"BEYOND THE MELTING POT": CULTURAL TRANSMISSION, MARRIAGE, AND THE EVOLUTION OF ETHNIC AND RELIGIOUS TRAITS*

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This paper presents an economic analysis of the intergenerational transmission of ethnic and religious traits through family socialization and marital segregation decisions. Frequency of intragroup marriage (homogamy), as well as socialization rates of religious and ethnic groups, depend on the group's share of the population: minority groups search more intensely for homogamous mates, and spend more resources to socialize their offspring. This pattern generally induces a dynamics of the distribution of ethnic and religious traits which converges to a culturally heterogeneous stationary population. Existing empirical evidence bearing directly and indirectly on the implications of the model is discussed.

I. INTRODUCTION

Before 1960 most social scientists argued that the conditions of American life and its opportunities for economic and social improvement would create a "melting pot." This assimilation technology would transform immigrants of different ethnic and religious groups into Americans sharing a common culture—developing common attitudes, values, and lifestyles (see Gleason [1980], for a historical account of the development of the theory of assimilation in the United States). Indeed, most research on American immigration until the 1960s has been explicitly or implicitly based on some variation of the melting pot theory of assimilation. Most notably, the classic historical and sociological accounts of the first part of the century on American immigration all portray immigrants interacting with American society, perhaps meeting with cultural difficulties and some hostility, and eventually becoming fully part of society (see, for example, W. C. Smith's *Americans in the Making* [1939], M. Hansen's *The Immigrant in American History* [1941], J. Higham's *Strangers in the Land* [1955], and O. Handlin's *The Uprooted* [1951] and *Boston's Immigrants* [1959]).

Starting in the late 1950s and 1960s, many began discredit-

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ing the view that immigrants naturally assimilated in a melting pot process. Herberg [1955] noticed that the assimilation of immigrants along religious dimensions was clearly failing to occur, and suggested that the "three great faiths" (Protestant, Catholic, and Jewish) might constitute a "triple melting pot." Glazer and Moynihan [1963], in a celebrated study of the five major ethnic groups of New York City, argued that even along ethnic traits, assimilation was proceeding at best very slowly. The "Negroes, Puerto Ricans, Jews, Italian[s], and Irish" retained distinctive economic, political and cultural patterns long after arriving in the United States (see also Gordon [1964]). More recently, Mayer [1979] studying Orthodox Jewish communities in New York in the 1970s concluded that they were facing a "cultural Renaissance" rather than the complete assimilation considered inevitable by much of the previous sociological literature on the subject (for example, Leventman [1969]). Also Borjas [1995], in one of the few econometric attempts at measuring the persistence of cultural traits, studied the assimilation of immigrants' "ethnic capital" in the United States, finding quite slow rates of cultural convergence. Moreover, outside the United States we find examples of the striking persistence of ethnic and religious minorities. Basques, Catalans, Corsicans, Irish Catholics, in Europe, Quebecois in Canada, and Jews of the diaspora have all remained strongly attached to their languages and cultural traits even through the formation of political states that did not recognize their ethnic and religious diversity.[1] Indeed, such persistence of ethnic and religious minorities led Levi Strauss [1997] to observe that the risks of cultural assimilation have been much overstated in the anthropological and sociological debate of the 1950s, because cultures have demonstrated a "very resilient strong core."[2]

How could melting pot theories of assimilation fail so dramatically in their predictions? Several relevant aspects of the assimilation process are neglected by such theories. Most importantly, parents have well-defined preferences over the cultural traits acquired and developed by their own children. Further, they have

1. Among the extreme examples of such resilience, small communities of Orthodox Christian Albanians have lived in the south of Italy since they emigrated there in the fifteenth century, maintaining their language and religious faith although surrounded by Catholic communities; "Blancs Matignons" in the French Caribbean islands preserve themselves from racial mixing through strong homogamy strategies, and have done so since the eighteenth century.

2. The melting pot idea has not only been discredited on the basis of the empirical evidence, but also on ethical grounds; see, for instance Greeley [1979] and Novak [1971].

access to a socialization technology that allows them to influence the cultural traits of their children, rationally reacting to their childrens' social environment. This ability, neglected by the melting pot theories of assimilation, explains the theories' predictive failure.[3]

The purpose of this paper is to present an economic framework that studies the evolution and persistence of ethnic and religious traits as dynamic properties of cultural transmission and socialization mechanisms. We view such mechanisms as centered on the role of the family. Therefore, we study the role of marriage in the development of cultural traits of children. More precisely each parent is modeled as wishing to transmit his/her own trait to his/her children. They can exert a direct socialization effort to influence their children's process of preference formation. (These socialization efforts take the form, for instance, of spending time with children, choosing appropriate neighborhoods, schools, and acquaintances, and attending church.) The effective socialization of children to a particular religious or ethnic trait is then determined by the interaction of the direct socialization effort of parents and the indirect influence of society toward assimilation (the melting pot factor). The direct socialization technology of parents operates at the level of the family. Families in which parents share the same cultural trait (homogamous families) enjoy a more efficient socialization technology for their shared trait than families with mixed cultural parents (heterogamous families). Therefore, each individual's choice of the marriage mate crucially determines his/her ability to transmit his/her set of cultural traits to their eventual children. While perfect assortative matching along religious and ethnic dimensions (complete homogamy) would arise optimally in the absence of search costs, we model the marriage market as characterized by search frictions. More specifically, we assume that the admission to marriage pools, whose ethnic and religious composition is restricted, is only available at a cost.

The cultural transmission mechanism just delineated produces different behavior for cultural minorities and majorities with respect to their effort to marry homogamously and to socialize children to their own trait. Minorities, other things equal and in

3. A demand for "cultural pluralism" on the parts of immigrants has in fact often clashed in U. S. history with the melting pot ideology: from the anti-Catholic riots in Philadelphia in 1844, motivated by the request for public support of Catholic schools and by their objections to the King James version of the Bible, to the forced assimilation of immigrants proposed by the National Americanization Committee in the 1920s, and the heated debate over the academic curriculum in many U. S. states in the 1990s (see Glazer [1997] and Gleason [1980]).

equilibrium, have more highly segregated marriage markets, and more intensely exercise effort in directly socializing their children. Intuitively, since the population at large is mostly populated by majority types, a member of a minority cultural group is likely to marry heterogamously if he/she does not enter a restricted marriage pool composed of members of his/her same cultural group (e.g., if he/she does not attend church and live in a segregated neighborhood). Moreover, a minority type in a heterogamous marriage will have difficulty transmitting his/her own traits, since the spouse will favor a different set of traits, and peers and role models will be taken from a population mostly of the majority types. For both reasons, individuals from the cultural minority have higher incentives to marry homogamously and to exert direct socialization efforts in order to transmit their cultural identity to their offsprings. In other words, minorities rationally react to the assimilation of the melting pot.

Such analysis of the socialization and marriage segregation behavior of minorities has natural implications for the dynamics of the distribution of ethnic and religious traits in the population. The population dynamics converge to a heterogeneous limit distribution in which minorities are never completely assimilated. This result helps us to understand the historical and ethnographic observations of the existence of several resilient ethnic and religious populations motivating our analysis.[4] Finally, we are able to derive a number of implications on the impact of various different socioeconomic environments (relative to, e.g., gender roles, family structures, urbanization, and divorce) on the marital behavior of ethnic and religious groups, their socialization strategies, and the consequences for the long-run pattern of cultural diversity.

II. Assimilation and the Transmission of Ethnic and Religious Traits

We argued in the introduction that the persistence of ethnic and religious traits and the difficulties in the assimilation of minorities, while hard to measure quantitatively, have been

4. In particular, our analysis of the socialization and segregation behavior of minorities implies that linear extrapolations of intermarriage rates, socialization practices, and demographic dynamics of minority populations tend to underestimate the persistence of cultural traits. The failed predictions on the assimilation of Orthodox Jews in the 1960s were, for instance, based on such linear extrapolations (see Mayer [1979]). This is still the case for many sociological analyses of population dynamics by ethnic groups (see, for instance, the prediction on intermarriage for Secular, Reform and Conservative Jews, cited in Dershowitz [1997], and, more generally, the survey in Heer [1980]).

largely documented since the 1960s. The persistence of cultural traits, we claim, is the consequence of the demand for "cultural pluralism" on the part of ethnic, religious, and racial minorities. This demand naturally arises from the interaction of rational individual agents in culturally heterogeneous social environments.[5] To formalize such claims, we introduce the following model of cultural transmission.

Suppose that there are two possible types of cultural traits in the population, $\{a,b\}$. In particular, different traits should capture some relevant aspect of ethnic traits or religious beliefs. In each period there are two stationary, equally sized populations of adult males and females. Agents live two periods. Young agents are born without well-defined cultural traits, which they acquire (in a way described below) before becoming adult. In his adult life a male is matched with an adult female (in a way to be described below) to form a household. In order to keep the size of each population stationary, we assume that each family union has two children, a male and a female.

The model has two main components: socialization and marriage. We describe them and motivate the main assumptions in turn.

A. Socialization

Cultural transmission is modeled as a mechanism that interacts socialization inside the family with socialization outside the family. Socialization outside the family occurs in society at large via imitation and learning from peers and role models. (Socialization inside the family is also called "direct vertical" socialization, and socialization outside the family "oblique" socialization.)[6] We assume that children are born without defined preferences or cultural traits, and are first exposed to their family socialization effort (i.e., vertical socialization). If the direct verti-

5. The modeling of the economic choice of agents with respect to the socialization of their children is naturally a fundamental aspect of our approach, as it distinguishes it from most analysis of cultural transmission in the biology and sociology literatures (Cavalli-Sforza and Feldman [1981], Boyd and Richerson [1985], and Coleman [1990], for instance). This approach is also different from the analysis of marriage as an institution of transmission of cultural values as in anthropology (from Boas [1928], and Levi Strauss [1949]). Economists have mostly concentrated instead on the agents' choice of their own preferences and values, as, e.g., Becker [1996], Becker and Mulligan [1997], and, specifically for religious preferences, Iannaccone [1990, 1998]. For genetic rather than cultural transmission models, see, e.g., Kockesen, Ok, and Sethi [1998]. See Bowles [1998] for a survey and complete references.

