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Keywords: Cultural Identity, Cosmopolitan City, Productiviy

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April 2009

Abstract

We study how the city system is affected by the possibility for the members of the same cultural diaspora to interact across different cities. In so doing, we propose a simple two-city model with two mobile cultural groups. A localized esternality fosters the productivity of individuals when groups interact in a city. At the same time, such interaction dilutes cultural identities and reduces the consumption of culture-specific goods and services. We show that the two groups segregate in different cities when diaspora members find it hard to communicate at distance whereas they integrate in multicultural cities when communication is easy. The model generates situations in which segregation is an equilibrium but is Pareto dominated by integration.

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1 Introduction

Recent decades have seen the intensification of cultural diasporas. People have always moved across countries and large cities have often hosted multicultural crowds. Historically, however, cultural identity and territory have mostly tended to coincide. This is increasingly changing. Due to rapid improvements in communication and transportation technologies it is now possible for people belonging to the same culture to maintain close interactions even when geographically separated. Individuals are thus able to maintain their cultural identities wherever they move to, so they can be "both here and there" (Beck, 2000). Indeed, many contemporary immigrants are what anthropologists call *transmigrants*, that is, people firmly rooted in their new country who still maintain multiple linkages to their homeland (Glick Schiller et al., 1995).[1]

Our aim is to study how the city system is affected by the possibility of members of the same cultural diaspora to interact across different cities. In particular, we want to investigate how such possibility affects the size and cultural composition of cities as well as the productivity and consumption patterns of their residents.

In so doing, we propose a simple model with two mobile cultural groups and two open cities whose size is penalized by congestion costs. In the model what works in favor of the coexistence of different cultures within the same city is a localized esternality that fosters the productivity of individuals when these interact with other individuals belonging to a different culture. The underlying idea is that individuals with different cultures have complementary ways of addressing the same problem. It is as if they had access to different pieces of the same puzzle. Because they possess complementary pieces of information, pooling them generates better outcomes. What works against coexistence is, instead, the dilution of cultural identities that reduces the consumption of culture-specific goods and services. We model the defense of cultural identity as a costly activity involving both parental effort and peer effects. Quite naturally, costs are particularly high for minorities, which make individuals prefer to reside in cities where their culture is majoritarian. This desire is weakened when individuals can keep strong links with their own folks no matter where they reside.

The model predicts that improvements in communication foster the emergence of multicultural cities as people become able to enjoy the associated productivity gains without suffering from cultural dilution. In the focal case of equally sized cultural groups, for high level of communication barriers, the unique equilibrium outcome is characterized by the segregation of the two cultural groups in two cities of the same size. At the other extreme, for low communication barriers the unique equilibrium outcome implies the integration of cultural groups in two cities sharing not only the same size but also the same degree of cultural diversity.

For intermediate communication costs, both segregation and integration are equilibria of the model. This implies 'hysteresis' in the cultural composition of cities: only large enough migration

[1] This phenomenon has been linked to the fact that global modes of production necessitate transnational practices (Basch et al., 1994).

shocks can drive the equilibrium from segregation to integration and viceversa.[2] For high congestion costs, additional equilibria also exist in which the two cities have different sizes. While the large city hosts both cultural groups, the small city hosts one group only. In this outcome, the large city has higher congestion costs but pays higher wages due to higher producivity. At the same time, it offers a lower level of cultural consumption as cultural identities are more diluted. Hence, the model is able to generate a city system in which a large multicultural primary city exhibiting higher productivity coexists with a small culturally homogeneous secondary city where lower productivity is compensated buy stronger cultural identity. This seems to capture a salient feature of the urban system in several countries. It also generates a positive correlation between cultural diversity and productivity that, as discussed below, is indeed found in the data.

Additional results concern the extent to which preferences value standard consumption relative to cultural consumption ('materialism') and cultural transmission relies on parental effort. Materialism and parental transmission both favor multicultural cities by giving little weight to cultural consumption and peer effects respectively. From a welfare point of view, the model generates situations in which segregation of different cultural groups in different cities is an equilibrium but is Pareto dominated by integration. In these situations market signals do not assign enough weight to the positive impact of intercultural interactions on productivity. This is the case for intermediate communication barriers.

Our modeling choices build on two main lines of research. The first consists of studies on the relation between cultural diversity and economic performance. At the urban level, productivity gains from cultural diversity have been measured by Ottaviano and Peri (2005, 2006) in US cities as well as by Bellini, Ottaviano, Pinelli and Prarolo (2008) in EU NUTS3 regions.[3] These gains have been identified by crossing the information contained in the spatial pattern of wages and rents. The fact that both these variables are positively correlated with various measures of cultural diversity reveals a positive correlation between diversity and total factor productivity.[4] Instrumental variable analysis then highlights a casual link from the former to the latter. These findings are consistent with work by Lazear (1999). His idea is that a global firm is a multicultural team whose existence is somewhat puzzling. Combining workers who have different cultures, legal systems, and languages imposes costs on the firm that would not be present were all workers to conform to one standard. In order to offset the costs of cross-cultural dealing, there must be complementarities between the workers that are sufficiently important to overcome the costs. Disjoint and relevant skills create an environment where the gains from complementarities can be significant.[5] This is confirmed by several experimental results such as those reported by

[2]The role played by communication barriers in determining the spatial equilibrium is reminiscent of some results of the so-called 'new economic geography' (see, e.g., Ottaviano and Thisse, 2004). Indeed, with respect to the location of each cultural group, the productivity externality acts as a 'dispersion force' whereas the peer effect acts as an 'agglomeration force' with communication barriers regulating the balance between the two forces.

