = 1/2$ remains the unique stable steady state depends on the relative strength of the cultural free riding effect and the relative-variety effect when one departs from the symmetric situation $q^a = 1/2$. Consider for instance that q becomes larger than 1/2. The relative-variety effect is then triggered in favor of trait X whose frequency in the population increases. Indeed, the market size for goods of type-X increases relative to that for goods of type Y. Such a change implies a larger (respectively smaller) equilibrium number varieties of type-X (respectively type-Y). N_X/N_Y increases and the relative value $\Delta V^X/\Delta V^X$ to transmit type-X compared to type-Y traits is increased. This effect is stronger the larger the relative weight ω individuals have on their favored cultural-type goods and the larger the love of variety for these goods (i.e. the smaller the elasticity of substitution σ between the different varieties). The relative-variety effect promotes the further diffusion of trait X, driving away the cultural dynamics from the symmetric situation $q^a = 1/2$. For $q^a = 1/2$ to remain the unique steady state equilibrium, it should be that the opposite force related to the cultural free riding effect is strong enough to overcome the relative-variety effect. This is likely to hold when relative-variety effect is weak, namely when the relative weight ω is small and the elasticity of substitution σ

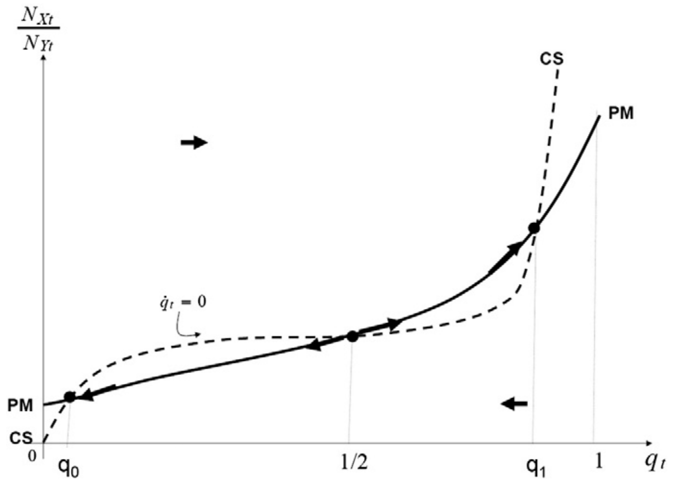

Fig. 4. Phase diagram in the case $\sigma > 1 + \omega^2$.

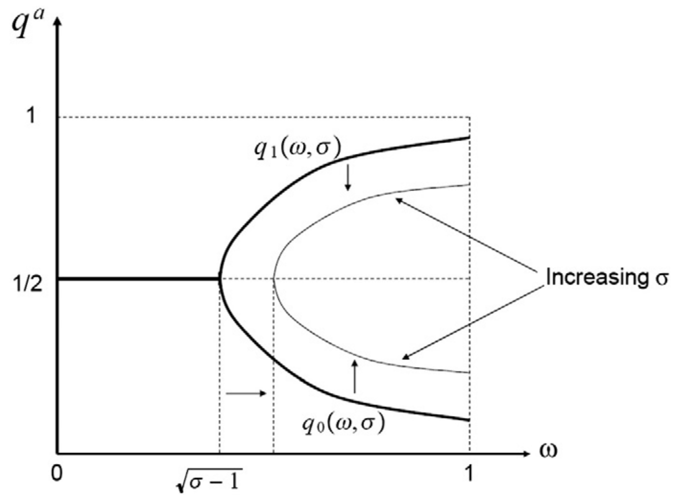

Fig. 5. Bifurcation diagram in the case $1 < \sigma < 2$.

is large. Analytically this happens when the condition $\sigma \geq 1 + \omega^2$ is satisfied.

The following proposition considers now the parameter regime where the elasticity of substitution is low: $\sigma < 1 + \omega^2$

Proposition 2. Multiple cultural steady states under autarky

Suppose $\sigma < 1 + \omega^2$ then:

(i) *There are three cultural steady states which satisfy Eq. (12):* $\{q_0(\omega,\sigma), 1/2, q_1(\omega,\sigma)\}$ with $0 < q_0(\omega,\sigma) < 1/2 < q_1(\omega,\sigma) < 1$.
(ii) *The steady states $q_0(\omega, \sigma)$ and $q_1(\omega, \sigma)$ are stable while $q^a = 1/2$ is unstable.*
(iii) *We have*

$$\frac{\partial q_0(\omega,\sigma)}{\partial \omega} < 0 < \frac{\partial q_1(\omega,\sigma)}{\partial \omega} \quad \text{and} \quad \frac{\partial q_1(\omega,\sigma)}{\partial \sigma} < 0 < \frac{\partial q_0(\omega,\sigma)}{\partial \sigma}.$$

Proof. See Appendix B.1

The intuition behind Proposition 2 is exactly the mirror image of that of Proposition 1. Fig. 4 depicts the autarky equilibrium where we see that there are multiple steady-state equilibria. Beyond the symmetric steady-state $q^a = 1/2$ (which is unstable), two asymmetric stable steady states arise: one with a large proportion of type X agents and another equilibrium with a large proportion of type Y agents. Again a small positive perturbation of q_t around the symmetric steady-state $q^a = 1/2$ leads to a relative-variety effect and an opposite cultural free riding effect. Now for small σ, the love for variety effect is now so strong that the relative-variety effect dominates the cultural free-riding effect and the initial positive perturbation of q_t is self-reinforcing. This drives the system away from $q^a = 1/2$. Given however that the cultural free-riding effect becomes very effective when one gets closer to the homogenous population with $q = 1$, the system eventually settles at a less than fully homogenous cultural population with a steady state given by $1/2 < q_1(\omega, \sigma) < 1$. A similar symmetric reasoning for a small negative perturbation of q_t away from $q^a = 1/2$ leads to the existence of the other asymmetric cultural steady state $0 < q_0(\omega, \sigma) < 1/2$.

The last part of Proposition 2 provides some comparative statics on the asymmetric steady states $q_0(\omega, \sigma)$ and $q_1(\omega, \sigma)$, reflecting the impact of the two parameters ω and σ on the strength of relative-variety effect. Indeed the larger the weight ω and the smaller the elasticity of substitution σ, the stronger the relative-variety effect and the stronger the self-reinforcing process between market size and cultural transmission. As a consequence asymmetric steady states will be more likely to differ from each other, as small initial differences around $q^a = 1/2$ are likely to be magnified. This implies that $q_0(\omega, \sigma)$ (resp. $q_1(\omega, \sigma)$) is decreasing (resp. increasing) in ω and increasing (resp. increasing) in σ.

This last feature is illustrated for instance in Fig. 5 which depicts the bifurcation diagram of cultural dynamics under autarky with respect to the parameter $\omega \in [0,1]$ for a given value of the elasticity of substitution σ. As long as σ is larger than 2, there is no bifurcation and for all values of $\omega \in [0,1]$, the unique steady state is $q^a = 1/2$. Conversely for a low enough elasticity of substitution (ie. $1 < \sigma < 2$), the dynamic system exhibits a bifurcation when ω crosses the threshold $\sqrt{\sigma - 1}$, with the appearance of two stable asymmetric steady states $q_0(\omega, \sigma)$ and. $q_1(\omega, \sigma)$. Economically, when the two cultural types are associated to very contrasted underlying preferences (ie. ω large enough), it is more likely that one has also contrasted multiple cultural equilibria under autarky (the difference between $q_1(\omega, \sigma)$ and $q_0(\omega, \sigma)$ is maximal at $\omega = 1$). For such patterns of preferences, initial conditions matter a lot for the dynamics of cultural evolution. Countries sharing otherwise similar structural parameters may therefore end up with very different long run patterns of preferences in autarky.

6. Trade integration with two countries

We now consider trade integration between two identical economies, labeled as the domestic and foreign (*) economies. The size of each economy is normalized to 1. We assume that: (1) there are two idiosyncratic cultural types, X and X^*, which are specific to the domestic and the foreign country respectively; (2) there is a cultural type, Y, which is common to both countries.[16] As a consequence, at equilibrium, type-X goods are consumed only in the domestic country; type-X^* goods are consumed only in the foreign country; type-Y goods are consumed everywhere. Hereafter the ^{aut} and ^{int} superscripts refer to the autarkic equilibrium and to the integrated world equilibrium. The symmetry assumption simplifies considerably the analysis. Indeed at any date t, the numbers of type-X and type-X^* agents are equal, and we have $q_t = q_t^*$; hence the world equilibrium is still characterized by a two dimensional system.