6. This terminology is taken from Cavalli-Sforza and Feldman [1981].

cal socialization attempts of his/her family are not successful, a child remains naive and is then influenced by a role model chosen randomly from the population at large. This captures the influence of friends, peers, teachers, or the like. It has been extensively documented, in fact, that religious and ethnic traits are usually adopted in the early formative years of children's psychology and that family, peers, and role models play a crucial role in determining their adoption [Clark and Worthington 1987; Cornwall 1988; Erickson 1992; Hayes and Pittelkow 1993].

We also assume that only homogamous families can vertically socialize their children. This is an extreme assumption made to simplify the analysis. All that is needed for our results is that the socialization technology of homogamous families be more efficient than that of heterogamous families. There is some evidence that homogamy is associated with higher socialization rates. For example, children of mixed religious marriages have weaker religious commitments than those of religiously homogamous marriages [Hoge and Petrillo 1978; Ozorak 1989]; and, children of mixed religious marriages are less likely to conform to any parental religious ideology or practices, like church attendance or prescribed fertility behavior [Heaton 1986; Hoge, Petrillo, and Smith 1982]. There is also some evidence consistent with our assumption that homogamy proxies for more intense direct socialization on the part of the family. In their study of religious belief in Australia, Hayes and Pittelkow [1993] find that the effect of homogamy on socialization vanishes when a measure of socialization effort (e.g., "parental discussion of religious beliefs") is introduced in the regression.

The socialization process is illustrated in Figure I. When both parents have the same trait, say i, direct vertical socialization to that trait occurs with probability τ^i. Let q^i be the fraction of individuals with trait i in the population. If a child from a family with trait i is not directly socialized, which occurs with probability $1 - \tau^i$, he/she picks the trait of a role model chosen randomly in the population as do all children born in heterogamous families (i.e., they pick trait i with probability q^i and trait j with probability $q^j = 1 - q^i$).

We assume that families care about their children's cultural traits and consciously exercise effort in an attempt to socialize children. Socialization is costly. Socialization costs increase with the probability of successful direct socialization by parents, and

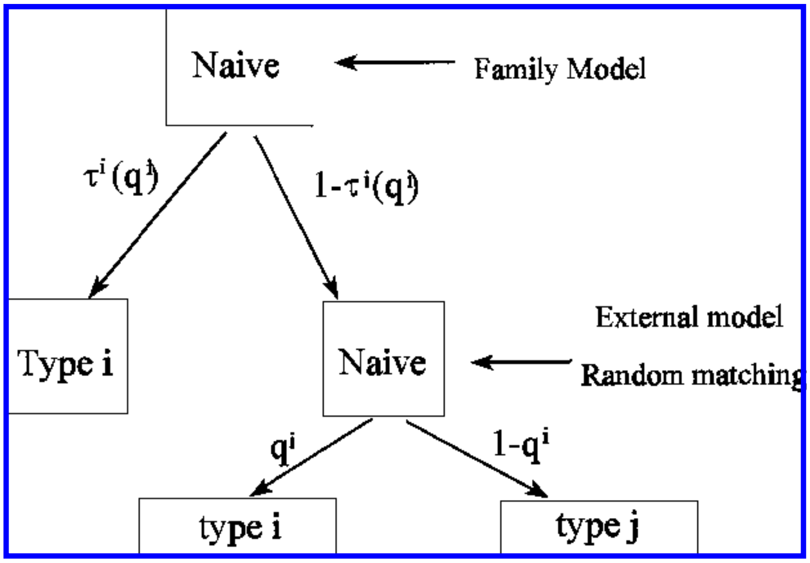

FIGURE I

are denoted $H(\beta\tau^i)$, for $i \in \{a,b\}$ (β is just a parameter that we shall use in the comparative statics exercises).

We assume that altruism motivates parents to exert effort to socialize their children. This altruism, however, is assumed to be "paternalistic" in the sense that parents wish to transmit their own trait, and do not just internalize their children's preferences or some measure of their success. More precisely, parents are altruistic toward their children and want to socialize them to their own specific cultural model. Let V^{ij} denote the utility a type i parent derives from a type j child, $i, j \in \{a,b\}$. We assume then $V^{ii} > V^{ij}$, if $i \neq j$.[7] Parents take direct actions that influence the cultural ethnic and religious traits of their children. Much evidence supports such claim. Moreover, the evidence also supports

7. This would in general be the case endogenously if V^{ij} were constructed as the indirect utility of some economic choice made by an agent of type j, evaluated with the preferences of agents of type i; if the choice set of each agent is independent of his/her cultural type. By assuming that $V^{ii} > V^{ij}$, we effectively restrict the relevance of our analysis to "pure" cultural traits that have no effect on the objective economic opportunities of the agents. This is, of course, an abstraction meant to disentangle the cultural transmission mechanism from other economic considerations. Some aspects of religious and ethnic traits, more than other cultural traits and attitudes, seem to approximate satisfactorily "pure" traits (but not, for instance, those aspects of ethnic traits that relate to the language spoken; see, e.g., Lazear [1995]).

the claim that parents are motivated by a form of "paternalistic altruism," or "imperfect empathy," when shaping their children's cultural traits. Studies of parental school choice decisions are particularly informative. Gussin Paley [1995], for instance, provides a vivid ethnographic documentation of school choice of middle-class African-American parents on Chicago's South Side. The main issue in the choice consists of trading off the low academic quality of the predominantly black public schools with the exposure to "white culture" in integrated schools. O'Brien and Fugita [1991] document the perceived importance for Japanese families of the development of Japanese schools after World War II in the United States. Similar attitudes are documented for many ethnic groups (e.g., Mayer [1985] for Jews, Tyack [1974] for Germans, and more recently, Glazer [1997] for African-Americans). Some evidence in support of paternalistic altruism can also be derived from socioeconomic surveys. For instance, in response to NORC's General Social Survey's question, "Which three of the qualities listed would you say are the most desirable for a child to have?" "obedience" is cited on average across the sample more than (in order) "self-control," "success," "studiousness," "cleanliness," and less often only than "honesty."[8]

Formally, the altruistic utility of children for each parent in a homogamous family with type i, in the model, is

$$W^i(q^i) = \max_{\tau^i} [\tau^i + (1 - \tau^i)q^i]V^{ii} + (1 - \tau^i)(1 - q^i)V^{ij} - H(\beta\tau^i). \tag{1}$$

Since homogamous marriages are endowed with a direct socialization technology, the value of children for such families, $W^i(q_t^i)$, depends on the parents' choice of socialization effort, τ^i, as well as on matching probability q^i. On the contrary, heterogamous families are not endowed with a socialization technology, and hence the altruistic value of children for a parent of type i in such a family is

$$q^iV^{ii} + (1 - q^i)V^{ij}. \tag{2}$$

B. Marriage

Since each parent wishes to transfer his/her own trait to his/her children, in the model, the choice of a mate in the marriage market is a function of the desire to socialize the children that will arise from the union. While of course many elements enter in real

8. For a natural selection explanation of paternalistic forms of altruism, see Bisin and Verdier [1998].

world marriage decisions, there is evidence that they are relevantly influenced by the anticipated socialization of children. Psychological studies of heterogamous couples, for instance, consistently report partners' concerns about possible cultural attitudes of children when deciding to form a family (Rosenblatt, Karis, and Powell [1995] for racial traits, and Mayer [1985] and Smith [1996] for ethnic and religious traits). Also, many studies of cohabitating couples reveal that the expected fertility at the moment of the union is very low, not significantly different from that of single women [Rindefuss and Van den Heuvel 1990], and, consistent with our presumption, cohabitations are also significantly less homogamous than marriages (e.g., 51 percent of marriages in the National Survey of Families and Households (1987–1988) are religiously homogamous, compared with only 37 percent of cohabitations [Schoen and Weinick 1993]). Finally, an analysis of norms regarding interreligious marriages reveals that parents of most major denominations (from Catholics to Baptists and Jews, but also, for instance, Seventh-Day Adventists and Lutherans) at least tend to warn children not to intermarry, justifying their position with a concern about the religious education of grandchildren (See Smith [1996] for a survey of rules and regulations of the main American denominations regarding religious intermarriage).[9]

The desire to socialize children would drive the equilibrium marriage rates to complete homogamy in the absence of search costs. We can see this from equations (1) and (2), $W^i(q^i) > q^iV^{ii} + (1 - q^i)V^{ij}$, for $0 < q^i < 1$, and $i \in \{a,b\}$. Hence, mates are complementary (see Becker [1973, 1974]). But we model the marriage market as characterized by search frictions. More specifically, we assume that while both males and females can search for a mate in some restricted pool where everyone admitted has the same cultural trait (hence all marriages in the pool are homogamous), admission to the pool is costly. (We think of direct admission costs, but also of costs in terms of other unmodeled desirable characteristics of a match that might be limited by constraining oneself to search in a restricted pool.)