[3]See Alesina and La Ferrara (2005) for a survey on the relation between ethnic diversity and economic performance at country, city and community levels.

[4]Our model predicts such positive correlation if we interpret congestion costs in terms of congestion in land use.

[5]See Berliant and Fujita (2006, 2007) for models of team formation in which a mix of common and individual

De Drew and West (2001) and Cooper and Kagel (2005).

The second line of research we build on consists of recent studies on the dynamics of education and cultural transmission. In Bisin and Verdier (2000, 2001) and Bisin et al. (2006) the cultural environment shapes preferences, due to the substitutability between parental pressure and peer effects in transmitting certain cultural traits from one generation to the next. Peer pressure in the form of neighborhood effects features in Benabou (1993) who models the links between residential choices, education, and productivity in a city consisting of several communities. Local complementarities in human capital investment induce occupational segregation, although efficiency may require identical communities. De Bartolome (1990) obtains the mirror result in terms of efficiency in a community model with public expenditures set by voting. Here the tension is between the tendency to segregate due to different tastes for public inputs and the tendency to integrate due to different tastes for peer groups. In the decentralized equilibrium communities may become heterogeneous in composition and inefficient when the peer group effect is neither "too strong" nor "too weak".

The remainder of the paper is organized in five additional sections. Section 2 presents the model. Section 3 characterizes its equilibrium properties in the case of equally sized cultural groups. Section 4 studies some welfare implications. Section 5 discussed the case of cultural groups of different sizes. Section 6 concludes.

2 The model

We model a spatial economy consisting of a system of two open cities, A and B, and two types of individuals belonging to two different cultural groups, 1 and 2. Each individual is endowed with one unit of labor. We call L_1 and L_2 the exogenouly given measures ('numbers') of individuals of the two types. All individuals are mobile between the two cities and their residential choices will be endogenously determined. We index cities by $j \in \{A, B\}$ and types by $k \in \{1, 2\}$. Accordingly, we call L_{jk} the endogenous number of individuals of type k residing in city j such that $L_{Ak} + L_{Bk} = L_k$. When needed, we will refer to the endogenous population of city j by $L_j = L_{j1} + L_{j2}$.

2.1 Preferences

Each individual ('parent') is endowed with one unit of time that she divides between working and putting effort in passing her type ('cultural trait') to her child. Her utility comes from the consumption of a standard good and a cultural good whose fruition is possible as long as the child shares some of the cultural trait with the parent. The utility of an individual of type k in

types of knowledge determines knowledge creation.

city j is assumed to take the following Cobb-Douglas functional form

$$U_{jk} = \beta \log y_{jk} + (1-\beta) \log c_{jk} \tag{1}$$

where y_{jk} and c_{jk} are the consumption levels of the standard and cultural goods respectively. The parameter $\beta \in (0,1)$ measures the degree of 'materialism' in preferences: the larger β, the more the parent prefers the consumption of the standard good to sharing her culture with her child.[6]

Following Bisin et al (2006), the cultural affinity between parent and child depends positively on the time e_{jk} the parent devotes to cultural transmission ('parental education') as well as on the child's interactions with other individuals of the same type as the parent ('peer effect'). These interactions can be both local with residents of the same city j or global with residents in the other city i. Their intensity depends on the shares of individuals of type k in the two cities $l_{jk} = L_{jk}/L_j$ and $l_{ik} = L_{ik}/L_i$. It also depends on distance with global interactions being weaker than local ones. These ideas can be captured by assuming that the peer effect f_{jk} has the simple functional form $f_{jk} = l_{jk} + \phi l_{ik}$ where $\phi \in [0,1)$ is the discount factor applied to global interactions. An intuitive way to interpret this assumption is that, walking around his home city, the child has a probability l_{jk} of meeting someone of his parent's type (apart from his parent). He has also a probability ϕ of getting into contact with someone from the other city, who in turn has a probability l_{ik} of belonging the child's parental type. Parental effort e_{jk} and peer effect f_{jk} then determine the affinity between parent and child, which in turn determines the consumption level of the cultural good c_{jk}. For concreteness, we assume that

$$c_{jk} = e_{jk}^{\lambda} \left(l_{jk} + \phi l_{ik}\right)^{1-\lambda} \tag{2}$$

where $\lambda \in (0,1)$ represents the relative importance of parental education for cultural transmission with respect to the peer effect.