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

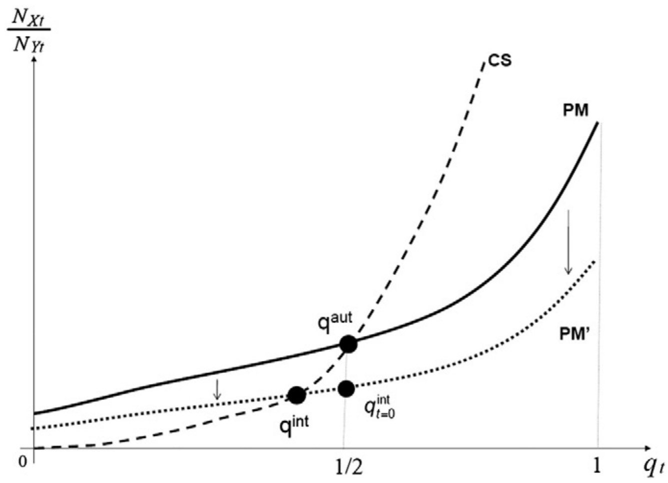

Fig. 6. Trade openness in the case $\sigma > 1 + \omega^2$.

6.1. Trade integration under high goods substitutability

We first focus on the case with high goods substitutability, where there is an unique stable steady state equilibrium under autarky. We assume that both economies have converged to their steady-state $q^{aut} = q^{*aut} = 1/2$ prior to opening to trade. Under trade integration, the utility cost functions are unchanged and the law of motion of q_t is still characterized by equation (*CS*), which is left unchanged compared to autarky. Similarly, the aggregate demand for the local varieties (X, X^*) is left unchanged: $D^{int}_{X,t} = D^{int}_{X^*,t} = [1/2 + \omega(q_t - 1/2)]P^{(\sigma-1)}_{X,t} p^{-\sigma}_{X,t}$. However, the demand for the global type-*Y* varieties is aggregated across the two symmetric countries and is thus equal to twice its autarkic value: $D^{int}_{Y,t} = 2D^{aut}_{Y,t} = 2[1/2 + \omega(1/2 - q_t)]P^{(\sigma-1)}_{Y,t} p^{-\sigma}_{Y,t}$. Thus, the only change induced by trade integration concerns the product market equilibrium. Substituting aggregate demands and constant mark-up monopoly pricing into the free entry conditions yields (*PM*'), which is the free trade counterpart of the (*PM*) curve:

$$\left(\frac{N_{X,t}}{N_{Y,t}}\right)^{int} = \frac{1}{2} \times \frac{1 + 2\omega(q_t - \frac{1}{2})}{1 - 2\omega(q_t - \frac{1}{2})} \qquad PM'.$$

Comparing (*PM*') with (*PM*), we observe that, for a given q_t, the relative number of type-*Y* varieties is larger under trade integration than under autarky. This is due to the standard market size effect present in trade models à la Krugman (1979). We can see this effect on Fig. 6 by observing that at date $t = 0$, when the economy opens to free trade, product market equilibrium implies that the economy goes from its autarky steady state q^{aut} to the point $q^{int}_{t=0}$ and by comparing the y-coordinates of the two points. Notice however that the point is not a steady state since it lies to the right of the (*CS*) curve. This observation implies that the standard Krugman effect is reinforced here by a feedback effect from the cultural dynamics on aggregate demand. Indeed, the shift in the supply of differentiated goods towards relatively more type-*Y* varieties under free trade implies more (resp. less) incentives for parents of type *Y* (resp. of type *X* or X^*) to socialize their children. Over time, this effect pushes down the proportion of type-*X* agents in the economy until the economy reaches the steady state of an integrated world q^{int}, which is characterized by an even larger number of type-*Y* varieties than at the point $q^{int}_{t=0}$.

Note that this result has an immediate empirical counterpart. In Section 4, we defined bilateral cultural distance, D_t, as the probability that two randomly picked up individuals in two different countries do not share the same cultural types. In our model indeed we have three cultural types: the country-specific types *X* and X^* and the common type *Y*. A random pair of individuals belonging to the domestic and the foreign country share the same cultural type if and only if they are both of type *Y*. This event has a probability $(1 - q_t)(1 - q^*_t) = (1 - q_t)^2$, which implies that bilateral cultural distance D_t is equal to $D_t = 1 - (1 - q_t)^2$. Similarly, the internal cultural distance is defines as $I_t = 1 - (q_t^2 + (1 - q_t)^2)$. As the volume of trade at any point in time is proportional to the demand for the global *Y*-type goods, that is to $1 - 2\omega(q_t - \frac{1}{2})$, we immediately conclude that bilateral and internal cultural distances on the one hand and volume of trade on the other hand continuously move in opposite directions as q_t converges to its steady-state value. This result is the exact theoretical counterpart of the empirical evidence reported in the previous section.

We collect the results obtained so far in the following proposition:

Proposition 3. Trade integration

Suppose $\sigma \geq 1 + \omega^2$, then:

(i) *Trade openness brings down q_t. The new steady-state is such that $q^{int} < q^{aut} = 1/2$.*
(ii) *The magnitude of the effect decreases with σ: $\frac{q^{int}}{q^{aut}} \simeq 1 - \omega / [4(\sigma - 1) - 4\omega^2]^{aut}$.*
(iii) *After countries open to trade, the bilateral and internal cultural distances (resp. volume of trade) continuously decrease (resp. increases) along the transition path.*

Proof. See Appendix B.2.

6.2. Trade integration under low goods substitutability

We now turn to the impact of trade integration in the presence of multiple equilibria, that is when goods substitutability is low. We provide in this section the intuition based on graphical analysis (Fig. 7) while the formal analysis of this case is confined in the next section.

Two cases must be considered: either the economy has converged to the low q^{aut}_0 steady-state under autarky or it has converged to the high q^{aut}_1 steady-state. In both cases, trade openness leads to a downward shift from (*PM*) to (*PM*'). In the first case, this shift implies a continuous decrease from q^{aut}_0 to q^{int}_0; this is qualitatively similar to Proposition 2. In the second case, the shift as represented on Fig. 7, implies a discrete jump from the high autarkic equilibrium q^{aut}_1 to the low integrated equilibrium q^{int}_0.

This observation has a number of intriguing implications. Since multiple equilibria arise only for parameter values corresponding to highly differentiated products (low σ), it reinforces the prediction in Proposition 2 that the more differentiated the products, the more trade openness weakens local cultural types *X* and X^*. It indeed suggests a strong non-linearity in that relationship. Second and more importantly, Fig. 7 illustrates the fact that the relationship between trade

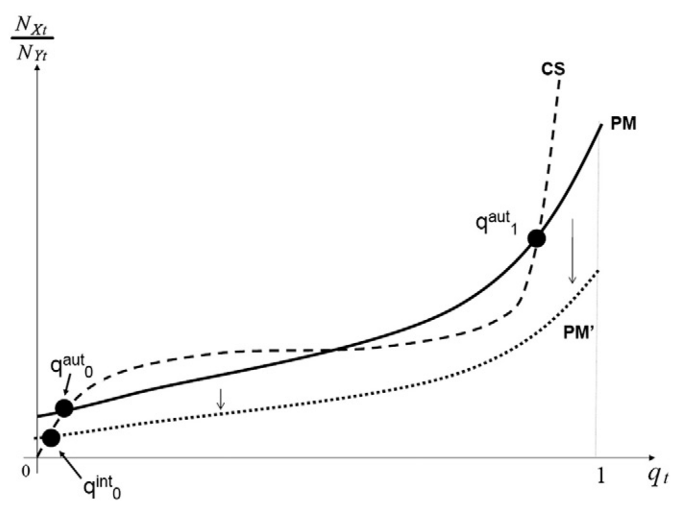

Fig. 7. Trade openness in the case $\sigma > 1 + \omega^2$.

openness and culture exhibits path-dependency. Once an economy has opened to trade and shifted from the high autarkic equilibrium q_1^{aut} to the low integrated equilibrium q_0^{int}, stability of that equilibrium ensures that the economy is trapped in its neighborhood: if it were to close to trade, (*PM*') would switch back to (*PM*) and the economy would converge to the low autarkic equilibrium q_0^{aut}.

It also has an important policy implication: many NGOs and social scientists oppose trade integration on the grounds that the move to free trade has caused a brutal erosion of local cultures and social norms. Both the empirical evidence in the previous section and our theoretical analysis suggest that this claim may be very well-founded. However, our model also suggests that if a shift to the integrated equilibrium q_0^{int} has already occurred, then it is impossible to go back to the old equilibrium through new trade restrictions. The path dependence of the relationship between trade and cultural distance implies that we should not expect to see any sizeable effect of the recent trade collapse on cultural divergence across countries. More generally, it implies an asymmetry in the effect of trade on culture: periods where barriers to trade have been progressively removed to reach their lowest ever level should have the largest effect on the distribution of bilateral cultural distances while periods of abrupt and temporary trade contraction should have significantly less impact.

7. Extension: a multi-country world

We now extend our baseline model to a world with H identical economies. Due to the high-dimensionality of the equilibrium system, the proofs (relegated to the Appendix) are more involved than in the 2-country case. In particular the stability analysis is much more subtle and relies on technical results due to Tambs–Lyche on stable matrices (i.e. matrices for which all characteristic roots have negative real parts; see Marcus and Minc, 1992).

The size of each economy $h \in \{1,\ldots,H\}$ is normalized to 1 . We assume that: (1) each country h has a country specific cultural type X^h; (2) there is a worldwide cultural type, Y, which is common to all countries.[17] As a consequence, at equilibrium, type-X_h goods are consumed only in country h; type-Y goods are potentially consumed everywhere in the world.