More precisely, the matching of adult individuals is organized via a marriage game. The probability of entering a homogamous

9. Indirect evidence for the perceived importance of homogamy in marriage decisions can be found in the study of religious conversions. Greeley [1979], for instance, found that most conversions were attributable to the desire of establishing homogamy in marriages.

marriage is endogenously chosen by each agent. We assume that there are two restricted marriage matching pools (one for each cultural trait) where individuals with the same trait can possibly match in marriage. With probability α^i an agent of type i (trait $i \in \{a,b\}$) enters the restricted pool and is married homogamously. With probability $1 - \alpha^i$ an agent of type i does not get married in the restricted pool. He then enters a common pool made of all individuals who have not been matched in marriage in their own restricted pools. In this common pool individuals match randomly. Let A^i be the fraction of individuals of type i who are matched in their restricted pool (in equilibrium, by symmetry, all individuals with the same trait behave identically and hence $\alpha^i = A^i$). The probability an individual of type i in the common unrestricted marriage pool is matched in marriage with an individual of the same type is then $[(1 - A^i)q^i]/[(1 - A^i)q^i + (1 - A^j)(1 - q^i)]$, and the probability of homogamous marriage of an individual of type i is given by

$$\pi^i(\alpha^i, A^i, A^j, q^i) = \alpha^i + (1 - \alpha^i)\frac{(1 - A^i)q^i}{(1 - A^i)q^i + (1 - A^j)(1 - q^i)}. \tag{3}$$

Individuals of type i can affect the probability of being matched in their restricted pool by choosing α^i at a cost $C(\delta\alpha^i)$, where δ is just a parameter that we will use in the comparative statics exercises.

Many institutions do function to some degree as marriage pools, restricted along cultural and religious traits. Two examples of populations with rather extreme socialization practices can best illustrate our view of the marriage process. These are the cases of aristocrats in France and Orthodox Jews in New York.

The Bottin Mondain and the Rallye. Various ethnographic studies of aristocrats have revealed the importance of their attachment to specific cultural values and their concern for the intergenerational transmission of their symbolic and cultural capital. Documented examples include a concern for family names, negative attitudes toward work and money, and an emphasis on the importance of land property (see Grange [1996]). But how are these values transmitted? In France the most relevant institutions for this purpose are the Bottin Mondain, the main aristocracy's listing book, and the Rallye, a chain of dancing parties [Grange 1996]. Families can be listed in the Bottin only if invited by families already listed. Most information published in the Bottin Mondain is family and dynasty oriented, and professional indications are kept to a strict minimum. The Rallye, which organizes a gathering of between 100 and 500 young people each month, consists instead of a group of young single women, whose families are listed in the Bottin Mondain. The family of each woman, when subscribing to the Rallye, commits to host a party for all the participants of the Rallye. Along with the Bottin Mondain, the Rallye is therefore an institution intended to stimulate homogamous aristocratic mating. It involves substantial resources spent by the different families (e.g., parties are generally organized in sumptuous palaces), and well reflects our vision of a restricted pool in which resources are spent to increase the probability of being married homogamously with respect to the relevant cultural trait.

The Shadchan. Orthodox Jews live in mostly segregated neighborhoods and adhere to very extreme norms to preserve their religious and cultural traits (see the ethnographic studies of Heilman [1995] and Mayer [1979]). In a religious community whose various proscriptions limit casual encounter between the sexes, many marriages are arranged. The ethnographic study of Orthodox Jews in Boro Park, an Orthodox Jewish neighborhood in Brooklyn, New York, conducted by Mayer [1979] in the 1970s, surveys matchmakers (*shadchans*). This study reveals that not only do *shadchans* serve as go-betweens ("telephone numbers' distributors"), but, most importantly, they also inform both parties of each other's adherence to religious norms, prescriptions, and proscriptions (e.g., about the dress code of the woman, the tenure at the rabbinical seminary of the man, etc.). Essentially, the *shadchan* ensures the preservation of religious and cultural traits in marriage, while its historical role in protecting and matching families' assets has lost much of its importance. As important as matchmaking is (as a restricted marriage pool) in Orthodox Jewish communities, "love-marriages" are slowly replacing arranged ones. Nonetheless, in Boro Park, for instance, many institutions, from *kosher* pizza parlors and cafeterias of the hundreds of *Yeshivas* (religious schools) in the neighborhood, to Orthodox summer camps, and Young Men's & Women's Hebrew Association's activities, operate to substitute the *shadchan* in facilitating mating by religious and cultural traits (see, again, Mayer [1979]).

The timing of actions in the typical lifetime of an individual in the model is as follows. In his/her childhood period, an individual is socialized and acquires a cultural trait i. In his/her mature period, he/she chooses a probability of matching in a restricted pool. Matches are then realized (first in the restricted pools and then in the common pool), and households are formed. Families then have children and socialize them according to the socialization technology at their disposal.

C. Equilibrium Socialization, Marriage, and Homogamy

In the model, the problem of, say, a male of type i is to choose the probability of matching in the restricted marriage pool knowing that, if he is matched in a homogamous household, he has access to a technology to socialize his children. An agent with trait i chooses $\alpha^i \in [0,1]$, for given A^i, A^j, q^i, to maximize

$$(4) \quad \pi^i(\alpha^i, A^i, A^j, q^i) W^i(q^i) + [1 - \pi^i(\alpha^i, A^i, A^j, q^i)][q^i V^{ii} + (1 - q^i) V^{ij}] - C(\delta\alpha^i),$$

where $\pi^i(\alpha^i, A^i, A^j, q^i)$ is the probability of homogamous marriage for type i agents, $q^i V^{ii} + (1 - q^i) V^{ij}$ is the expected utility of a type i parent in a heterogamous marriage (in which the socialization of the children is determined by random matching only (equation (2)); while $W^i(q^i)$ is the corresponding expected utility in a homogamous marriage (equation (1)).

Note that agents i and j interact nontrivially in the marriage game: agent's i maximization problem depends (via $\pi^i(\cdot)$) on A^j, the fraction of agents of type j in the restricted pool. In fact, the more agents of type j in the restricted pool, the less of them in the residual population, and the more favorable the strategy of not entering their own restricted pool (and being matched in the common residual pool) is for agents of type i.

The maximization of equation (4) for each agent of type i provides an optimal α^i as a function of A^i, A^j, and q^i. Using the fact that in a symmetric Nash equilibrium, all individuals of type i choose the same marital segregation effort α^i and therefore that, by the Law of Large numbers, $A^i = \alpha^i$, one can derive marriage "best reply" functions $\tilde{\alpha}^i(\alpha^j, q^i)$ of each group as a function of the marital segregation effort of the other group α^j and the population fraction q^i. As illustrated in Figure II in the space (α^i, α^j), these best reply functions are downward sloping, reflecting the fact that marital segregation efforts are strategic substitutes. Intuitively, when group j tends to segregate more in the marriage market, it is less likely for an individual of group i to marry heterogamously in

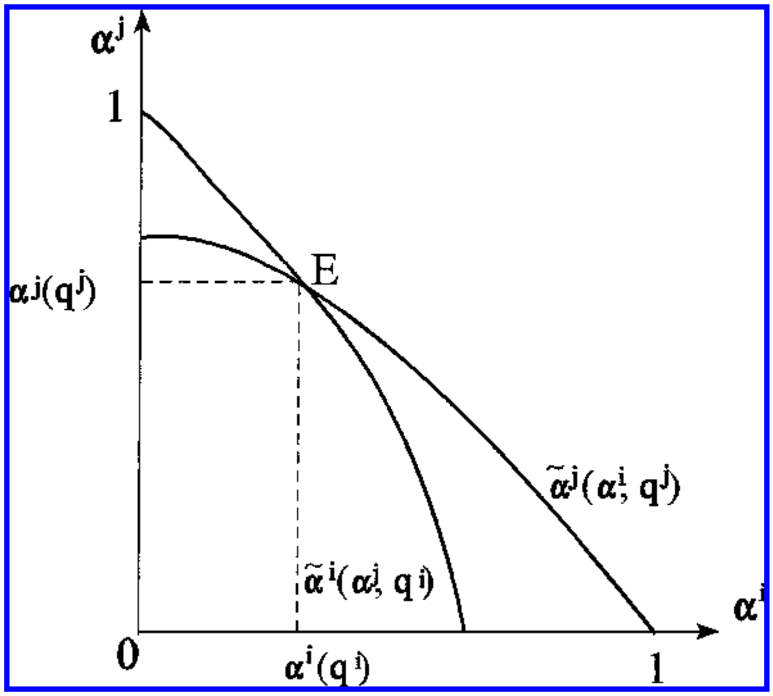

FIGURE II

the marriage "common pool." This, in turn, makes it less profitable to spend resources to be matched in his own "restricted pool" in the first place.

A symmetric Nash equilibrium of the marriage game is then represented by mappings $\alpha^i(q^i)$ which are fixed points of the best replies of agents $i \in \{a,b\}$. The probability of homogamous marriage for agents of type i is just a function of q^i in equilibrium, and is denoted by $\pi^i(q^i)$. Under convexity and regularity assumptions on costs $C(\delta\alpha^i)$ and $H(\beta\tau^i)$,[10] we can show that there exists a unique intersection point E in Figure II of the best reply functions $\tilde{\alpha}^i(\alpha^j,q^i)$ (i.e., a unique symmetric Nash equilibrium of the marriage game, denoted $[\alpha(q^i)] = [\alpha^i(q^i)]_{i\in\{a,b\}}$). Also, there is a well-defined solution of the socialization effort choice of homogamous families of type i, or of the maximization in equation (1) denoted by $\tau^i(q^i)$. The equilibrium homogamy rate (i.e., the probability of

10. The convexity and regularity conditions are maintained for the rest of the paper and are explicitly stated in the Appendix.

homogamous marriage for agents) of the type i population is then $\pi^i(q^i) = \pi(\alpha^i(q^i),\alpha^i(q^i),\alpha^j(1 - q^i),q^i)$, while the equilibrium socialization rate (i.e., each agent's probability of socializing the offspring to one's own trait) of the type i population is $P^{ii}(q^i) = \tau^i(q^i) + (1 - \tau^i(q^i))q^i$.