Labor supply and, therefore, individual income are affected by two factors. First, time spent in parental education e_{jk} is subtracted from working time. Second, living in city j entails congestion costs that are positively related to its population L_j. We define these costs as a friction that leaves only a fraction $\Gamma(L_j)$ of time to work and parental education.[7] Following Duranton and Puga (2001), we assume $\Gamma(L_j) = (1 - \tau L_j)$ for $L_j < 1/\tau$ and $\Gamma(L_j) = 0$ otherwise, with the positive parameter τ measuring the intensity of congestion. Hence, both parental education and congestion have an opportunity cost in terms of forgone salary, which is reflected in the individual's budget constraint

$$P_j y_{jk} = w_{jk} \Gamma(L_j)(1 - e_{jk}) \tag{3}$$

where P_j is the price of the standard good, w_{jk} is the wage per unit time and $\Gamma(L_j)(1 - e_{jk})$ is

[6] Since our model is a static one, we are not interested in the distribution on types among children, but rather on the time allocation of the parents and the aggregate economic characteristics of the current generation.

[7] See Fujita (1989) for a discussion of congestion costs arising from commuting.

working time net of parental effort and congestion costs.

Maximizing (1) with respect to e_{jk} subject to (2) and (3) gives the amount of time the individual spends on education:

$$e^* = \frac{\lambda(1-\beta)}{\beta + \lambda(1-\beta)} \tag{4}$$

This is decreasing in the individual's materialistic orientation and increasing in the relative importance of parental education for cultural transmission. The fact that e^* is independent of type and city of residence is due to the chosen functional forms. This result serves analytical tractability without changing the nature of the main tradeoff individuals face in their residential choices as we will discuss in Section 3.

2.2 Technology

The standard good is supplied by a perfectly competitive sector. It is freely traded within and between cities so that its price is the same everywhere. We choose this good as numeràire so that $P_A = P_B = 1$. Labor is the only input and in city j technology is described by the aggregate production function

$$Y_j = a_{j1}\left[\Gamma(L_j)(1-e_{j1})L_{j1}\right] + a_{j2}\left[\Gamma(L_j)(1-e_{j2})L_{j2}\right] \tag{5}$$

where each bracketed term measures the working time of the corresponding type of individual net of parental effort and congestion costs.

In (5) the two types of individuals are perfectly substitutable but their productivities a_{jk} are allowed to be different. The source of such difference lies in the cultural composition of cities in that individuals are assumed to benefit from interactions outside their own groups. Only interactions within the same city enhance productivity so that the occurrence of inter-cultural interactions depends only on home city composition and their probability differs between groups being higher for the minoritian group than for the majoritarian one. Specifically, let a denote an individual's productivity when exposed to inter-cultural interactions and $\theta \in (0,1)$ the discount factor when not exposed to such interactions.[8] In city j an individual of type 1 faces a probability l_{j1} of meeting someone of her own group and l_{j2} of meeting someone of the other group. Accondingly, the average productivity of an individual of type 1 is $a_{j1} = a\left(\theta l_{j1} + l_{j2}\right)$ whereas the (average) productivity of an individual of type 2 is $a_{j2} = a\left(l_{j1} + \theta l_{j2}\right)$. Perfect competition and our choice of numeraire then imply that the (average) wage of type k in city j is $w_{jk} = a_{jk}$ so that we can write:

$$w_{j1} = a\left(\theta l_{j1} + l_{j2}\right) \text{ and } w_{j2} = a\left(l_{j1} + \theta l_{j2}\right) \tag{6}$$

[8] As pointed out, for example, by Lazear (1999), inter-cultural interactions are fruitful provided that individuals with different cultures are able to communicate with one another. Assuming $\theta \in (0,1)$ implicitly assumes that productivity gains are positive net of any inter-cultural communication cost.

for $j \in \{A, B\}$.

3 The equilibrium

Since L_k is exogenously given, the equilibrium can be defined only in terms of L_{Ak} knowing that $L_{Bk} = L_k - L_{Ak}$. In particular, the distribution of individuals (L_{A1}, L_{A2}) is a spatial equilibrium when no individual of either type may attain a higher utility level by changing city. Given (3), (1), (2) and (4), the indirect utility of an individual of type k in city $j \in \{A, B\}$ is:

$$V_{jk}\left(L_{A1}, L_{A2}\right) = \beta \log\left(w_{jk}\Gamma(L_j)(1 - e^*)\right) + (1 - \beta)\log\left((e^*)^{\lambda}\left(l_{jk} + \phi l_{ik}\right)^{1-\lambda}\right) \tag{7}$$

Then a spatial equilibrium arises at $L_{Ak} \in (0, L_k)$ when

$$\Delta V_k\left(L_{A1}, L_{A2}\right) \equiv V_{Ak}\left(L_{A1}, L_{A2}\right) - V_{Bk}\left(L_{A1}, L_{A2}\right) = 0 \tag{8}$$

or at $L_{Ak} = 0$ when $\Delta V_k\left(L_{A1}, L_{A2}\right) \leq 0$, or at $L_{Ak} = L_k$ when $\Delta V_k\left(L_{A1}, L_{A2}\right) \geq 0$ for $k \in \{1, 2\}$.