We consider international trading regimes in which a given number $K \in (1,H]$ countries are freely trading with each other (for varieties of the tradable good Y) while the $H - K \geq 0$ remaining countries stay in autarky. K is then a convenient measure of international trade integration. Hereafter $\mathcal{K} \subset \{1,\ldots,H\}$ will refer to the set of K countries under free trade.

For each trading economy $h \in \mathcal{K}$, let denote by q_t^h the fraction of individuals at time t in that country with cultural type X^h. Conversely $1 - q_t^h$ will be the fraction of individuals in country h with the world common cultural type Y. For such trading economy, one may derive the demand for each variety of type-X^h goods in country h and the aggregate demand for the type-Y varieties which are traded internationally

$$\begin{cases} D_{X,t}^h = D_{X,t}^h = \left[\frac{1}{2} + \omega\left(q_t^h - \frac{1}{2}\right)\right]\left(P_{X^h,t}\right)^{(\sigma-1)}\left(p_{X^h,t}\right)^{-\sigma} \\ D_{Y,t} = \left[\frac{1+\omega}{2}K - \omega\left(\sum_{h\in\mathcal{K}} q_t^h\right)\right]P_{Y,t}^{(\sigma-1)}p_{Y,t}^{-\sigma} \end{cases} \tag{13}$$

where the aggregate price index for each composite good $i \in \{X^h, Y\}$ is given by the following: $P_{i,t} \equiv \left(\int_0^{N_{i,t}}\left(p_{i,t}(k)\right)^{1-\sigma}dk\right)^{1/(1-\sigma)}$. Following the same steps as in the benchmark model, we obtain the equilibrium number of varieties for the cultural types X^h or Y at each date t:

$$N_{X^h,t} = (\sigma F)^{-1} \times \left[\frac{1}{2} + \omega\left(q_t^h - \frac{1}{2}\right)\right] \text{ and } N_{Y,t} = (\sigma F)^{-1} \times \left[\frac{1+\omega}{2}K - \omega\left(\sum_{h\in\mathcal{K}} q_t^h\right)\right] \tag{14}$$

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

and the utility costs $\Delta V_t^{X^h}$ and $\Delta V_t^{Y,h}$ as perceived through the preferences of parents in country h:

$$\begin{cases} \Delta V_t^{X^h} = \varpi \times \left[\left(N_{X^h,t}\right)^{(1+\omega)/2}\left(N_{Y,t}\right)^{(1-\omega)/2}\right]^{1/(\sigma-1)} \\ \Delta V_t^{Y,h} = \varpi \times \left[\left(N_{X^h,t}\right)^{(1-\omega)/2}\left(N_{Y,t}\right)^{(1+\omega)/2}\right]^{1/(\sigma-1)} \end{cases}. \tag{15}$$

Note that the utility function costs $\Delta V_t^{Y,h}$ relative to the cultural type-Y parents differ according to the country h where those individuals are located, as it depends on their country specific varieties $N_{X^h,t}$. From Eq. (14) we can write $\Delta V_t^{X^h}$ and $\Delta V_t^{Y,h}$ under the following form

$$\Delta V_t^{X^h} = \mathcal{W}^X\left(q_t^h, Q_t^K\right) \text{ and } \Delta V_t^{Yh} = \mathcal{W}^Y\left(q_t^h, Q_t^K\right) \tag{16}$$

with

$$\begin{cases} \mathcal{W}^X\left(q_t^h Q_t^K\right) \equiv \frac{\varpi}{(\sigma F)^{1/(\sigma-1)}}\left[\left(\frac{1}{2} + \omega\left(q_t^h - \frac{1}{2}\right)\right)^{(1+\omega)/2}\left(\frac{1+\omega}{2}K - \omega Q_t^K\right)^{(1-\omega)/2}\right]^{1/(\sigma-1)} \\ \mathcal{W}^Y\left(q_t^h Q_t^K\right) \equiv \frac{\varpi}{(\sigma F)^{1/(\sigma-1)}}\left[\left(\frac{1}{2} + \omega\left(q_t^h - \frac{1}{2}\right)\right)^{(1+\omega)/2}\left(\frac{1+\omega}{2}K - \omega Q_t^K\right)^{(1+\omega)/2}\right]^{1/(\sigma-1)} \end{cases}$$

with $Q_t^K \equiv \sum_{h\in\mathcal{K}} q_t^h$ corresponding to the total number of individuals who are not of type Y in the integrated set of countries κ.

Considering our cultural transmission mechanism in each country, one can then describe the cultural dynamics of the integrated economies $h \in \mathcal{K}$ as $\dot{q}_t^h = q_t^h \times \left(1 - q_t^h\right) \times \left(\tau_{X,t}^h - \tau_{Y,t}^h\right)$ where $\tau_{X,t}^h = \left(1 - q_t^h\right) \times \Delta V_t^{X^h}$ and $\tau_Y^h = q_t^h \times \Delta V_t^{Y,h}$. This finally yields the following K dimensional dynamic system

$$\dot{q}_t^h = q_t^h \times \left(1 - q_t^h\right) \times \left[\left(1 - q_t^h\right) \times \mathcal{W}^X\left(q_t^h, Q_t^K\right) - q_t^h \times \mathcal{W}^Y\left(q_t^h, Q_t^K\right)\right] \text{ for all } h \in \mathcal{K}. \tag{17}$$

A symmetric interior steady state $q^h = q^*$ of this system is such that $(1 - q^*) \times \mathcal{W}^X(q^*, q^* \tilde{n} K) = q^* \times \mathcal{W}^Y(q^*, q^* \times K)$. Combined with Eq. (16) a steady state can be characterized by the following equation

$$\frac{1}{K} \times \frac{1 + 2\omega(q^* - \frac{1}{2})}{1 - 2\omega(q^* - \frac{1}{2})} = \left(\frac{q^*}{1 - q^*}\right)^{\frac{\sigma-1}{\omega}}. \tag{18}$$

Geometrically a symmetric interior steady-state $q^*(K)$ of the economy is located at the intersection of curves (*CS*) and $(PM)^h$ where the latter is the free trade counterpart of the (*PM*) curve and is defined for each (symmetric) country $h \in \mathcal{K}$ by

$$\left(\frac{N_{X^h}}{N_Y}\right)^{int} \equiv \frac{1}{K} \times \frac{1 + 2\omega(q - \frac{1}{2})}{1 - 2\omega(q - \frac{1}{2})} \qquad PM^h.$$

We now present the counterparts of the two trade integration results in the 2-country world. We start with the high goods substitutability case:

Proposition 4. *When $\sigma \geq 1 + \omega^2$*

i) *There is a unique interior steady state which is symmetric, $q^*(K)$, and characterized by* Eq. (18). *This steady state is locally stable.*
ii) *q_K^* is a decreasing function of the number of integrating economies K.*
iii) *The equilibrium number of local varieties $N_{X^h}^*(K)$ in each country h is decreasing in K and the equilibrium number of global varieties $N_Y^*(K)$ is increasing more than proportionally $\frac{\partial N_Y^*}{\partial K}\frac{K}{N_Y^*} > 1$.*
iv) *Assume that the integrated world K is large enough and has already settled to the symmetric cultural steady state. Then for any additional country h that integrates with that world economy κ, the bilateral cultural distance (resp. bilateral volume of trade) between that country h and any other already integrated country economy*

$l \neq h$ decreases (resp. increases) along the transition path towards its new cultural steady state. Furthermore, the internal cultural distance of that country h decreases along the transition path towards its new cultural steady state.

Proof. See Appendix B.3.

Part i) of the proposition says that when goods are sufficiently substitutable (i.e. $\sigma \geq 1 + \omega^2$), an interior cultural steady-state is unique and necessarily symmetric across the integrated economies. This steady state is also locally stable in our K-dimensional cultural dynamic system.[18] The intuition for parts ii) and iii) of the proposition follows directly the argument in the 2-country world. After trade integration, the market size effect concerns only the product market of the global cultural good Y: indeed the market for local cultural goods X^h are by nature limited to the home country. The larger H (the number of integrating countries) the stronger the difference in terms of market size between local goods X^h and global goods Y. Consequently this affects entry decisions by firms and translates in all countries in a decrease of (N_{X^h}/N_Y) proportional to H. By impacting the relative subjective costs of socialization Eqs. (11) and (12), this change in (N_{X^h}/N_Y) leads to decreased incentives for the transmission of local cultures X and conversely to increased transmission of the global cultural trait Y. In all countries we then observe a shift from local to global culture (i.e. q_t^h decreases).

Along global market integration, the market for global products of type-Y gets larger. Under free entry, this tends to sustain more equilibrium varieties for that type of goods in each integrated country and therefore a larger number of varieties N_Y^* of the tradable Y goods in the world economy. Conversely, the equilibrium number of local varieties $N_{X^h}^*(K)$ in each country h is decreasing in K. First, because in each country $h \in \kappa$, there is a lower fraction of individuals with preferences biased towards the country specific good X^h. Second, because as individuals in the rest of the integrated world also tends to prefer more goods of the Y-type, more resources are devoted in country h to satisfy such world demand. This in turn crowds out the limited resources that the country can use for the production of local varieties of X^h-goods.