D. Results

Several implications can be derived from this model of marriage and socialization for a given distribution of traits in the population, q^i. The implied dynamics of the distribution of traits will be studied in Section IV.

PROPOSITION 1. For any $0 < q^i < 1$ and for $i \in \{a,b\}$, in equilibrium,

i. the probability of matching in the restricted pool for agents of type i, $\alpha^i(q^i)$, and the socialization effort of homogamous families of type i, $\tau^i(q^i)$, are strictly positive; the homogamy rate of the population of type i is greater than the homogamy rate associated with random matching, $\pi^i(q^i) > q^i$, and the probability of successful socialization for a family of type i is greater than the oblique socialization rate, $P^{ii}(q^i) > q^i$, moreover.

ii. $\alpha^i(q^i)$ and $\tau^i(q^i)$ are decreasing in the fraction of the population with trait i,q^i.

For general convex marriage and socialization costs, agents have incentives both to actively look for homogamous marriages ($\alpha^i(q^i) > 0$), and, conditionally on actually being married homogamously, to socialize their offspring to the trait of the family ($\tau^i(q^i) > 0$). This implies that the marriage process is biased toward homogamy ($\pi^i(q^i) > q^i$), and that socialization is biased toward transmitting the traits of the parents in homogamous families ($P^{ii}(q^i) > q^i$).[11]

Most importantly, Proposition 1. ii implies that the probability of matching in the restricted pool and the choice of socialization effort of homogamous families are higher for minorities, other things equal.[12]

An individual in a cultural minority has a large probability of being matched in a heterogamous marriage if he does not enter

11. It can also easily be seen that Proposition 1.i also implies, if appropriately reinterpreted, a positive differential in the rates of homogamy and socialization between agents who plan to have children and agents who do not.

12. It is important to stress that this cross-sectional interpretation of Proposition 1 requires that cultural traits not be too much different in terms of tolerance of each other, i.e., in terms of $V^{ii} - V^{ij} = \Delta V^i$, $i \in \{a,b\}$.

the restricted pool, since the common unrestricted pool would be mostly populated by majority types. Moreover, a minority type in a heterogamous marriage will not have access to the technology of socialization, and his children will be socialized to the external cultural environment, that is, with high probability, to the majority trait. This motivates agents with minority traits to homogamy. In particular, if the proportion of agents with trait i, q^i, decreases, ceteris paribus, agents of type i choose to increase the probability of entering the restricted pool, since the probability of homogamous marriage in the common pool decreases; the best reply function of type i agents, $\tilde{\alpha}^i(\alpha^j,q^i)$, then shifts upward in Figure II. Symmetrically, the best reply of type $j \neq i$ agents, $\tilde{\alpha}^j(\alpha^i,q^j)$, shifts downward as $q^j = 1 - q^i$. With the resulting new Nash equilibrium are associated a larger segregation effort of group i, $\alpha^i(q^i)$, and a smaller segregation effort of group j, $\alpha^j(q^j)$.

Once homogamous, families with a minority trait still have large incentives to directly socialize their children because if direct socialization is unsuccessful, once again, children will be socialized to the external cultural environment, i.e., most probably to the majority trait. As a consequence, the socialization effort of a homogamous family of type i, $\tau^i(q^i)$, is decreasing in i.[13]

We next study how, for given distribution of the traits in the population, equilibrium levels of marriage segregation, socialization effort, homogamy rates, and socialization rates depend on the parameters of the model. The next proposition provides a complete characterization of the comparative statics.[14] We will develop some extensions of the basic model with a richer parameterization and comparative statics analysis in the next subsection.

PROPOSITION 2. For any $0 < q^i < 1$ and for $i \in \{a,b\}$, in equilibrium,

i. the probability of matching in the restricted pool for agents of type i, $\alpha^i(q^i)$, the socialization effort of homogamous families of type i, $\tau^i(q^i)$, and hence the homogamy rate and the socialization rate of the population of type i, $\pi^i(q^i), P^{ii}(q^i)$, are decreasing in the cost of direct socialization, β;

13. It should be noted that the model does not predict homogamy rates, $\pi^i(q^i)$, which are monotonically related to q^i. Homogamy rates of minority populations reflect the trade-off of stronger marriage segregation strategies ($\alpha^i(q^i)$ is decreasing in q^i) with the opposite effect due to their higher intercultural matching in the common pool, where matching is random and hence reflects relative population sizes. Similarly, socialization rates, $P^{ii}(q^i)$, also do not necessarily depend monotonically on q^i.

14. The proof is available upon request from the authors. We do not make explicit the dependence of the endogenous variables on the parameters other than q^i, for simplicity.

ii. $\alpha^i(q^i)$ and $\pi^i(q^i)$ are decreasing in the marriage segregation costs δ, which do not affect $\tau^i(q^i)$, and $P^{ii}(q^i)$;
iii. $\alpha^i(q^i)$ and $\pi^i(q^i)$ are increasing in the degree of cultural intolerance of group i, ΔV^i,$\alpha^i(q^i)$ is decreasing and $\pi^i(q^i)$ is increasing (for convex enough costs $C(\delta\alpha^i)$) in the degree of intolerance of group j, ΔV^j; $\tau^i(q^i)$ and, $P^{ii}(q^i)$ are also increasing in the degree of intolerance of group i, but are unaffected by the degree of intolerance of group j.

Both $\alpha^i(q^i)$ and $\tau^i(q^i)$ are decreasing in socialization costs, β. A positive change in the cost of direct socialization, not surprisingly, negatively affects direct socialization effort, but it also negatively affects entry to the restricted marriage pool. The benefits of the restricted pool consist of the option to use the direct socialization technology, which is now more costly; the best reply curves, $\tilde{\alpha}^i(\alpha^j,q^i)$, shift down in Figure II. The equilibrium probability of matching in restricted pools $\alpha^i(q^i)$, the socialization, and the homogamy rates are decreased as a consequence.[15] Similarly, α^i and π^i are decreasing in (while τ^i and P^{ii} are unaffected by) marriage segregation costs, parameterized by δ. An increase in cultural distance or intolerance of group i, $V^{ii} - V^{ij} = \Delta V^i$ means higher gains from socialization for that group. This, in turn, positively affects both direct socialization effort and entry into the restricted marriage pool of group i (i.e., an upward shift of $\tilde{\alpha}^i(\alpha^j,q^i)$ in Figure II). $\alpha^i(q^i)$ as well as group i's homogamy and socialization rates are increased as a result. Interestingly, an increase in cultural intolerance of the other group, j, has no effect on family socialization τ^i of group i, but negatively affects its marital segregation effort, α^i, reflecting the strategic complementarity that exists between segregation efforts in the marriage game. As ΔV^j increases, individuals of group j increase both their family socialization effort, τ^j, and their marriage segregation strategy, α^j (i.e., an upward shift of $\tilde{\alpha}^j(\alpha^i,q^i)$ in Figure II). This makes it less likely for an individual of group i to form a heterogamous marriage through the common pool, thereby reducing his/her incentives to spend resources to be matched in his/her own restricted pool (i.e., a smaller equilibrium level of $\alpha^i(q^i)$). However, under enough convexity of the marriage cost function $C(\delta\alpha^i)$, the

15. We would then expect, for instance, high cultural homogamy for families in which the parents are self-employed or own a family business. This is consistent, for instance, with the behavior of Asian minority groups in the United States, which have high rates of self-employment and homogamy (see Boyd [1990] and Zhou and Logan [1989]).

direct effect on group j outweighs the reactive effect on group i, so that the homogamy rate of both groups increases.

E. Extensions

The model can be extended in several directions.

Suppose first that the marriage market (i.e., the common pool) is biased in favor of homogamous matching, because of exogenous segregation elements (geography, localization, neighborhood effects). For instance, the bias could arise from segregated neighborhoods in the population, or from the existence of institutions that function as restricted marriage pools and whose entry is free. We write the probability of an individual of type i being matched in marriage with an individual of the same type (the homogamy rate of type i) as

$$\pi^i(\alpha^i,A^i,A^j,q^i,\gamma) = \alpha^i + (1-\alpha^i)\frac{(1-A^i)q^i + (1-A^j)(1-q^i)\gamma}{(1-A^i)q^i + (1-A^j)(1-q^i)}, \tag{5}$$

where the second term on the right-hand side of (5) represents the fraction of type i individuals homogamously matched in the common residual marriage pool, given that there is a biased matching process parameterized by $\gamma \in [0,1]$. When $\gamma = 0$, there is random matching in the common pool. When $\gamma = 1$, individuals match with probability 1 to someone of the same type in the common pool; there is perfect assortative matching for each community independent of the existence of restricted pools (i.e., $\pi^i(\alpha^i,A^i,A^j,q^i,1) = 1$ for any α^i).

PROPOSITION 3. For any $0 < q^i < 1$ and for $i \in \{a,b\}$, in equilibrium, the probability of matching in the restricted pool for agents of type i, $\alpha^i(q^i)$, is decreasing in the degree of segregation of the marriage market, γ, while the homogamy rate of group i, $\pi^i(q^i)$, is increasing (if marriage segregation costs $C(\delta\alpha^i)$ are convex enough) in γ; the socialization effort of homogamous families of type i, $\tau^i(q^i)$, and the socialization rate of the population of type i, $P^{ii}(q^i)$, are unaffected by γ.