In order to study the stability of a spatial equilibrium, we assume a myopic adjustment process, that is, the driving force in the migration process is individuals' current utility differential between A and B:

$$\dot{L}_{Ak} \equiv dL_{Ak}/dt = \begin{cases} \Delta V_k\left(L_{A1}, L_{A2}\right) & \text{if } 0 < L_{Ak} < L_k \\ \min\{0, \Delta V_k\left(L_{A1}, L_{A2}\right)\} & \text{if } L_{Ak} = L_k \\ \max\{0, \Delta V_k\left(L_{A1}, L_{A2}\right)\} & \text{if } L_{Ak} = 0 \end{cases} \tag{9}$$

where t is time. Clearly, a spatial equilibrium implies $\dot{L}_{Ak} = 0$ for both $k = 1$ and $k = 2$. If $\Delta V_k\left(L_{A1}, L_{A2}\right)$ is positive, some individuals of type k will move from B to A; if it is negative, some will move in opposite direction.

A spatial equilibrium is stable for (9) if, for any marginal deviation from the equilibrium, this equation of motion brings the distribution of individuals back to the original one. Formally, this is the case if and only if the corresponding eigenvalues of the Jacobian associated with the dynamic system

$$\begin{cases} \dot{L}_{A1} = \Delta V_1\left(L_{A1}, L_{A2}\right) \\ \dot{L}_{A2} = \Delta V_2\left(L_{A1}, L_{A2}\right) \end{cases} \tag{10}$$

are negative if real numbers or have negative real parts if complex numbers.

To characterize the existence and stability of thedifferent equilibrium distributions, it is helpful to use (6) and (7) to rewrite (8) as

$$\Delta V_1(L_{A1}, L_{A2}) = \log\left\{\left(\frac{\theta\frac{L_{A1}}{L_A}+\frac{L_{A2}}{L_A}}{\theta\frac{L_{B1}}{L_B}+\frac{L_{B2}}{L_B}}\right)^{\beta}\left(\frac{1-\tau L_A}{1-\tau L_B}\right)^{\beta}\left(\frac{\frac{L_{A1}}{L_A}+\phi\frac{L_{B1}}{L_B}}{\frac{L_{B1}}{L_B}+\phi\frac{L_{A1}}{L_A}}\right)^{(1-\lambda)(1-\beta)}\right\} \quad (11)$$

$$\Delta V_2(L_{A1}, L_{A2}) = \log\left\{\left(\frac{\theta\frac{L_{A2}}{L_A}+\frac{L_{A1}}{L_A}}{\theta\frac{L_{B2}}{L_B}+\frac{L_{B1}}{L_B}}\right)^{\beta}\left(\frac{1-\tau L_A}{1-\tau L_B}\right)^{\beta}\left(\frac{\frac{L_{A2}}{L_A}+\phi\frac{L_{B2}}{L_B}}{\frac{L_{B2}}{L_B}+\phi\frac{L_{A2}}{L_A}}\right)^{(1-\lambda)(1-\beta)}\right\}$$

where we recall that $L_{Bk} = L_k - L_{Ak}$ and $L_j = L_{j1} + L_{j2}$. The three factors inside the logarithms on the right hand side of (11) capture the effects of the distribution of individuals between cities on, from left to right, differential productivity, congestion and cultural transmission. The productivity effect attracts individuals of a certain type to the city where they have a higher chance of interacting with someone of the other type. This fosters the integration of the two types in the same city. The congestion effect, then, determines whether the integrated equilibrium entails the agglomeration of all individuals in a single cosmopolitan metropolis or their cohabitation in two multicultural cities. The cultural transmission effect attracts, instead, individuals to the city where they have a higher chance of interacting with someone of their own type, which promotes the segregation of types in two different cities irrespective of the level of congestion costs. Henceforth, we will focus our attention of the role of ϕ in balancing the productivity and cultural transmission effects. This parameter measures the ease of global interactions among individuals of the same type and, therefore, the strength of the distant component of the peer effect. Hence, a larger value of ϕ reduces the importance of segregation for cultural transmission.

From a different angle, (11) also gives information about the different consumption patterns of cultural minorities and majorities. While congestion is culture blind, in a city cultural minorities enjoy a productivity advantage to the detriment of cultural transmission. Viceversa, cultural majorities have lower productivity but better cultural transmission. The fact that, by (4), parental effort is the same for majorities and minorities implies that both allocate the same time to work so that the former enjoy higher cultural consumption but lower materialistic consumption than the latter. Clearly, constant parental effort deprives the model from a further effect that could lead minorities to compensate their weaker peer effect with higher parental effort. This would make them allocate less time to work than majorities leading to a convergence in materialistic and cultural consumption between minoritian and majoritarian types.

3.1 Agglomeration

Intuition is better served by focusing on the analytically simpler case of two equally sized types such that $L_1 = L_2 = 1$. The implications of allowing for types of different sizes will then be discussed in Section 5.