Note that the effect of trade integration is magnified in the sense that the elasticity of the equilibrium number of varieties N_Y^* of Y-goods to market integration is larger than 1. The source of this magnification effect is intimately related to the fact that cultural preferences change overtime. Indeed with fixed symmetric preference patterns across countries (i.e. same fixed fraction q of country specific types), an increase in the number of integrated economies has a one to one effect on the equilibrium number of varieties N_Y as N_Y is simply proportional to K (i.e. $N_Y = \left[\frac{1+\omega}{2}K - \omega K q\right]/\sigma F$). When preferences are endogenous and can be affected by cultural transmission, each additional country moving to free trade generates not only a short run impact on the market size for Y-goods, but also triggers a long run change in preferences biased towards Y-goods in each of the countries participating into international trade. This provides an additional long run "kick" to the market size of such goods and therefore a magnifying effect on the equilibrium number of varieties of Y-goods.

Part iv) of the proposition deals with the relation between cultural distance and trade flows along the transition path. Given the multi-dimensionality of the dynamic system governing cultural change and trade flows, a complete analysis of bilateral trade flows and bilateral cultural distances along the transition path towards the world cultural steady state is difficult. When the integrated world is large enough (i.e. K large enough) and has already settled to a symmetric cultural steady state $q^*(K)$, one may still however still consider the effects of an expansion of the free trade regime, namely ask the question of what happens to an additional small country h that moves from autarky to free trade. Given that this trading economy h is small compared to the rest of the world, changes in q_t^h have little effects on $(\sum_{l \in \kappa} q_t^l) \approx K q^*(K)$. As q_t^h converge from its initial autarkic equilibrium $q^a = 1/2$ to a lower value (close to) $q^*(K)$, the bilateral cultural distance between h and any other trading economy $l \neq h$ that has already reached the steady state $q^*(K)$ moves from $D_0^{hl} = 1 - (1 - q^a)(1 - q^*(K))$ to a lower value close to D^*.

The intuition is clear: trade integration increases the size of the market for the common good Y, which implies entry of firms into that market. More varieties of type-Y good raises in turn the benefits of being a type-Y agents. As the proportion of type Y agents increases in country l, cultural distance goes down between such economy and any of the economies of the rest of the integrated world. At the same time, as q_t^h converges from its initial autarkic equilibrium $q^a = 1/2$ to the lower value $\approx q^*(K)$, more demand for traded global goods translates into more trade between the newly integrated economy and the other open economies. Hence along the transition path, bilateral and internal cultural distances on the one hand and bilateral trade flows between our (small) integrating economy and the rest of the world on the other hand move in opposite directions[19] as in the two country world.

We finally turn to the low substitutability case. One issue hindering a general analysis of that case in a multi-country world is that one can get more than one symmetric steady-state for integrated economies. However, when the number of (integrating) countries is large enough, one can again ensure that there is a unique interior cultural steady state in the world economy which is symmetric and we are able to prove formally the intuition discussed informally in the 2-country case. Specifically:

Proposition 5. *For all $\sigma \geq 1$ and $\omega \in [0, 1]$, there exists a value $K_{\min} > 1$ such that for all $K > K_{\min}$*

i) *There is a unique interior world cultural steady state (which is symmetric and locally stable) among the K integrated economies, $q_h^* = q^*(K)$, and is characterized by Eq.(18),*
ii) *When $\sigma < 1 + \omega^2$, for a country starting under autarky with a strong bias towards its country specific goods), trade integration induces "cultural hysteresis", in the sense that long enough temporary trade liberalization has permanent effects on the cultural patterns of preferences in this country.*

Proof. See Appendix B.3.

8. Political economy implications

It is naturally difficult to derive welfare implications of trade integration in a model with endogenous preferences. Still, from a positive political economy point of view, it may be instructive to investigate the utility levels obtained after trade integration by individuals endowed with different preference profiles. If indeed, unlike what happens in Krugman (1979) or in the version of our model without endogenous

[18] Contrary to the case of autarky, global stability cannot be ensured in this case as the system Eq. (20) is a fully multi-dimensional dynamic system.

[19] Indeed differentiation around the steady state and assuming K large enough provides that:

$$\Delta D_t^{hl} \approx [(1 - q^*(K)] \Delta q_t^h \quad \text{for all } l \in K$$
$$\Delta V_t^{hl} \approx -\frac{\sigma - 1}{\sigma} \omega \frac{[\frac{1}{2} + \omega(\frac{1}{2} - q^*(K))]}{[\frac{1+\omega}{2}K - \omega K q^*(K)]} \Delta q_t^h \quad \text{for all } l \in K$$

while the cultural dynamics in the integrating country h is given by:

$$\Delta q_t^h \approx q_t^h \left(1 - q_t^h\right) \left[(W^X \left(q_t^h, K q^*(K)\right) \left(1 - q_t^h\right) - W^Y \left(q_t^h, K q^*(K)\right) q_t^h\right].$$

preferences, some agents are found to be harmed by trade integration for reasons unrelated to factor ownership, we may be in a position to better understand some resistance to international trade due to non economic factors, as for instance identified by Mayda and Rodrik (2005).

Consider then the utility level at the steady state of an individual endowed with preferences biased towards local varieties (i.e. preferences $U_X(.)$), which is given by:

$$V_X^h(K) = \tilde{\omega} \times \left\{ \left[N_X^{h*}(K)\right]^{(1+\omega)/2} \left[N_Y^*(K)\right]^{(1-\omega)/2} \right\}^{1/(\sigma-1)}$$

with $\tilde{\omega} \equiv \left(\frac{\sigma-1}{\sigma}\right)\left(\frac{1+\omega}{2}\right)^{\left(\frac{1+\omega}{2}\right)}\left(\frac{1-\omega}{2}\right)^{\left(\frac{1-\omega}{2}\right)}$. Similarly, the steady state utility level of an individual endowed with preferences biased towards global varieties (i.e. preferences $U_Y(.)$) is

$$V_Y(H) = \tilde{\omega} \times \left\{ \left[N_X^{h*}(K)\right]^{(1-\omega)/2} \left[N_Y^*(K)\right]^{(1+\omega)/2} \right\}^{1/(\sigma-1)}.$$

Logarithmic differentiation of the two previous equations leads to

$$\frac{dV_X^h}{V_X^h} = \frac{1}{\sigma-1}\left[\frac{1+\omega}{2}\frac{dN_X^{h*}}{N_X^{h*}} + \frac{1-\omega}{2}\frac{dN_Y^*}{N_Y^*}\right]$$
$$\frac{dV_Y}{V_Y} = \frac{1}{\sigma-1}\left[\frac{1-\omega}{2}\frac{dN_X^{h*}}{N_X^{h*}} + \frac{1+\omega}{2}\frac{dN_Y^*}{N_Y^*}\right]$$

with

$$\frac{dN_X^{h*}}{N_X^{h*}} = \frac{\omega\frac{\partial q^*(K)}{\partial K}}{\frac{1}{2}+\omega\left(q^*(K)-\frac{1}{2}\right)}dK$$
$$\frac{dN_Y^*}{N_Y^*} = \frac{dK}{K} - \frac{\omega\frac{\partial q^*(K)}{\partial K}}{\frac{1}{2}-\omega\left(q^*(K)-\frac{1}{2}\right)}dK.$$

In Appendix B.4 we show that individuals with preferences biased towards global varieties, Y, will gain from trade integration. As a matter of fact their utility change can be decomposed into two positive terms:

$$\frac{dlnV_Y}{dlnK} \sim \underbrace{\frac{1+\omega}{2}}\ - \underbrace{\frac{\omega^2 K\frac{\partial q^*(K)}{\partial K}q^*(K)}{\left[\frac{1}{2}+\omega\left(q^*(K)-\frac{1}{2}\right)\right]\left[\frac{1}{2}-\omega\left(q^*(K)-\frac{1}{2}\right)\right]}} > 0$$

The first term reflects the direct utility gain of international integration. That consumer has access to more global varieties. The second term reflects the indirect cultural effect of international integration. As it induces a shift of preferences towards global varieties, the increased market size due to that shift creates again even more varieties of such good that this consumer values more.