An increase in segregation of the population outside of the restricted pool (i.e., a positive change in γ) reduces the incentives for agents to enter the restricted pool (i.e., it reduces α^i), without affecting the direct socialization effort, τ^i, for both $i \in \{a,b\}$. A more interesting implication is the differentiated impact of a change in γ on homogamy rates and on the differential rates of homogamy with respect to (biased) random matching. Controlling for the structural bias in the common pool, this can be written as $\pi^i(q^i) - q^i - \gamma(1 - q^i)$. The effect of a change in γ on the homogamy rate of both groups is generally ambiguous, because an increase in γ, besides decreasing α^i, also has a direct positive effect on the homogamy rate (homogamous marriages by random matching are now easier). Under some regularity conditions, it can be shown that the direct effect on the homogamy rate is stronger, which then is increasing in γ.[16] The differential rate of homogamy, however, can be shown to be decreasing in γ for both groups.[17]

Another extension we consider involves adding an exogenous probability of divorce. Suppose that each family has a probability c of separating. Assume that separation occurs after children are born, but before they are socialized to the cultural traits. If separation occurs, we assume that one of the parents is chosen randomly to form a single-parent family. Assume also that socialization is more costly for single-parent families (see Thomson, McLanahan, and Curtin [1992] for some evidence on this point). Note that single-parent families, as opposed to heterogamous families, have a technology to socialize children; no ambiguity on which trait to transmit in fact arises in this case.

The typical problem of an individual of type i becomes to maximize

$$\pi^i(\alpha^i, A^i, A^j, q^i)[(1 - c)W^i_m(q^i) + cW^i_s(q^i)] + [1 - \pi^i(\alpha^i, A^i, A^j, q^i)][(1 - c)W^i_h(q^i) + cW^i_s(q^i)] - C(\delta\alpha^i),$$

where $W^i_m(q^i)$, $W^i_s(q^i)$, and $W^i_h(q^i)$ denote, respectively, the gains from socializing children inside a homogamous marriage, a single-parent family, and a heterogamous marriage. Given our assumptions about the socialization technologies of the different family types, the gains from socialization are given by

$$W^i_m(q^i) = \max_{\tau^i} [\tau^i + (1 - \tau^i)q^i]V^{ii} + (1 - \tau^i)(1 - q^i)V^{ij} - H_m(\beta\tau^i), \tag{6}$$

16. Consistently, Johnson [1980] documents higher rates of homogamy, after controlling for the probability of random matching, in urban environments, where intercultural contacts are easier, than in rural environments.

17. Similar analysis, with qualitatively similar comparative statics results, can be carried over for distortions that favor the parents' trait in the oblique phase of socialization.

$$(7)\quad W_s^i(q^i) = \max_{\tau^i}\,[\tau^i + (1-\tau^i)q^i]V^{ii} + (1-\tau^i)(1-q^i)V^{ij} - H_s(\beta\tau^i),$$

and

$$W_h(q^i) = [q^i V^{ii} + (1-q^i)V^{ij}],$$

where $H_m(\beta\tau^i)$ and $H_s(\beta\tau^i)$ are the socialization cost functions of homogamous couples and single-parent families. We assume that $H_m(\beta\tau^i) < H_s(\beta\tau^i)$, and $H'_m(\beta\tau^i) < H'_s(\beta\tau^i)$ for all $\tau^i \in (0,1)$; i.e., homogamous families have a more efficient direct socialization technology than single-parent families.

PROPOSITION 4. For any $0 < q^i - 1$ and for $i \in \{a,b\}$, in equilibrium,

i. the probability of matching in the restricted pool for agents of type i, $\alpha^i(q^i)$, and the homogamy rate of group i, $\pi^i(q^i)$, are decreasing in the divorce rate c; while the socialization efforts of both homogamous and single-parent families, $\tau^i_m(q^i)$ and $\tau^i_s(q^i)$, as well as their respective socialization rates, P^{ii}_m and P^{ii}_s, are unaffected by c. Moreover,

ii. the socialization effort of homogamous families, $\tau^i_m(q^i)$, is greater than that of single-parent families, $\tau^i_s(q^i)$, and hence the socialization rate of homogamous families, P^{ii}_m, is higher than that of single-parent families, P^{ii}_s.

Higher divorce rates in equilibrium imply lower segregation rates in restricted marriage pools, lower homogamy rates, and lower differentials in homogamy with respect to agents who cannot have children. When searching for a mate, agents anticipate that the marriage might fail. The value of homogamy in marriage is then reduced, because, if the marriage ends, children will be socialized with a relatively inefficient technology. Agents' incentives to enter the restricted marriage pool, i.e., to search for a homogamous mate, are lower the higher is the probability of divorce, c. Consequently, homogamy rates are also decreasing functions of the probability of divorce.

Also, higher socialization efforts and socialization rates for homogamous families with respect to single-parent ones simply reflect the fact that homogamous families have a better direct socialization technology than single-parent families, and hence, in equilibrium, they actually do socialize their children more intensely.[18]

18. See the evidence already cited on this point, in subsection II.A.

III. The Dynamics of the Distribution of Traits

Until now, the distribution of cultural traits q^i, was exogenously fixed. However, patterns of marital segregations and socialization across cultural groups in turn affect the dynamics of cultural traits in society, i.e., the dynamics of q^i. What distribution of traits will then prevail in the long run? Does the population remain multicultural in the limit, or do we observe a tendency toward cultural homogeneity? What are the effects of various structural changes in institutional arrangements within marriage? In this section we investigate these issues by explicitly analyzing the dynamics of the distribution of the cultural traits in the population.

A. Long-Run Dynamics and Cultural Diversity

Let us first consider the model with a bias in the common pool ($\gamma \neq 0$) but no divorce and single-parent families ($c = 0$). The probability that a child with a father with trait i will develop trait i (i.e., the socialization rate of group i) is

$$P^{ii}(q^i) = \pi^i(q^i,\gamma)[\tau^i(q^i) + (1 - \tau^i(q^i))q^i] + [1 - \pi^i(q^i,\gamma)]q^i,$$

where $\pi^i(q^i,\gamma)$ is the equilibrium homogamy rate of population i. We note its dependence in equilibrium on the parameter γ. Similarly, the probability that a child with a father with trait j will develop trait i is

$$P^{ji}(q^j) = \pi^j(q^j,\gamma)[(1 - \tau^j(q^j))q^i] + [1 - \pi^j(q^i,\gamma)]q^i.$$

Let q^i_t denote the fraction of the population with trait i at time t (we use explicitly the index t only when necessary). The dynamics of the population of agents with trait i is then determined by the difference equation:

$$\begin{aligned} (8) \qquad q^i_{t+1} &= P^{ii}_t q^i_t + P^{ji}_t(1 - q^i_t) \\ &= q^i_t + q^i_t(1 - q^i_t)[\pi^i(q^i_t,\gamma)\tau^i(q^i_t - \pi^j(q^j_t,\gamma)\tau^j(q^j_t)]. \end{aligned}$$

This dynamic process has degenerate stationary states, $q^i = 0$ and $q^i = 1$, which correspond to culturally homogeneous populations, and possibly interior stationary states, q^{i*}, which correspond to culturally heterogeneous populations, and satisfy

$$(9) \quad \pi^i(q^{i*},\gamma)\tau^i(q^{i*}) = \pi^j(1 - q^{i*},\gamma)\tau^j(1 - q^{i*}), \quad i,j \in \{a,b\}, \quad i \neq j.$$

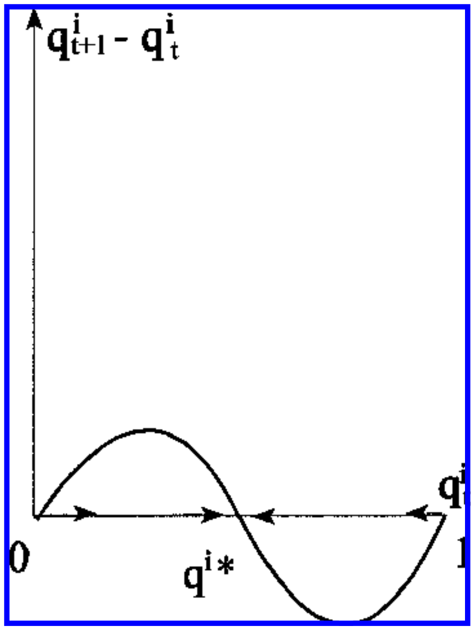

FIGURE III

PROPOSITION 5. The degenerate stationary states, $q^i = 0$ and $q^i = 1$, which correspond to culturally homogeneous populations, are locally unstable. There always exists one interior stationary state, q^{i*}, associated with a culturally heterogeneous population, which, under enough convexity of costs, is locally stable.

The phase diagram is represented in Figure III for the case of a unique interior steady state. The mechanism of marriage and cultural transmission we study generates dynamics of the distribution of cultural traits that tend to culturally heterogeneous populations and away from complete assimilation of minorities. This is because the transmission mechanism has the property that cultural minorities tend to react in equilibrium to the prospect of cultural assimilation with marriage segregation, homogamous marriages, and with more intense strategies for the direct socialization of children. Even though majorities have higher socialization rates, due simply to the effect of peers and role models, the dynamics of the distribution of traits in the population, when one trait is close to becoming extinct, depends essentially on direct socialization effort, which is higher for minorities.[19]

B. Comparative Statics

How will changes in the marital and social environment affect the long-run distribution of cultural traits? It is useful to rewrite the equation that determines the interior stationary states (equation (9)) as

$$\frac{q^{a*} - HT^{ab}(q^{a*})}{(1 - q^{a*}) - HT^{ab}(q^{a*})} = \frac{q^{a*}}{1 - q^{a*}} \frac{\tau^b(1 - q^{a*})}{\tau^a(q^{a*})}, \tag{10}$$

where $HT^{ab}(q^{a*})$ denotes the number of heterogamous marriages in the population in equilibrium at the stationary state distribution $q^{a*} : HT^{ab}(q^{a*}) = q^a - \pi^a(q^{a*})q^a$. This equation is represented in Figure IV, where the LL and RR curves represent, respectively, the left- and the right-hand side of equation (10) as a function of q^{a*}.[20]

While several comparative dynamics may be performed on the steady state distribution, here we wish to concentrate on two of them that have natural interesting interpretations. More precisely, we consider changes in the matching process (a shift in γ) and in the technologies of family socialization (a shift in β).