In an agglomerated equilibrium all individuals of both types are happy to be concentrated in a single cosmopolitan metropolis. Without loss of generality, let us assume that agglomeration takes place in city A. As discussed above, this is a spatial equilibrium provided that $\Delta V_1(L_{A1}, L_{A2})$ and $\Delta V_2(L_{A1}, L_{A2})$ are both non-negative for $L_A = L_1 + L_2$, $L_{A1} = L_1$, $L_{A2} = L_2$, $L_B = 0$, $L_{B1} = 0$, and $L_{B2} = 0$. Substituting these values in (11), we get:

$$\Delta V_1(L_{A1}, L_{A2}) = \Delta V_2(L_{A1}, L_{A2}) = \log\left\{(1-2\tau)^{\beta}\left(\frac{1}{\phi}\right)^{(1-\lambda)(1-\beta)}\right\}$$

which is non-negative as long as

$$\phi \leq (1-2\tau)^{\frac{\beta}{(1-\lambda)(1-\beta)}} \equiv \phi_C \tag{12}$$

Condition (12) shows that a cosmopolitan metropolis is an equilibrium when congestion costs are low (small τ) and there is a strong preference for materialistic consumption (large β). That is the case also when, relatively to parental effort, the peer effect is of little importance (large λ) and weak between cities (small ϕ). Intuitively, when congestion costs are low, spatial concentration is little penalized. When materialism is strong, the beneficial effect of multiculturality on productivity dominates its adverse effect on cultural transmission. The latter is, however, weak when the peer effect does not play an important role and difficult inter-city interactions do not make it worthwhile to avoid congestion costs by relocating to the empty city.

Computation of the eigenvalues of the Jacobian associated with the dynamic system (10) shows that, when the equilibrium with a cosmopolitan metropolis exists, it is always unstable (see the discussion of Figure 1 below).[9] The reason is that any small relocation away from the metropolis involving both types of individuals makes further relocation attractive due to congestion costs saving.

3.2 Segregation

In a segregated equilibrium all individuals of each type are happy to be separated from the other type in their own homogeneous city. Without loss of generality, let us assume that types 1 and 2 are concentrated in cities A and B respectively. This is a spatial equilibrium provided that $\Delta V_1(L_{A1}, L_{A2}) \geq 0$ and $\Delta V_2(L_{A1}, L_{A2}) \leq 0$ for $L_A = L_1$, $L_{A1} = L_1$, $L_{A2} = 0$, $L_B = L_2$, $L_{B1} = 0$, and $L_{B2} = L_2$. Substituting these values in (11) and recalling that $L_1 = L_2 = 1$, we get:

$$\begin{aligned}\Delta V_1(L_{A1}, L_{A2}) &= \log\left\{\theta^{\beta}\left(\frac{1}{\phi}\right)^{(1-\lambda)(1-\beta)}\right\}\\ \Delta V_2(L_{A1}, L_{A2}) &= \log\left\{\left(\frac{1}{\theta}\right)^{\beta}(\phi)^{(1-\lambda)(1-\beta)}\right\}\end{aligned}$$

[9] The instability of agglomeration is related to the assumption that the standard good is freely traded between cities. High enough trade barriers may turn agglomeration into a stable equilibrium.

Hence, two segregated cities of equal size are a stable equilibrium as long as

$$\phi \leq \theta^{\frac{\beta}{(1-\lambda)(1-\beta)}} \equiv \phi_S \tag{13}$$

This result is explained by the fact that an individual leaving the city where her type is concentrated faces a trade off between higher wage and lower consumption of the cultural good. The former advantage is due to better chances of interacting with individuals of the other type. The latter advantage is due to lower chances of transmitting her cultural trait. Difficult inter-city interactions (small ϕ), low productivity gain from multiculturality (large θ), high importance of the peer effect (low λ), little materialism (low β) all foster segregation.

3.3 Integration

In a symmetric cosmopolitan equilibrium individuals are happy to live in two identical cities where both types are equally represented. This is a spatial equilibrium provided that $\Delta V_1 (L_{A1}, L_{A2}) = \Delta V_2 (L_{A1}, L_{A2}) = 0$ for $L_A = L_1/2 + L_2/2$, $L_{A1} = L_{B1} = L_1/2$, and $L_{A2} = L_{B2} = L_2/2$. Substituting these values in (11), it is straightfoward to see that for both types $\Delta V_k (L_1/2, L_2/2)$ always equals zero. This implies the symmetric multicultural outcome with the two groups evenly split between cities is always an equilibrium. It may be, however, unstable. To check its stability we calculate the corresponding eigenvalues of (10) recalling that $L_1 = L_2 = 1$. These eigenvalues turn out to be real and equal to

$$r_1 = -4\tfrac{\beta\tau}{1-\tau} \quad r_2 = -4\tfrac{[(1-\beta)(1-\lambda)(1+\theta)+\beta(1-\theta)]\phi-[(1-\beta)(1-\lambda)(1+\theta)-\beta(1-\theta)]}{(1+\phi)(1+\theta)}$$

While the former eigenvalue is always negative, the latter is negative if and only if

$$\phi > \frac{(1-\beta)(1-\lambda)(1+\theta) - \beta(1-\theta)}{(1-\beta)(1-\lambda)(1+\theta) + \beta(1-\theta)} \equiv \phi_B \tag{14}$$

In this case the symmetric multicultural equilibrium is stable. Condition (14) then implies that the stability of the symmetric multicultural equilibrium is fostered by strong materialism (large β), large productivity gains (small θ), important parental rather than peer-driven cultural transmission (large λ) and easy cultural interactions between cities (large ϕ).