On the other hand, individuals endowed with preferences biased towards local varieties face two countervailing forces. First, they have access to less local varieties (which are weighted more in their utility function). Second however, they have access to the global varieties produced by other countries in the world. The full effect on their equilibrium utility level is therefore ambiguous. Formally we can show again (see Appendix) that their change in utility can be decomposed into two terms:

$$\frac{dlnV_X^h}{dlnK} \sim \underbrace{\frac{\omega^2 K\frac{\partial q^*(K)}{\partial K}\left(1-q^*(K)\right)}{\left[\frac{1}{2}+\omega\left(q^*(K)-\frac{1}{2}\right)\right]\left[\frac{1}{2}-\omega\left(q^*(K)-\frac{1}{2}\right)\right]}} + \underbrace{\frac{1-\omega}{2}} \lessgtr 0.$$

The first term in bracket is negative as $\frac{\partial q^*}{\partial K} < 0$ and shows the negative crowding out effect of global varieties on local varieties. The second term $\frac{1-\omega}{2}$ is positive and reflects the gains from trade due to access to increased global varieties from the rest of the world. It is therefore possible for individuals with such preferences to be worse off compared to the autarky situation. This feature is suggestive of why one may encounter opposition to trade based on cultural factors in some countries. Individuals having preferences strongly biased towards local varieties may internalize the fact that in the long run, from the perspective of these preferences, the steady state equilibrium is providing less utility than before integration. Indeed they may well understand that trade leads to more effective cultural socialization towards global cultural items. This in turn reduces the market size for local non traded varieties, and as a consequence the number of local varieties that this local market can sustain Individuals sharing strong enough biased preferences for local goods (ω close to 1) may therefore end up worse off than before trade.[20]

This feature also suggests that along trade integration, there should be more intense intergenerational trade-related cultural conflicts within "local goods-biased" families. Overtime parents with preferences biased towards local products are less effective at transmitting their trait. Indeed their kids are more and more effectively socialized through oblique transmission to the more frequent global Y-types preferences. Such parents respond to this by increasing their own socialization efforts. However that does not prevent their transmission rate to decline and to have children adopting more frequently the global cultural trait. When ω is large enough (i.e. close to 1), these cultural intergenerational differences translate into intergenerational conflicts about trade integration.

From a political economy perspective, the cultural dynamics induced by trade liberalization may also generate some "political lock-in effects" in trade policy. To see that consider again a case where ω is large enough so that individuals with preferences biased towards local varieties tend to loose from trade integration. Under autarky, when $q^a = 1/2$ (in the case $\sigma > 1 + \omega^2$), or a fortiori when $q^a = q_1(\omega, \sigma) > 1/2$ (in the case $\sigma > 1 + \omega^2$), an economy is unlikely to liberalize as at least a majority of the population has preferences biased towards local varieties and therefore tends to loose from trade integration. Suppose that for exogenous reasons that economy nevertheless integrates internationally and stays integrated until the new cultural steady state $q^*(K) < 1/2$ is reached. Then obviously, at this moment there is no political economy reason for the country to return to autarky. Now a majority of the new generations are individuals with preferences biased towards the global Y-types goods and they benefit from trade integration. A temporary long enough trade liberalization shock may therefore build-up its own cultural constituency to sustain the process of trade liberalization.

This feature that current trade liberalization may commit the society to future trade liberalization is also present some earlier work. In Devereux (1997), trade liberalization brings productivity gains in the tradable sector of each country through learning by doing externalities, thus making static gains from trade larger, which in turn raises the cost for each country to switch back to autarky and finally sustains further trade liberalization as an equilibrium of a non-cooperative tariff game. A similar mechanism is at play in Staiger (1995), where temporary trade liberalization and the fear of human capital depreciation induce workers endowed with skills specific to the import competing sector to exit that sector, thus diminishing enforcement issues associated with further trade liberalization. The mechanism in the present paper is however very different since it is not related to the supply side of the economy but rather goes through an endogenous process of changes in preferences through cultural transmission.

[20] Obviously there will be also less of these individuals in a steady state after trade integration. Hence, in such a case, it is not obvious to provide normative statements on the overall social desirability of integration or not.

9. Conclusion

In this paper, we analyze the effect of product market integration on the evolution of cultural values across individuals and countries. We make three contributions to the literature. First, we build a direct measure of cultural distance across countries based on answers to the World Values Survey and we show that, on average, bilateral cultural distance decreased over the 1989–2004 period. Second, we show that bilateral trade openness is associated with a reduction of bilateral cultural distance. Last, we provide a simple theory of product-based cultural change which builds from insights from other social sciences and which can rationalize these stylized facts.

Obviously our analysis touches only the tip of the iceberg and several important issues remain to be investigated. First, our empirical results are based on country-level panel data. While we find evidence of a pervasive impact at the aggregate level, we remain silent on the channels of transmission at the micro-level. Future work should look at more disaggregated trade flows and intra-country evidence. On the theory side, an avenue for future research is the development of a micro-founded theory of the embodiment of cultural values in goods through advertising, product design or R&D and its implications for global market competition and cultural evolution. This would be specifically interesting in the context of multinational firms that need to sale simultaneously their products to different local cultural markets. Another interesting angle for future research is the political economy dimensions of global cultural convergence. Is this process associated with resistance efforts and frictions across civilizations? Or is cultural convergence reducing conflicts and facilitating the worldwide diffusion of stable, efficient and tolerant institutions? All these questions are important in the context of an increasingly globalized world. We hope that the framework developed here can be used as a stepping stone to analyze these issues in the future.

Appendix A. List of the 30 questions with the best statistical coverage in the WVS

Questions are ranked in decreasing order of statistical coverage. The top 10 questions are marked with *.

Question a165*: Most people can be trusted//Question a062*: How often discusses political matters with friends//Question a008*: Feeling of happiness//Question a025*: Respect and love for parents//Question a026*: Parents responsibilities to their children//Question e003*: If you had to choose, which one of the things on this card would you say is most important? 1 — Maintaining order in the nation; 2 — Give people more say; 3 — Fighting rising prices; 4 — Protecting freedom of speech//Question e004*: And which would be the next most important? 1 — Maintaining order in the nation; 2 — Give people more say; 3 — Fighting rising prices; 4 — Protecting freedom of speech//Question g006*: How proud of nationality//Question a029*: Important child qualities: independence//Question a030*: Important child qualities: hard work//Question a032: Important child qualities: feeling of responsibility//Question a035: Important child qualities: tolerance and respect for other people//Question a038: Important child qualities: thrift saving money and things//Question a042: Important child qualities: obedience//Question c001: Jobs scarce: Men should have more right to a job than women//Question a001: Family important in life//Question a002: Friends important in life//Question a003: Leisure time important in life//Question a004: Politics important in life//Question a005: Work important in life//Question a006: Religion important in life//Question d019: A woman has to have children to be fulfilled//Question a034: Important child qualities: imagination//Question a041: Important child qualities: unselfishness//Question a170: Satisfaction with your life//Question e016: Future changes: More emphasis on technology//Question f121: Is divorce justifiable?//Question d022: Marriage is an out-dated institution//Question e072: Confidence in The Press//Question e074: Confidence in The Police.

Appendix B. Proof of propositions

B.1. Propositions 1 and 2

To characterize the autarkic equilibrium in a given country, we proceed in several steps. We first show the following lemma:

Lemma 1. *Let $\tilde{q}$ be a candidate for a cultural steady state defined by $P(\tilde{q}) = C(\tilde{q})$ where $P(.)$ and $C(.)$ are respectively the LHS and the RHS in Eq. (12). Then we should have:*

$$\frac{C'(\tilde{q})}{P'(\tilde{q})} \geq \frac{\sigma-1}{\omega^2}$$

Proof of Lemma 1. By definition any candidate $\tilde{q}$ as a cultural steady state is defined by $P(\tilde{q}) = C(\tilde{q})$ where $P(.)$ and $C(.)$ are respectively the LHS and the RHS in Eq. (12). Inference on stability requires to study how P and C cross each other at the point $\tilde{q}$. This consists in computing the ratio of the tangent slopes. Straightforward computations show that:

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

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

$$\frac{C'(\tilde{q})}{P'(\tilde{q})} = \frac{\sigma-1}{4\omega^2}H(\tilde{q}) \tag{19}$$

where we set

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

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

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

It is straightforward to check that $H'(1/2) = 0$ and that $H'(\tilde{q})>0$ if $\tilde{q}>1/2$. Thus $H(\tilde{q})$ is decreasing for $\tilde{q}\in[0,1/2]$ and increasing for $\tilde{q}\in[1/2;1]$. And we get from Eq. (19):

$$\forall\tilde{q}, \frac{C'(\tilde{q})}{P'(\tilde{q})} \geq \frac{C'(1/2)}{P'(1/2)} = \frac{\sigma-1}{\omega^2}. \tag{20}$$

QED.

Proof of Proposition 1. Consider now the case $\sigma - 1 \geq \omega^2$

i) From Eq. (12) it is clear that $q = 1/2$ is a steady state. From Eq. (20) we get that $C'(1/2) \geq P'(1/2)$. Hence 1/2 is a locally stable steady state. Moreover from Lemma 1 we get that any alternative steady state $\tilde{q}$ should also be such that $C'(\tilde{q}) \geq P'(\tilde{q})$ and thus stable. ii) 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. It is such that for all $q_t \in [0, 1/2[$ (resp. $q_t \in]1/2, 1]$) one has $P(q_t) > C(q_t)$ (resp. $P(q_t) < C(q_t)$). It follows that $\dot{q}_t \gtrless 0$ if q_t 1/2; and $q = 1/2$ is globally stable.
QED.