A change in γ. Consider first a negative change in γ, the distortion toward homogamy in the unrestricted pool. A negative change in γ increases equilibrium marriage segregation, α^i, of both cultural groups. It generally increases heterogamy, HT^{ab}, and it does not affect the socialization effort of homogamous marriage (the RR curve in Figure IV does not move). Note that an increase in HT^{ab} shifts up (respectively, down) the LL curve to LL', when q^a is larger (respectively, smaller) than ½ (see Figure

19. For an example of how, on the contrary, peer pressure and social interactions might lead to homogeneity, see Glaeser, Sacerdote, and Scheinkman [1996]. In our framework, cultural homogenization to trait i would occur when there are social externality effects in socialization such that the technology of family socialization $H(\tau)$ depends on q^i (with $H'_q(\tau,q) < 0$) and strong enough that $\tau^i(1) > [\pi^j(0)]\tau^j(0)$. It is also important to stress that our result on cultural heterogeneity of limit populations depends on the traits not having effects on the agents' economic opportunities. This is, of course, an abstraction. The results of Proposition 3 are most properly interpreted as identifying a form of persistence in the dynamics of cultural traits, a nonlinearity in the degree of cultural assimilation.

20. The comparative dynamics analysis that follows refers to any stable stationary state q^{a*}, so that the RR curve crosses the LL from below as in Figure IV: the analysis does not depend on q^{a*} being unique.

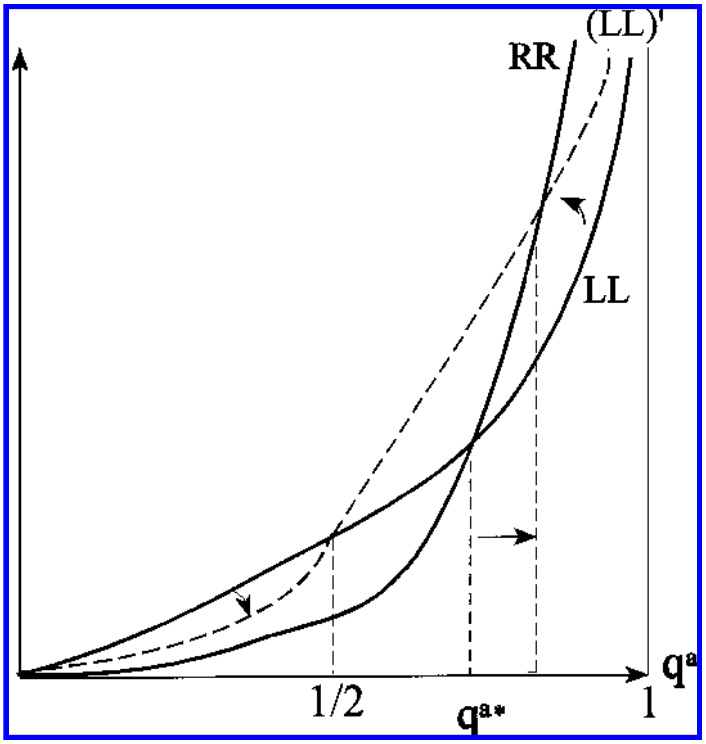

FIGURE IV

IV). The reason is that an increase in HT^{ab} decreases the homogamy rates, $\pi^i(q^i)$ of both groups. However, the shift is more pronounced for the group that is a minority in the stationary state rather than for the majority group, since random matching in the unrestricted pool favors, by definition, homogamy of the group that is a majority in the stationary state. As the *LL* curve represents the ratio of homogamous marriages in group *a* to group *b*, it is then increasing (respectively, decreasing) with HT^{ab} when *a* is the majority (respectively, minority) group in the stationary state (i.e., when q^{a*} is larger, respectively, smaller, than ½). A reduction in γ, though leading in the short run to higher effort to marital segregation by both groups, generally tends to increase heterogamy in society, and, as shown in Figure IV, favors in the limit the trait of group *i* with $q^{i*} > ½$.

A change in β. The impact of a less efficient family socialization technology (i.e., an increase in β) by directly changing the family socialization effort, τ^i, and indirectly the marital segregation strategies, α^i, affects both the LL and the RR curves in Figure IV. As it induces a reduction in the marital segregation strategy α^i, and in the family socialization effort τ^i, the impact on the marriage game to induce a larger equilibrium heterogamy rate HT^{ab}. As before, this effect decreases the probability of homogamous matching for the group that a minority in the stationary state more than for the majority group, thus favoring the majority group in the long-run distribution of traits. However, there is in principle another effect emanating from the direct decrease in τ^i stimulated by the parameter's change. If the increase in socialization costs, β, affects the technology of family socialization in the same way for both groups,[21] the ratio of socialization efforts $[\tau^b(q^b)]/[\tau^a(q^a)]$ is not affected; the RR curve does not shift. The effect of an increase in the cost of direct family socialization, β, is equivalent, then, to a decrease in γ; it increases in the limit the fraction of agents with trait i such that $q^{i*} > ½$.

IV. Some Evidence on Homogamy, Socialization, and Cultural Minorities

In this section we discuss some of the existing evidence on marriage and socialization which highlights the main classes of implications of our analysis. Homogamy and socialization rates are high relative to the fraction of the population with the trait, i.e., relative to the homogamy and socialization rates that would derive by random matching in marriage (Proposition 1.i); and, most importantly, cultural minorities, other things equal, exercise more effort in marriage segregation and socialize children more intensely than majorities (Proposition 1.ii).

Clearly identifiable cultural groups are generally characterized by high homogamy and socialization rates relative to the fraction of the population with the trait. Generally high rates of homogamy by ethnic group are documented by Peach [1980]. Religious homogamy is also pervasive (see, e.g., Johnson [1980] and Schoen and Weinick [1993]). The examples of French aristocrats and Orthodox Jews reported in subsection III.B, for in-

21. This is so in particular if the socialization cost function is of the form $H(\tau) = \tau^k$ with $k > 1$.

stance, also strongly support these observations. From a survey of 3914 nuclear families in the Bottin Mondain during the period 1903–1987, Arrondel and Grange [1993] estimate the probability of homogamous marriage for a child of a family in the Bottin Mondain. They find a significant rate of homogamy well above that implied by random matching, which, as we have seen, is explained by the existence of institutions like the *Rallye* which favor marriage segregation. More specifically, the average probability of being married to someone of the Bottin Mondain for a daughter of a couple listed in the Bottin is 44 percent (in the period 1950–1969) and 39 percent (in the period 1970–1983). For young males the average estimated probability in either periods is 39 percent. When the two parents share important aristocratic attributes (e.g., old aristocracy, a family castle, or membership in an aristocratic club), this probability is over 65 percent for young females, and over 80 percent for young males. Similarly, the institutions of arranged marriages, segregated living arrangements, segregated education in religious school, and the creation of restricted marriage pools like summer camps, have been exceptionally effective in promoting homogamy for Orthodox Jews. According to the *National Jews Population Survey,* the outmarriage rate in 1990 for Orthodox Jews was only 3 percent.

The pattern of homogamy and segregation observed for French aristocrats and Orthodox Jews, while extreme, is certainly not unique, and appears particularly common for populations with extreme minority traits, as our analysis implies.[22]

Some evidence on the marriage behavior of minorities is contained in Johnson [1980]. He constructs marriage tables for six religious groups, Baptists, Methodists, Presbyterians, Lutherans, Catholics, and Others, using data from the pooled 1973–1976 NORC *General Social Survey* (*GSS*), the 1960 *Growth of Families Survey,* and other sources. He then estimates a log-linear model of marriage frequencies for each religious group to fit the marriage tables, identifying two main explanatory factors in the analysis of assortative marriage: the religious composition of the population, and the "intrinsic endogamy" of each religious group, where "intrinsic endogamy" is a measure of the group's effort in marriage segregation, i.e., a measure of α^i in our notation. Both the

22. But even for a population with less extreme homogamy patterns, Japanese-Americans, O'Brien and Fugita [1991] report that cultural and ethnic institutions and clubs (which we would interpret as restricted marriage pools) are most prevalent in areas where Japanese-American are minorities.

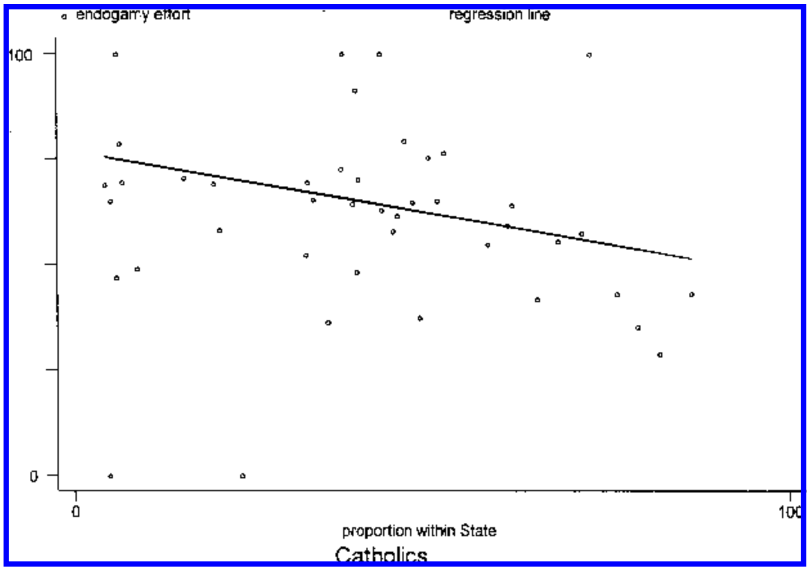

FIGURE Va

estimates of the model relative to the national and the regional level (i.e., relative to the national or the regional composition of the population by religious group), show that the intrinsic homogamy coefficients are generally higher for the groups which comprise a smaller proportion of the population, as our results imply. At the national level, for instance, the smallest group, "Others" (the residual group), has the highest intrinsic homogamy, while the largest groups, Baptists and Catholics, have the lowest. At the regional level, also, the smallest intrinsic homogamy for Catholics is in the Northeast, where Catholics comprise more than 45 percent of the population, while the largest (more than three times as large) is in the South, where Catholics constitute only 10 percent of the population.