Comparing (13) and (14), it can be shown that $\phi_B < \phi_S$ for any $\theta \in (0,1)$ when $\beta/[(1-\beta)(1-\lambda)] > 1$, i.e. when peer effects are relatively unimportant for cultural transmission (large λ) and materialistic consumption is relatively important for consumption (large β). In this case, for $\phi \in (\phi_B, \phi_S)$ both segregation and integration are stable spatial equilibria. Viceversa, when $\beta/[(1-\beta)(1-\lambda)] < 1$, $\phi_B > \phi_S$ for any $\theta \in (0,1)$ which rules out the coexistence of the segregated and integrated equilibria. Henceforth, we allow for such coexistence by assuming $\beta/[(1-\beta)(1-\lambda)] > 1$.

3.4 Partial integration

The existence and the stability of segregated and integrated equilibria described so far do not involve congestion costs τ because of symmetry. Indeed, in both types of equilibria all cities host a population of unit size so that there are no differences in congestion across cities. Unfortunately analytical solutions useful to investigate the existence and stability of equilibria (L_{A1}, L_{A2}) different from $(0,1)$, $(1,0)$ and $(1/2,1/2)$ are not available. We have, therefore, to rely on numerical analysis. In particular, we study the full set of equilibria that arise in the three regions identified by $\phi < \phi_B$, $\phi_B < \phi < \phi_S$ and $\phi > \phi_S$ when we vary the congestion cost parameter τ.

Figure 1 about here

Figure 1 depicts six different phase diagrams of the dynamic system (10), where the thin and thick curves plot $\Delta V_1 (L_{A1}, L_{A2}) = 0$ and $\Delta V_2 (L_{A1}, L_{A2}) = 0$ respectively. Some parameters' values are hold constant across all diagrams: $\beta = 3/5$, $\lambda = 1/2$ and $\theta = 2/3$. These imply $\phi_B = 1/4$ and $\phi_S = 8/27$. The remaining parameters ϕ and τ are varied across diagrams as reported in Table 1. Arrows depict the dynamics and circles highlight stable equilibria.

	(a)	(b)	(c)	(d)	(e)	(f)
ϕ	0.15	0.27	0.4	0.15	0.27	0.4
τ	0.01	0.01	0.01	0.08	0.08	0.08

Table 1. Values of ϕ and τ used in the numerical example.

All panels report L_{A1} on the horizontal axis and L_{A2} on the vertical one. Left panels (a)-(c) and right panels (d)-(f) correspond to low and high congestion costs respectively. In panels (a) and (d), communication costs between cities are such that $\phi < \phi_B$. Since (13) holds but (14) is violated, in those two panels the integrated equilibrium $(L_{A1}, L_{A2}) = (1/2, 1/2)$ is unstable ('saddle') whereas segregated outcomes at $(0,1)$ or $(1,0)$ are stable equilibria. Moreover, changes in congestion costs do not qualitatively alter the number and the position of the equilibria. In panels (c) and (f) communication costs are such that $\phi > \phi_S$. As condition (14) holds whereas condition (13) is violated, the integrated equilibrium $(1/2, 1/2)$ is stable ('stable node') while segregation is not an equilibrium. Again, congestion costs do not qualitatively impact on the number and the position of the equilibria. In panels (b) and (e), we have $\phi_B < \phi < \phi_S$. Because both conditions (14) and (13) hold simultaneously, both integration and segregation are stable equilibria. In this case, panel (e) shows that, if congestion costs fall in an intermediate range, four additional stable equilibria (plus four additional unstable equilibria) arise. In the four additional stable equilibria two cities of different sizes coexist. The small homogeneous city is inhabited by only one type of individuals. The big city is, instead, cosmopolitan as it hosts not only the remaining fraction of individuals of that type but also all the individuals of the other type. Hence, in the case of $\phi_B < \phi < \phi_S$, there is 'hysteresis' in the cultural composition of cities as only large enough exogenous migration shocks can drive the equilibrium from segregation to (partial or complete) integration and viceversa.

To sum up, the different panels of Figure 1 can be used to gauge the impact of improvements in cultural interactions between cities. This is achieved by comparing the phase diagrams from top to bottom: (a), (b) and (c) on the left; (d), (e) and (f) on the right. The common conclusion is that better distant communication (larger ϕ) supports the emergence of cosmopolitan cities by allowing individuals to increasingly rely on their enlarged community for cultural transmission.[10]

4 Pareto optimality

A key issue is whether decentralized location decisions lead to a suboptimal city composition from a Pareto point of view. To avoid numerical computations, we focus on the specific question whether segregation can emerge as a stable decentralized equilibrium when it is Pareto dominated by integration.

Individuals are better off in the integrated outcome if their indirect utility is higher than in the segregated one. This is the case whenever:

$$\phi > 2\left(\frac{2\theta}{1+\theta}\right)^{\frac{\beta}{(1-\lambda)(1-\beta)}} - 1 \equiv \phi_O \tag{15}$$

As (14) and (13), also (15) holds for strong materialism (large β), large productivity gains (small θ), parental rather than peer-driven cultural transmission (large λ) and easy cultural interaction between cities (large ϕ).