Proof of Proposition 2. Consider the case $\sigma - 1 < \omega^2$

Parts i) and ii). From Eq. (12) it is clear that $q = 1/2$ is a steady state. From Eq. (20) 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:

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

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 stable steady state on the interval (0, 1/2). By symmetry we get that there exists a unique steady state $q_1 = 1 - q_0$ on the interval (1/2; 1). And q_1 is also stable.

Part iii). The multiple steady states q_0 and q_1 are given by the following equation:

$$P(q) = C(q) \qquad \text{with} \qquad \begin{array}{c} P(q,\omega) = \dfrac{1+2\omega(q-\frac{1}{2})}{1-2\omega(q-\frac{1}{2})} \\ \text{and} \\ C(q,\omega,\sigma) = \left(\dfrac{q}{1-q}\right)^{\frac{\sigma-1}{\omega}} \end{array}.$$

Simple differentiation gives for q_i $i \in \{0, 1\}$

$$\frac{\partial q_i}{\partial \omega} = -\frac{P'_\omega - C'_\omega}{P'_q - C'_q}.$$

The denominator of this expression is negative. The sign of $\partial q_i/\partial\omega$ is then given by the sign of

$$P'_\omega - C'_\omega = P(q,\omega).\frac{4(q-\frac{1}{2})}{[1+2\omega(q-\frac{1}{2})(1-2\omega(q-\frac{1}{2}))]} + C(q,\omega,\sigma).\frac{\sigma-1}{\omega^2} Log\left(\frac{q}{1-q}\right).$$

As $P(q,\omega) = C(q,\omega,\sigma)$ at q_i $i \in \{0, 1\}$, one obtains that the sign of $P'_\omega - C'_\omega$ at such points is the same as the sign of

$$\frac{4(q-\frac{1}{2})}{[1+2\omega(q-\frac{1}{2})(1-2\omega(q-\frac{1}{2}))]} + \frac{\sigma-1}{\omega^2} Log\left(\frac{q}{1-q}\right).$$

Given that $\omega < 1$, the first term of the expression is positive if and only if $q \geq 1/2$; given that $\sigma > 1$, the second term is positive if and only if $q \geq 1/2$. From this and the fact that $q_0 < 1/2 < q_1$, it follows that $P'_\omega - C'_\omega$ is negative at q_0 and positive at q_1. Hence the comparative statics

$$\frac{\partial q_0(\omega,\sigma)}{\partial \omega} < 0 < \frac{\partial q_1(\omega,\sigma)}{\partial \omega}.$$

Similarly, one has

$$\frac{\partial q_i}{\partial \sigma} = -\frac{P'_\sigma - C'_\sigma}{P'_q - C'_q}.$$

Similar reasoning shows that the sign of $P'_\sigma - C'_\sigma = -C'_\sigma$ is given by the sign of

$$-\frac{1}{\omega} Log\left(\frac{q}{1-q}\right).$$

Hence given that $q_0 < 1/2 < q_1$, one immediately gets:

$$\frac{\partial q_1(\omega,\sigma)}{\partial \sigma} < 0 < \frac{\partial q_0(\omega,\sigma)}{\partial \sigma}.$$

QED.

B.2. Proof of Proposition 3

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

$$\frac{1}{2}\frac{1+2\omega\left(q^{int}-\frac{1}{2}\right)}{1-2\omega\left(q^{int}-\frac{1}{2}\right)} = \left(\frac{q^{int}}{1-q^{int}}\right)^{(\sigma-1)/\omega} \tag{21}$$

we get from Eqs. (12) and (21) that the autarkic and international equilibria (q^{aut}, q^{int}) are such that:

$$C(q) = kP(q) \tag{22}$$

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

Differentiating Eq. (22) 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:

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

Part (iii) of the proposition directly follows from the main text.

B.3. Proof of Propositions 4 and 5

To characterize the steady state cultural equilibria under trade integration, we again proceed in several steps

- Step 1:Note first that in each integrated country $h \in K$, an interior cultural steady state $(q^h)_{h \in K}$ is given by:

$$W^X\left(q^h, Q^K\right)\left(1-q^h\right) = W^Y\left(q^h, Q^K\right) q^h$$

where $Q^K = \sum_{k \in K} q^k$. This can be rewritten as:

$$\left(\frac{1-q^h}{q^h}\right)^{\frac{\sigma-1}{\omega}} \left[\frac{1}{2} + \omega\left(q^h - \frac{1}{2}\right)\right] = \frac{1+\omega}{2} K - \omega Q^K. \tag{23}$$

The RHS of Eq. (23) defines a function $\Theta(q) = [(1-q)/q]^{\frac{\sigma-1}{\omega}}[\frac{1}{2}+\omega(q-\frac{1}{2})]$. We have the following lemma:

Lemma 2. i) *When* $\sigma \geq 1+\frac{\omega^2}{2}$ *the* $\Theta(q)$ *is decreasing in* q *for all* $q\in[0,1]$. ii) *When* $\sigma<1+\frac{\omega^2}{2}$, *there exists two values* q_L *and* $q_H \in]0,1[$ *such that* $q_L < q_H$ *such that the RHS of Eq.* (23) $\Theta(q)$ *is decreasing in* q *on the set* $[0,q_L]\cup[q_H,1]$ *and increasing in* q *on the set* $[q_L,q_H]$.

Proof. Take the function $\Theta(q) = [(1-q)/q]^{\frac{\sigma-1}{\omega}}[\frac{1}{2}+\omega(q-\frac{1}{2})]$ and differentiate logarithmically. We get

$$\frac{\Theta'(q)}{\Theta(q)} = -\frac{\sigma-1}{\omega}\left[\frac{1}{q}+\frac{1}{1-q}\right]+\frac{\omega}{\frac{1}{2}+\omega(q-\frac{1}{2})}$$

whose sign is the same as the sign of $\Psi(q) = \omega^2 q(1-q)-(\sigma-1)\left[\frac{1}{2}+\omega\left(q-\frac{1}{2}\right)\right]$. Now the function $\Psi(q)$ has a maximum at $q = 1/2$ and is such that $\Psi(0) = -(\sigma-1)\frac{1-\omega}{2}<0$ and $\Psi(1) = -(\sigma-1)\frac{1+\omega}{2}<0$.

Moreover $\Psi(1/2) = \frac{\omega^2}{4}-\frac{(\sigma-1)}{2}$. Hence two possible cases occur:

i) When $\sigma \geq 1+\frac{\omega^2}{2}$, $\Psi(q) \leq \Psi(1/2) < 0$ and $\Theta'(q) < 0$ for all $q\in[0,1]$. Hence $\Theta(q)$ is decreasing in q for all $q\in[0,1]$.

b) When $\sigma<1+\frac{\omega^2}{2}$, then inspection of $\Psi(q)$ reveals that there exists two values q_L and $q_H \in]0,1[$ such that $q_L < q_H$ and $\Psi(q)$ is negative for $q \in[0,q_L]\cup[q_H,1]$ and $\Psi(q)$ is positive for $q\in[q_L,q_H]$. Hence $\Theta(q)$ is decreasing in q on the set $[0,q_L]\cup[q_H,1]$ and increasing in q on the set $[q_L,q_H]$.

QED.

– Step 2: Proof of Proposition 4

Consider now the case $\sigma \geq 1+\omega^2$

i) When $\sigma \geq 1+\omega^2$, we are necessarily in case a) of Lemma 2. The function $\Theta(q)$ is decreasing in q with $lim_{q\to 0}\Theta(q) = +\infty$ and $\Theta(1) = 0$. Given that $\frac{1+\omega}{2}K-\omega Q^K\in(0,1)$ it follows that there exists a unique $q^h = \tilde{q}\left(Q^K\right)$ satisfying Eq. (23) in each integrated economy at a given value Q^K. A world interior steady state equilibrium is then characterized by

$$q^h = \tilde{q}\left(Q^K\right) \quad \text{for all } h\in K \quad \text{and} \quad Q^K = \sum_{k\in K} q^k.$$

It follows immediately that such steady state is necessarily symmetric as $q^h = q^l = \tilde{q}\left(Q^K\right) = q_K^*$ for all $\{h,l\}\in K^2$. Therefore it should also satisfy $Q^K = Kq_K^*$. Substitution in Eq. (23) provides Eq. (18) in the text. This can be rewritten as

$$K = \frac{P(q)}{C(q)}. \tag{24}$$

Now when $\sigma \geq 1+\omega^2$ it is a simple matter to see that the function $P(q)/C(q)$ is decreasing in q, as

$$\frac{P'(q)}{P(q)}-\frac{C'(q)}{C(q)} = \frac{4\omega}{[1-2\omega(q-\frac{1}{2})][1+2\omega(q-\frac{1}{2})]}-\frac{\sigma-1}{\omega}\frac{1}{q(1-q)} = \left[\frac{1}{H(q)}-\frac{\sigma-1}{4\omega^2}\right]\frac{4\omega}{q(1-q)}<0$$

(from the proof of Lemma 1 the function $1/H(q)$ reaches its maximum 1/4 at $q = 1/2$; hence the bracket term is negative). Therefore Eq. (18) has a unique interior solution $q_h^* = q_K^* = q^*(K)$.