To provide some illustrative evidence of the pattern of increased endogamy efforts by minority groups with more recent data, we also constructed a simple measure of our direct endogamy effort α^i by U. S. state for three minority religious groups: Protestants, Catholics, and Jews, using the NORC's *General Social Survey* (*GSS*) from 1973 to 1990 and the distribution of adherents by religion, across U. S. states, from Bradley and Green

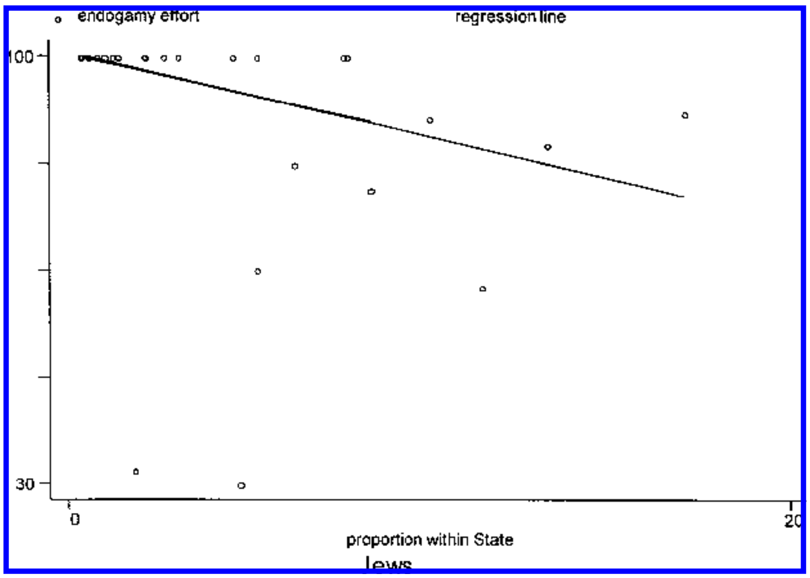

FIGURE Vb

[1992].[23] Figures Va and Vb plot across states this measure of α^i against the fraction q^i of religious adherents. As is shown in Figure Va, for Catholics, there is a clear decreasing relationship between endogamy effort and group size.[24] Although we have less observations for the Jewish group, Figure Vb also displays a negative (although weaker) relationship.[25] For both groups this is

23. The homogamy rate, determined by equation (3), can be rewritten as $\pi^i = \alpha^i + (1 - \alpha^i)Q^i$, where π^i is the homogamy rate, α^i is the direct effort in marriage segregation, and Q^i is the proportion of agents of type i in the common marriage pool (after those in the restricted pool have matched). Using the NORC's *GSS* (1973–1990), we constructed marriage tables (the π^i's) of three religious groups (Protestants, Catholics, Jews) by U. S. state. From Bradley and Green [1992], for each state, we have the fraction of adherents to each of the religious groups (the q^i's). Assuming (1) that the marriage pool of each individual is the state, (2) that the distribution of agents by religion determines the composition of the unrestricted pool, i.e., that $Q^i = q^i$, and (3) that nonreligious people marry by themselves (renormalizing the distribution by religion data so that the sum of the percentage of adherents of each of the three religions is 100), for each U. S. state with marriage observations, we computed a measure $\hat{\alpha}^i$ as $\hat{\alpha}^i = (\pi^i - q^i)/(1 - q^i) \cdot 100$ which is then plotted, across states, against q^i.

24. When we suppress the two outlier observations with $\alpha^i = 0$ (Utah and the District of Columbia), the regression line in Figure Va is given by $\hat{\alpha}^c = 76.41412 - 0.2917159\ q^c$ with t-statistics of (13.890) and (−2.496) and has therefore a negative significant slope.

25. We have only 25 observations for Jews. (Some states in the *GSS* do not report marriages with Jews.) When we suppress the two outlier observations on the southwest corner of Figure Vb (Oregon and Colorado), we also get a regression

consistent with our theoretical implication that cultural minorities have higher incentives to segregate in the marriage market. This evidence is clearly subject to many caveats and therefore should be considered only as casual and illustrative.[26] Still, it suggests that our theory may capture some interesting features of minorities' marriage patterns and that the link between cultural transmission and religious or ethnic minority behaviors certainly deserves more empirical attention.

Formal evidence on socialization behavior of ethnic and religious minorities is particularly difficult to obtain. But Barber [1994] documents that black and Hispanic families socialize their children more aggressively; they both set higher standards for behavior and are better able to enforce those standards.

V. Conclusions

This paper analyzed marital segregation decisions and their impact on the transmission of ethnic and religious traits. We concentrated on the interaction between direct family socialization and oblique socialization by teachers, peers, and role models. While most research on cultural transmission in biology and sociology has stressed this interaction, we complemented this emphasis by modeling marriage and direct family socialization as economic decisions of agents. Such an approach, we claim, is crucial to explaining the observed persistence of ethnic and religious traits, by implying intense marriage segregation and children's socialization behavior of cultural minorities.

While in the paper we emphasized the positive aspects of marriage and socialization mechanisms, our analysis also has interesting normative implications. We find that individuals segregate in marriage, and that families attempt to directly socialize their children more intensely than is efficient. Individuals, in fact, do not internalize the effect of their marriage decisions on the composition of the marriage pool, and families do not internalize the effect of their socialization effort on the future distribution of the population with respect to the cultural trait.

line with a negative significant slope given by $\hat{\alpha}^j = 100.4409 - 1.343498q^j$ with t-statistics of (32.489) and (−2.956).

26. For the Protestant group we did not get a clear negative relationship between endogamy effort and group size, across U. S. states. This may be due to our simplifying assumptions used to compute our measure of endogamy effort $\hat{\alpha}$ or to the fact that we aggregated all together the various protestant groups (Baptists, Methodists, Lutherans, Episcopal, Presbyterians, and Latter-day Saints).

This is in line with the result of Lazear [1995], who found, in a model of language assimilation, that minorities do not assimilate fast enough in terms of efficiency (in our analysis, though, both minorities and majorities socialize and segregate more than they should).

Finally, our model of socialization is relatively abstract, and, hence, in principle, can be extended to analyze the evolution of cultural traits other than ethnic and religious, or different socialization mechanisms. However, the assumption that cultural traits are "pure," or do not have relevant effects on agents' economic opportunities, is quite restrictive. This assumption needs to be relaxed in particular to apply our analysis to study the evolution of some aspects of ethnic traits, like language spoken, and to many other interesting cultural traits and preference parameters, like political attitudes, risk aversion, and intertemporal discounting. Such traits, in fact, seem to affect in a relevant manner how agents interact economically and socially, especially in strategic environments.

Appendix

The problem of an individual of type i is to choose $\alpha^i \in [0,1]$, for a given A^i, A^j, q^i, to maximize

$$(11) \quad \pi^i(\alpha^i, A^i, A^j, q^i) W^i(q^i) + [1 - \pi^i(\alpha^i, A^i, A^j, q^i)] V^i(q^i) - C(\delta\alpha^i),$$

where $W^i(q^i)$ is given by $W^i(q^i) = \max_{\tau^i} [\tau^i + (1 - \tau^i) q^i] V^{ii} + (1 - \tau^i)(1 - q^i) V^{ij} - H(\beta\tau^i)$ and $V^i(q^i) = q^i V^{ii} + (1 - q^i) V^{ij}$.

ASSUMPTION A. For $i \in \{a,b\}$, $C(\delta\alpha^i)$ and $H(\beta\tau^i)$ are monotonic increasing, of class C^3, and convex. Moreover,

A.i $(\partial^3 C)/(\partial \alpha^{i^3}) \leq 0$, $\delta\, (\partial C/\partial \alpha^i)\, (\delta) > [W^i(0) - V^i(0)]$;

A.ii $\delta(1 - \alpha^i)(\partial^2 C)/(\partial \alpha^{i^2}) - (\partial C)/(\partial \alpha^i) > 0$ at $\alpha^i = \alpha^i_{\max}$ such that $\delta(\partial C)/(\partial \alpha^i)(\delta \alpha^i_{\max}) = W^i(0) - V^i(0)$.[27]

A symmetric Nash equilibrium of the marriage game has the property that all agents of type i choose the same α^i, and is represented by mappings $\alpha^i(q^i)$ which are fixed points of the best

27. Assumptions A.i and A.ii provide sufficient conditions for the existence and uniqueness of the Nash equilibrium in the marriage game. A.i requires that the marginal cost of marriage segregation is increasing and concave; and it ensures that matching with probability 1 in the restricted pool is prohibitively costly. Finally, A.ii requires that, at some largest possible restricted pool matching probability, $\alpha^i_{\max}$, the cost function $C(\cdot)$ is convex enough.

replies of agents $i \in \{a,b\}$ derived from the maximization of equation (11).

PROPOSITION A. Under Assumption A the symmetric Nash equilibrium of the marriage game, $[\alpha(q^i)] = [\alpha(q^i)]_{i\in\{a,b\}}$ exists and is unique, $\alpha(q^i)$ is a continuous mapping, and $[\tau(q^i)]_{i\in\{a,b\}}$ is a continuous mapping.