The threshold ϕ_O can be compared with the other threshold ϕ_S below which segregation is an equilibrium to show that $\phi_O < \phi_S$ for any values of θ, β and λ.[11] Then, for values of the distant communication parameter $\phi \in (\phi_O, \phi_S)$ segregation is an equilibrium whereas a shift to integration would be welfare enhancing from a Pareto point of view. Hence, market signals do not assign enough weight to the positive impact of intercultural interactions on productivity. Note that when productivity gains from intercultural interaction are absent, $\theta = 1$ implies $\phi_B = \phi_S = \phi_O = 1$ so that segregation is the only stable equilibrium configuration and Pareto dominates integration.

These results imply that, if the economy starts from a segregated equilibrium and communication costs start falling, individuals are too slow in realizing that there are gains from integration. This may generate both an unwillingness to emigrate to alien places and a resistance to accept immigration of alien cultural groups driven by non-economic motives. On both grounds policy intervention should be granted.

[10] The same would be true when $\beta / [(1-\beta)(1-\lambda)] < 1$ implies $\phi_B > \phi_S$.

[11] To see this, use (13) and (15) to show that $\phi_O < \phi_S$ if and only if $\theta < 2^{1+(1-\beta)(1-\lambda)/\beta} - 1$. This disequality is always satisfied since $(1-\beta)(1-\lambda)/\beta > 0$.

5 The role of group size

All results developed so far assume that the groups of the two types of individuals have the same unit size ($L_1 = L_2 = 1$). This assumption has allowed us to derive several insights on how integration and segregation may endogenously arise from the tension between the productivity gains from multiculturality and the associated losses in terms of cultural transmission. In several real world situations, however, cultural groups have different sizes and it is therefore important to assess how differential group size may affect our results.

We start with investigating the role of different group sizes L_1 and L_2 on the sustainability of the segregated equilibrium in which two homogenous cities of unequal size coexist. As already discussed, sustainability requires each type to be happy to be separated from the other type. Without loss of generality, we assume again that types 1 and 2 are concentrated in cities A and B respectively. This is a spatial equilibrium provided that $\Delta V_1(L_{A1}, L_{A2}) \geq 0$ and $\Delta V_2(L_{A1}, L_{A2}) \leq 0$ for $L_A = L_1$, $L_{A1} = L_1$, $L_{A2} = 0$, $L_B = L_2$, $L_{B1} = 0$, $L_{B2} = L_2$. Substituting these values in (11), we get:

$$
\begin{aligned}
\Delta V_1(L_{A1}, L_{A2}) &= \log\left\{\theta^{\beta}\left(\frac{1-\tau L_1}{1-\tau L_2}\right)^{\beta}\left(\frac{1}{\phi}\right)^{(1-\lambda)(1-\beta)}\right\} \\
\Delta V_2(L_{A1}, L_{A2}) &= \log\left\{\left(\frac{1}{\theta}\right)^{\beta}\left(\frac{1-\tau L_1}{1-\tau L_2}\right)^{\beta}\phi^{(1-\lambda)(1-\beta)}\right\}
\end{aligned}
$$

Hence, two segregated cities of unequal size are a stable equilibrium as long as

$$
\phi \leq \min\left[\left(\theta\frac{1-\tau L_1}{1-\tau L_2}\right)^{\frac{\beta}{(1-\lambda)(1-\beta)}}; \left(\theta\frac{1-\tau L_2}{1-\tau L_1}\right)^{\frac{\beta}{(1-\lambda)(1-\beta)}}\right] \equiv \phi_S' \tag{16}
$$

which shows that, when cultural groups have different sizes, segregation is less likely to be a stable equilibrium as $\phi_S' < \phi_S$. This is because of the presence of congestion costs that make it less attractive to live in the city populated by the larger group. An implication is that, starting with a low ϕ and segregation, as ϕ increases individuals of the larger group are the first to leave their homogeneous city due to higher congestion costs.

Turning to integration, (11) implies that $(L_1/2, L_2/2)$ is always an equilibrium. However, its stability must be checked numerically, since no simple analytical solutions can be found for the expressions of the eigenvalues associated to the Jacobian of system (10). To this end, we have set $L_1 \geq L_2 = 1$ and analyzed how the phase diagrams (a)-(f) in Figure 1 change as we increase L_1 above one. A general pattern that emerges from every phase diagram is that the integrated equilibrium is never stable for very large L_1. In this case, the only equilibrium configuration features a larger cosmopolitan city inhabited by all individuals of type 2 together with some individuals of type 1 and a smaller city inhabited by the remaining individuals of type 1. The explanation is that a smaller relative number of type 2 individuals reduces the probability that an individual of type 1 meets someone of type 2 in each integrated city. This weakens the productivity gain from multiculturality for the larger type 1 giving more weight to cultural transmission through the peer effect.

6 Conclusion

We have presented a model in which multicultural cities emerge as the result of cultural diasporas when diversity fosters productivity and endangers cultural identity. This danger is weakened when individuals are able to keep strong links with people of their own culture wherever they reside. Against this background, improvements in communication foster the emergence of multicultural cities in which diversity promotes productivity. Additional results concern the extent to which cultural indentity is 'materialistic' or relies on community rather than parental transmission. Materialism and parental rather than peer-driven cultural transmission both favor the emergence of multicultural cities.