To investigate the (local) stability of the interior world steady state, we need to consider the full K dimensional dynamic system

$$\dot{q}_t^h = q_t^h\left(1-q_t^h\right)\left[\left(W^X\left(q_t^h,\sum_{k\in K}q_t^k\right)\left(1-q_t^h\right)-W^Y\left(q_t^h,\sum_{k\in K}q_t^k\right)q_t^h\right]\quad \text{for all } h\in K$$

around the steady state q_K^*. Differentiation of the system around q_K^* gives the Hessian matrix

$$q_K^*(1-q_K^*)\begin{pmatrix} a_{11} & \cdots & \cdots & a_{1K} \\ \vdots & \ddots & \cdots & \vdots \\ \vdots & \vdots & \ddots & \vdots \\ a_{K1} & \cdots & \cdots & a_{KK}\end{pmatrix}$$

where

$$\begin{aligned} a_{hh} &= -W^X-W^Y+\left[W_1^X+W_Q^X\right](1-q_K^*)-\left[W_1^Y+W_Q^Y\right]q_K^* \\ a_{hk} &= W_Q^X(1-q_K^*)-W_Q^Y q_K^* \end{aligned} \tag{25}$$

with $W_1^X = \partial W^X/\partial q^h$; $W_Q^X = \partial W^X/\partial Q^K$; $W_1^Y = \partial W^Y/\partial q^h$; $W_Q^Y = \partial W^Y/\partial Q^K$ and all these functions are evaluated at the steady state q_K^*. Denote $A = (a_{hk})_{h,k\in[1,K]^2}$ the associated matrix.

Given that:

$$\begin{aligned} W^X\left(q_t^h,Q_t^K\right) &= \frac{\varpi}{(\sigma F)^{1/(\sigma-1)}}\left[\left(\frac{1}{2}+\omega\left(q_t^h-\frac{1}{2}\right)\right)^{(1+\omega)/2}\left(\frac{1+\omega}{2}K-\omega Q_t^K\right)^{(1-\omega)/2}\right]^{1/(\sigma-1)} \\ W^Y\left(q_t^h,Q_t^K\right) &= \frac{\varpi}{(\sigma F)^{1/(\sigma-1)}}\left[\left(\frac{1}{2}+\omega\left(q_t^h-\frac{1}{2}\right)\right)^{(1-\omega)/2}\left(\frac{1+\omega}{2}K-\omega Q_t^K\right)^{(1+\omega)/2}\right]^{1/(\sigma-1)} \end{aligned}$$

we find:

$$\frac{W_1^X}{W^X} = \frac{1}{\sigma-1}\frac{1+\omega}{2}\frac{\omega}{\frac{1}{2}+\omega(q_K^*-\frac{1}{2})} \qquad \frac{W_1^Y}{W^Y} = \frac{1}{\sigma-1}\frac{1-\omega}{2}\frac{\omega}{\frac{1}{2}+\omega(q_K^*-\frac{1}{2})}$$

$$\frac{W_Q^X}{W^X} = -\frac{1}{\sigma-1}\frac{1-\omega}{2K}\frac{\omega}{\frac{1}{2}-\omega(q_K^*-\frac{1}{2})} \qquad \frac{W_Q^Y}{W^Y} = -\frac{1}{\sigma-1}\frac{1+\omega}{2K}\frac{\omega}{\frac{1}{2}-\omega(q_K^*-\frac{1}{2})}$$

Thus after substitution in Eq. (25), one obtains the coefficients a_{hk} as:

$$\begin{aligned} a_{hh} = &-W^X-W^Y+\frac{1}{\sigma-1}W^X(1-q_K^*)\left[\frac{1+\omega}{2}\frac{\omega}{\frac{1}{2}+\omega(q_K^*-\frac{1}{2})}-\frac{1-\omega}{2K}\frac{\omega}{\frac{1}{2}-\omega(q_K^*-\frac{1}{2})}\right] \\ &-\frac{1}{\sigma-1}W^Y q_K^*\left[\frac{1-\omega}{2}\frac{\omega}{\frac{1}{2}+\omega(q_K^*-\frac{1}{2})}-\frac{1+\omega}{2K}\frac{\omega}{\frac{1}{2}-\omega(q_K^*-\frac{1}{2})}\right] \end{aligned}$$

and

$$\begin{aligned} a_{hk} = &-\frac{1}{\sigma-1}\frac{1-\omega}{2K}\frac{\omega}{\frac{1}{2}-\omega(q_K^*-\frac{1}{2})}W^X(1-q_K^*) \\ &+\frac{1}{\sigma-1}\frac{1+\omega}{2K}\frac{\omega}{\frac{1}{2}-\omega(q_K^*-\frac{1}{2})}W^Y q_K^*. \end{aligned}$$

At the world steady state, we know that $W^X(1-q_K^*) = W^Y q_K^*$, thus regrouping terms:

$$\begin{aligned} a_{hh} &= -W^X-W^Y+\frac{\omega^2 W^X(1-q_K^*)}{\sigma-1}\left[\frac{1}{\frac{1}{2}+\omega(q_K^*-\frac{1}{2})}+\frac{1}{K[\frac{1}{2}-\omega(q_K^*-\frac{1}{2})]}\right] \\ &= -\frac{W^X}{q_K^*}+\frac{\omega^2 W^X(1-q_K^*)}{(\sigma-1)}\left[\frac{1}{\frac{1}{2}+\omega(q_K^*-\frac{1}{2})}+\frac{1}{K[\frac{1}{2}-\omega(q_K^*-\frac{1}{2})]}\right] \end{aligned}$$

and

$$a_{hk} = \frac{\omega^2 W^X(1-q_K^*)}{\sigma-1}\frac{1}{K[\frac{1}{2}-\omega(q_K^*-\frac{1}{2})]}.$$

Now we use a result due to Tambs–Lyche on stable matrices (i.e. matrices for which all characteristic roots have negative real parts)[21]:

If $A = (a_{ij})$ is a real K dimensional matrix with $a_{ij} \geq 0$ for all i,j such that $i \neq j$ and there exist strictly positive numbers $t_1,\ldots,t_K$ such that $\sum_{k=1}^{k=K} t_k a_{hk} < 0$ for all $h = 1,\ldots K$, then A is stable (i.e. all characteristic roots have negative real parts)

Now we have:

$$\sum_{k=1}^{k=K} a_{hk} = a_{hh} + \sum_{k \neq h} a_{hk} = -\frac{W^X}{q_K^*} + \frac{\omega^2 W^X (1-q_K^*)}{(\sigma-1)} \frac{1}{\frac{1}{2}+\omega(q_K^*-\frac{1}{2})} + \sum_{k=1}^{K} \frac{\omega^2 W^X (1-q_K^*)}{(\sigma-1)} \frac{1}{K[\frac{1}{2}-\omega(q_K^*-\frac{1}{2})]}$$
$$= -\frac{W^X}{q_K^*} + \frac{\omega^2 W^X (1-q_K^*)}{(\sigma-1)} \frac{1}{\frac{1}{2}+\omega(q_K^*-\frac{1}{2})} + \frac{\omega^2 W^X (1-q_K^*)}{(\sigma-1)} \frac{1}{[\frac{1}{2}-\omega(q_K^*-\frac{1}{2})]}.$$

This term is negative when

$$\frac{\omega^2 (1-q_K^*) q_K^*}{(\sigma-1)} \left[\frac{1}{\frac{1}{2}+\omega(q_K^*-\frac{1}{2})} + \frac{1}{[\frac{1}{2}-\omega(q_K^*-\frac{1}{2})]} \right] < 1$$

or when:

$$\frac{\omega^2}{(\sigma-1)} \frac{1}{H(q_K^*)} < 1$$

with

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

From Lemma 1, the function $H(q)$ admits a minimum at $q = 1/2$. Thus as long as

$$\frac{\omega^2}{(\sigma-1)} \frac{1}{H(1/2)} = \frac{\omega^2}{(\sigma-1)} \frac{1}{4} < 1$$

we have that $\sum_{k=1}^{k=K} a_{hk} < 0$ and we can apply the result of Tambs–Lyche to our specific case taking $t_h = 1$ for all $h \in K$.