Proof of Proposition A. At a symmetric Nash equilibrium $\alpha^i = A^i$ and the first-order condition of an individual of type i for the choice of α^i is

$$\text{(12)} \quad \Phi^i(\alpha^i,\alpha^j,q^i) \coloneqq \delta \frac{\partial C}{\partial \alpha^i}(\delta\alpha^i) - \frac{(1-\alpha^j)(1-q^i)}{[(1-\alpha^i)q^i + (1-\alpha^j)(1-q^i)]}[W^i(q^i) - V^i(q^i)] = 0.$$

Assumption A.i implies that $(\partial^2\Phi^i)/(\partial\alpha^{i^2}) < 0$, and hence Φ^i is continuous and concave in α^i for any $(\alpha^j,q^i) \in [0,1]^2$. Also $\Phi^i(0,\alpha^j,q^i) \leq 0$ and $\Phi^i(1,\alpha^j,q^i) > 1$, because of A.ii. Hence, for any $(\alpha^j,q^i) \in [0,1]^2$, there exists a unique $\alpha^i \in [0,1]$ satisfying $\Phi^i(\alpha^i,\alpha^j,q^i) = 0$. Let us denote such α^i by $\tilde{\alpha}^i(\alpha^j,q^i)$. $\tilde{\alpha}^i(\alpha^j,q^i)$ can be viewed as a best reply function of the marital segmentation effort of group i. Because of the concavity of Φ^i, a simple argument by contradiction shows that, at $\tilde{\alpha}^i(\alpha^j,q^i)$, necessarily $(\partial\Phi^i)/(\partial\alpha^i)(\tilde{\alpha}^i, \ldots) > 0$. Also, $(\partial\Phi^i)/(\partial\alpha^i) = 0$ implies that $0 < \tilde{\alpha}^i(0,q^i) < 1$ and $\tilde{\alpha}^i(1,q^i) = 0$. Finally,

$$\frac{\partial\tilde{\alpha}^i(\alpha^j,q^i)}{\partial\alpha^j} = \frac{(\partial\Phi^i)/(\partial\alpha^j)\,(\tilde{\alpha}^i, \ldots)}{(\partial\Phi^i)/(\partial\alpha^i)\,(\tilde{\alpha}^i, \ldots)},$$

and hence has the sign of $-(\partial\Phi^i)/(\partial\alpha^j)\,(\tilde{\alpha}^i, \ldots)$. But $-(\partial\Phi^i)/(\partial\alpha^j) < 0$, and therefore $\tilde{\alpha}^i(\alpha^j,q^i)$ is a decreasing function of α^j. After some algebra, using $W^i(q^i) - V^i(q^i) = \tau^i(q^i)[V^{ii} - V^{ij}](1-q^i) - H(\tau^i(q^i))$, it can be shown that $(\partial\Phi^i)/(\partial q^i) > 0$, which implies that $(\partial\tilde{\alpha}^i)/(\partial q^i) < 0$.

Consider now the mapping $\Omega(\alpha^a)$, defined on $[0,1]$ and given by $\Omega(\alpha^a) = \tilde{\alpha}^a[\tilde{\alpha}^b(\alpha^a)]$. A symmetric Nash equilibrium of the marriage game is a fixed point of this mapping. As both best responses functions $\tilde{\alpha}^a(\alpha^b)$ and $\tilde{\alpha}^b(\alpha^a)$ are continuous functions from $[0,1]$ into $[0,1]$, $\Omega(\alpha^a)$ is also a continuous mapping from $[0,1]$ into $[0,1]$. Hence the Kakutani fixed point theorem implies the existence of a symmetric Nash equilibrium in the marriage game.

To prove uniqueness of the symmetric Nash equilibrium, it suffices to show that $\Omega(\alpha^a) - \alpha^a$ is strictly decreasing in α^a. Continuity of $\alpha^i(q^i)$ then follows directly.

Since $\Omega(\alpha^a)$ is differentiable, $\Omega(\alpha^a) - \alpha^a$ is strictly decreasing in α^a iff $(\partial\tilde{\alpha}^a)/(\partial\alpha^b) \times (\partial\tilde{\alpha}^b)/(\partial\alpha^a) < 1$. Let $D = (1-\alpha^a)q^a + (1-\alpha^b)(1-q^a)$ and $K^i(q^{ai}) = [W^i(q^i) - V^i(q^i)]$. After some algebra, using (12), it can be shown that $\Omega(\alpha^a) - \alpha^a$ is strictly decreasing in α^a iff

$$\text{(13)} \quad \frac{\partial^2 C}{\partial \alpha^{b^2}} q^a \left[\delta(1-\alpha^a)\frac{\partial^2 C}{\partial \alpha^{a^2}} - \frac{\partial C}{\partial \alpha^a}\right] + \frac{\partial^2 C}{\partial \alpha^{a^2}}(1-q^a)\left[\delta(1-\alpha^b)\frac{\partial^2 C}{\partial \alpha^{b^2}} - \frac{\partial C}{\partial \alpha^b}\right] > 0$$

and that (13) is satisfied under Assumption A.

Finally, the choice of τ^i is derived from the following optimization problem:

$$\text{(14)} \quad \max_{\tau^i} [\tau^i + (1-\tau^i)q^i]V^{ii} + (1-\tau^i)(1-q^i)V^{ij} - H(\beta\tau^i),$$

which is a convex problem under Assumption A. This immediately implies the continuity of the solution as a function of the parameters $\tau^i(q^i)$. ◊

Proof of Proposition 1 (under Assumption A). We only prove Proposition 1.ii, since Proposition 1.i is trivial. Note that

$$\frac{\partial \alpha^a}{\partial q^a} = -\frac{(\partial\Omega)/(\partial q^a)}{(\partial\Omega)/(\partial\alpha^a) - 1}$$

has the sign of $(\partial\Omega)/(\partial q^a)$. Using the fact that $\tilde{\alpha}^a(\alpha^b, q^a)$ is decreasing in α^b, and $(\partial\tilde{\alpha}^a)/(\partial q^a) < 0$, it is easy to see that

$$\frac{\partial \Omega}{\partial q^a} = \frac{\partial \tilde{\alpha}^a}{\partial q^a} + \frac{\partial \tilde{\alpha}^a}{\partial \alpha^b} \times \frac{\partial \tilde{\alpha}^b}{\partial q^a} < 0.$$

Hence the result that $\alpha^a(q^a)$ is decreasing in q^a. By a symmetric argument $\alpha^b(q^b)$ is decreasing in $q^b = 1 - q^a$.

The implicit function theorem on the first-order condition of problem (14) readily implies that $\partial\tau^i/\partial q^i < 0$ (because of the convexity of $H(\cdot)$, the second-order condition is satisfied). ◊

The comparative statics results in Proposition 2 and the extensions and the comparative statics results in Propositions 3 and 4 involve only algebraic computations, and are developed in an Appendix available from the authors upon request.

Proof of Proposition 5. We study the case in which $\gamma \neq 0$ and $c = 0$. The general case in which $c \neq 0$ is studied in the Appendix available from the authors.

i. From the first-order conditions of the socialization problem, we have $\tau^i(1) = 0$, $\tau^i(0) > 0$, and $\pi^i(1) = 1$, $\pi^i(0) = \alpha^i(0) + (1 - \alpha^i(0))\gamma > 0$. Hence,

$$\left[\frac{\partial(q^i_{t+1} - q^i_t)}{\partial q^i_t}\right]_{q^i=0} = [\pi^i(0)]\tau^i(0) > 0; \qquad \left[\frac{\partial(q^i_{t+1} - q^i_t)}{\partial q^i_t}\right]_{q^i=1} = [\pi^j(0)]\tau^j(0) > 0.$$

As a consequence, the corner stationary states $q^{i*} = 0$ and $q^{i*} = 1$ are locally unstable.

ii. Consider the function $\Theta(q^i) = \pi^i(q^i)\tau^i(q^i) - \pi^j(1 - q^i)\tau^j(1 - q^i)$. It is continuous on [0,1]. Moreover, $\Theta(0) = \pi^i(0)\tau^i(0) > 0$ and $\Theta(1) = -\pi^j(0)\tau^j(0) < 0$. By continuity of $\Theta(\cdot)$, there then exists an interior point $q^{i*} \in (0,1)$ such that $\Theta(q^{i*}) = 0$ and $\Theta'(q^{i*}) < 0$. Such a point is an interior stationary state and satisfies $\pi^i(q^{i*})\tau^i(q^{i*}) = \pi^j(1 - q^{i*})\tau^j(1 - q^{i*})$.

iii. An interior stationary state q^{i*} will be locally stable if

$$\left[\frac{\partial(q^i_{t+1} - q^i_t)}{\partial q^i_t}\right]_{q=q^{i*}} = q^{i*}(1 - q^{i*})\Theta'(q^{i*}) \in (-2,0).$$

But $\left[[\partial(q^i_{t+1} - q^i_t)]/(\partial q^i_t)\right]_{q=q^{i*}} < 0$ is ensured by $\Theta'(q^{i*}) < 0$. We just need then to show that $q^{i*}(1 - q^{i*})\left|\Theta'(q^{i*})\right| < 2$. It is hence sufficient to guarantee $\left|\Theta'(q^{i*})\right| < 8$, which in turn is satisfied if $(\partial\tau^i)/(\partial q^i)$ and $(\partial\alpha^i)/(\partial q^i)$ are small enough, uniformly. But any upper bound on $(\partial\tau^i)/(\partial q^i)$ and $(\partial\alpha^i)/(\partial q^i)$ is guaranteed for $H(\beta\tau^i)$ and $C(\delta\alpha^i)$ convex enough in τ^i and α^i. ♢

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