From a welfare point of view, segregation of different cultural groups in different cities is an equilibrium but is Pareto dominated by their integration in multicultural cities when the relative importance of peer effects for cultural transmission is small, the relative importance of materialistic consumption is large and the communication within cultures is neither too easy nor too difficult. In this case, market signals fail to assign the right weight to the positive impact of intercultural interactions on knowledge creation.

A crucial assumption behind these results is that the externality through which diversity fosters productivity is more localized than the peer effect through which cultural homogeneity fosters cultural transmission. In the opposite scenario, cultural integration would be an equilibrium of the model for high communication barriers whereas cultural segregation would be an equilibrium for low communication barriers. The reason is that better communication would allow different cultural groups to enjoy the productive externality without facing the cultural dilution associated with cohabitation. While we have not dwelt on this scenario as it is symmetric to the one discussed in the paper, whether productive externalities are more localized than cultural links is clearly an open empirical issues. However, given that the existing evidence does show that technological spillovers appears to fade away quite rapidly with distance (see, e.g., Jaffe et al, 1993; Jaffe and Trajtenberg, 2002), we think it is fair to consider ours as the natural default assumption.

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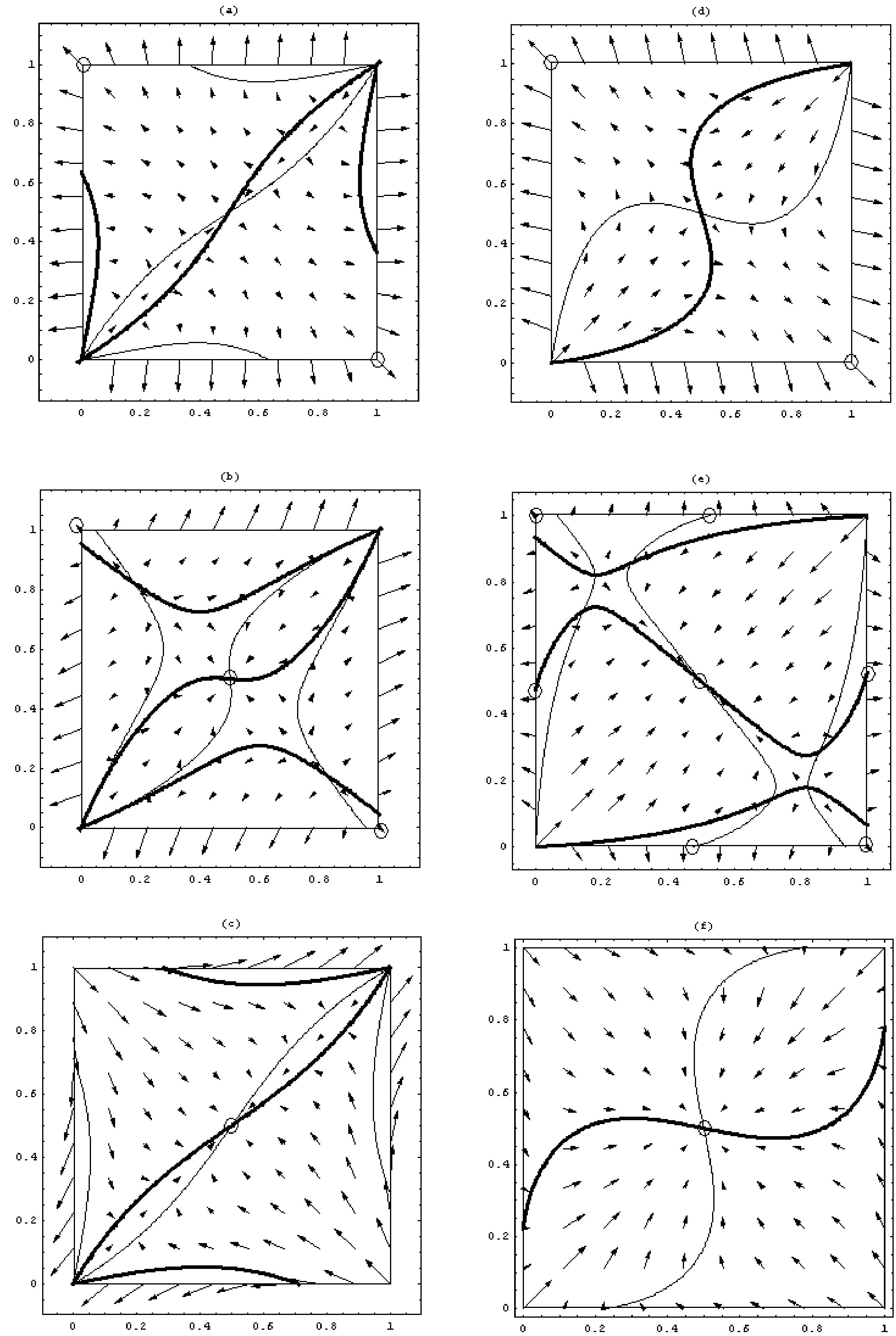

Figure 1 – The emergence of multicultural cities

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