It follows that for $\sigma > 1 + \omega^2 > 1 + \omega^2/4$, the interior steady state q_K^* is locally stable in our K-dimensional integrated world economy.

ii) Simple differentiation of Eq. (18) or (12) provides that $q^*(K)$ is a decreasing function of the number of integrating economies K.

iii) Given Eq. (14), it follows also immediately that the equilibrium steady state number $N_{X^h}^* = \left[\frac{1}{2}+\omega(q_K^*-\frac{1}{2})\right]/\sigma F$ of country-specific cultural goods is reduced with further trade integration as

$$\frac{\partial N_{X^h}^*}{\partial K} = \frac{\omega}{\sigma F} \frac{\partial q_K^*}{\partial K} < 0.$$

Conversely, the equilibrium steady state number of world common cultural goods is increased. We even have that it is increasing more than proportionally than K:

$$\frac{\partial N_Y^*}{\partial K} \frac{K}{N_Y^*} = \left[\frac{1+\omega}{2} - \omega q_K^* - \omega K \frac{\partial q_K^*}{\partial K} \right] \frac{K}{\left[\frac{1+\omega}{2}K - \omega K q_K^*\right]}$$
$$= 1 - \frac{\omega K^2 \frac{\partial q_K^*}{\partial K}}{\left[\frac{1+\omega}{2}K - \omega K q_K^*\right]} > 1.$$

– Step 3: Proof of Proposition 5

i) From Lemma 2 we know that for all $\sigma \geq 1 + \omega^2/2$, there exists again a unique $q^h = \tilde{q}\left(Q^K\right)$ satisfying Eq. (23) in each integrated economy at a given value Q^K and therefore a world interior steady state equilibrium is characterized by

$$q^h = \tilde{q}\left(Q^K\right) \text{ for all } h \in K \text{ and } Q^K = \sum_{k \in K} q^k$$

and is necessarily symmetric.

When $1 \leq \sigma < 1 + \omega^2/2$, we know that the LHS $\Theta(q)$ of Eq. (23) is non monotonic, such that it is first decreasing on the set $[0, q_L]$, increasing on the set $[q_L, q_H]$ and again decreasing on $[q_H, 1]$. It is therefore reaching a maximum at $\Theta(q_H)$ Now the RHS of Eq. (23) is increasing in K and therefore when K is large enough (i.e. larger than $\frac{2}{1+\omega}\Theta(q_H)$) we can ensure that for all values of Q^K, a solution to Eq. (23) is always located in the interval $[0, q_L]$ where $\Theta(q)$ is strictly decreasing in q (see picture A.1). It follows that when K is large enough, there exists a unique $q^h = \tilde{q}\left(Q^K\right) < q_L$ satisfying Eq. (23) in each integrated economy at a given value Q^K. It follows as well that a world interior steady state equilibrium is again necessarily symmetric.

Such a symmetric interior world steady state should therefore satisfy Eq. (18) which can be rewritten as:

$$\Gamma(q) = \frac{P(q)}{C(q)} = \left(\frac{1-q}{q}\right)^{\frac{\sigma-1}{\omega}} \frac{\frac{1}{2}+\omega(q-\frac{1}{2})}{\frac{1}{2}-\omega(q-\frac{1}{2})} = K. \quad (26)$$

Now for $\sigma < 1 + \omega^2$, we know that the function $\Gamma(q)$ is non monotonic. Indeed

$$\frac{\Gamma'(q)}{\Gamma(q)} = \left[\frac{1}{H(q)} - \frac{\sigma-1}{4\omega^2}\right] \frac{4\omega}{q(1-q)}.$$

Given that $1 \leq \sigma < 1 + \omega^2$, and $\frac{1}{H(0)} = \frac{1}{H(1)} = 0$ and that $\frac{1}{H(1/2)} = \frac{1}{4} > \frac{\sigma-1}{4\omega^2}$ there exists indeed two values q_N and q_M such that

$$\frac{1}{H(q)} = \frac{\sigma-1}{4\omega^2}$$

and where $\frac{1}{H(q)} < \frac{\sigma-1}{4\omega^2}$ on the set $[0,q_N] \cup [q_M,1]$, and $\frac{1}{H(q)} > \frac{\sigma-1}{4\omega^2}$ on the set $[q_N, q_M]$. From this, it follows that the function $\Gamma(q)$ is decreasing on $[0, q_N]$, increasing on $[q_N,q_M]$ and again decreasing on $[q_M,1]$.

Now when $K > \Gamma(q_M)$, given that $\lim_{q \to 0}\Gamma(q) = +\infty$, there exists a unique solution of Eq. (26) q_K^* which is necessarily in the interval $]0,q_N[$ (see picture A.2).

From the previous discussion, it follows that when $K > K_{min} = Max\left[\frac{2}{1+\omega}\Theta(q_H), \Gamma(q_M)\right]$, the world interior cultural steady state is necessarily symmetric. It exists and it is unique and given by the solution of Eq. (18).

[21] See e.g. Marcus and Minc, 1992, p.159

Finally, the local stability of the steady state q_K^* is obtained in a similar way as for Proposition 3, noting additionally that the condition for the Tambs–Lyche result to be applied is now $\frac{\omega^2}{(\sigma-1)}\frac{1}{H(q_K^*)}<1$ which is always satisfied when K is large enough (as q_K^* tends to be 0 and $\frac{1}{H(0)}=0$).

ii) From Proposition 2, we know that for $1 \leq \sigma < 1+\omega^2$, an autarkic economy can be in one of the two stable steady states q_0 and q_1 with $q_0 < 1/2 < q_1$. Consider an economy that settles under autarky in the high steady state q_1, (namely with a strong bias towards its country specific goods). After trade integration when K is large enough, this economy will settle to the new steady state $q_K^* < q_L$ below the low autarkic steady state of the economy. After setting to such steady state, it is clear from Proposition 2 that a return to autarky will induce this economy to converge towards the low autarkic equilibrium q_0 and not to the initial starting point at q_1. Hence trade integration induces "cultural hysteresis", in the sense that long enough temporary trade liberalization has permanent effects on the cultural patterns of preferences in such a country.
QED.

B.4. Welfare analysis in Section 8

Logarithmic differentiation of V_Y and V_X provide immediately:

$$\begin{aligned}\frac{dV_Y}{V_Y} &\sim \frac{1-\omega}{2}\frac{\omega\frac{\partial q^*(K)}{\partial K}dK}{\frac{1}{2}+\omega(q^*(K)-\frac{1}{2})}+\frac{1+\omega}{2}\left(\frac{dK}{K}-\frac{\omega\frac{\partial q^*(K)}{\partial K}dK}{\frac{1}{2}-\omega(q^*(K)-\frac{1}{2})}\right)\\ &=\omega\frac{\partial q^*(K)}{\partial K}\left[\frac{\frac{1-\omega}{2}}{\frac{1}{2}+\omega(q^*(K)-\frac{1}{2})}-\frac{\frac{1+\omega}{2}}{\frac{1}{2}-\omega(q^*(K)-\frac{1}{2})}\right]dK+\frac{1+\omega}{2}\frac{dK}{K}\\ &=\omega\frac{\partial q^*(K)}{\partial K}\left[\frac{\frac{1-\omega}{2}[\frac{1}{2}-\omega(q^*(K)-\frac{1}{2})]-\frac{1+\omega}{2}[\frac{1}{2}+\omega(q^*(K)-\frac{1}{2})]}{[\frac{1}{2}+\omega(q^*(K)-\frac{1}{2})][\frac{1}{2}-\omega(q^*(K)-\frac{1}{2})]}\right]dK\\ &\quad+\frac{1+\omega}{2}\frac{dK}{K}\\ &=\underbrace{-\frac{\omega^2\frac{\partial q^*(K)}{\partial K}q^*(K)}{[\frac{1}{2}+\omega(q^*(K)-\frac{1}{2})][\frac{1}{2}-\omega(q^*(K)-\frac{1}{2})]}dK}+\underbrace{\frac{1+\omega}{2}\frac{dK}{K}}>0\end{aligned}$$

and

$$\begin{aligned}\frac{dV_X^h}{V_X^h} &\sim \frac{1+\omega}{2}\frac{\omega\frac{\partial q^*(K)}{\partial K}}{\frac{1}{2}+\omega(q^*(K)-\frac{1}{2})}+\frac{1-\omega}{2}\left(\frac{dK}{K}-\frac{\omega\frac{\partial q^*(K)}{\partial K}}{\frac{1}{2}-\omega(q^*(K)-\frac{1}{2})}\right)\\ &=\omega\frac{\partial q^*(K)}{\partial K}\left[\frac{\frac{1+\omega}{2}}{\frac{1}{2}+\omega(q^*(K)-\frac{1}{2})}-\frac{\frac{1-\omega}{2}}{\frac{1}{2}-\omega(q^*(K)-\frac{1}{2})}\right]dK\\ &\quad+\frac{1-\omega}{2}\frac{dK}{K}\\ &=\omega\frac{\partial q^*(K)}{\partial K}\left[\frac{\frac{1+\omega}{2}[\frac{1}{2}-\omega(q^*(K)-\frac{1}{2})]-\frac{1-\omega}{2}[\frac{1}{2}+\omega(q^*(K)-\frac{1}{2})]}{[\frac{1}{2}+\omega(q^*(K)-\frac{1}{2})][\frac{1}{2}-\omega(q^*(K)-\frac{1}{2})]}\right]dK\\ &\quad+\frac{1-\omega}{2}\frac{dK}{K}\\ &=\underbrace{\frac{\omega^2\frac{\partial q^*(K)}{\partial K}(1-q^*(K))dK}{[\frac{1}{2}+\omega(q^*(K)-\frac{1}{2})][\frac{1}{2}-\omega(q^*(K)-\frac{1}{2})]}}+\underbrace{\frac{1-\omega}{2}\frac{dK}{K}}\lesseqgtr 0.\end{aligned}$$

QED.

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