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A Model of Multiple Equilibria in
Geographic Labor Mobility

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Abstract

We develop a model of double matching in the labor market and the social environment in order to explain different migration patterns in response to local economic shocks. This approach explains the different behaviors of workers in different groups, regions, or countries in an endogenous way by showing the existence of multiple equilibria, rather than in an exogenous manner by introducing ex-ante regulations or unemployment benefits. This model can also explain why individuals from some communities form 'sister' communities in some cases and not in others.

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Contents   Page

I. INTRODUCTION

Individuals belonging to different communities (people from different villages), ethnicities (African American vs non-African Americans), or countries (Europe vs US) show remarkably different behaviors with respect to the incentives to migrate. Members from some communities respond quickly to economic incentives and seem less worried to lose some 'social capital' in the sending place; in contrast, members from other communities are reluctant to leave their environment even in the presence of strong economic incentives. While economists and other commentators have attributed these differences to institutional, cultural or individual unobservable characteristics, we argue that a simple model of double matching in the labor market and in the social environment can easily explain the differences in migration behavior *without* supposing different exogenous institutions, cultures, or unobservable characteristics.

White workers in the United States move more easily in response to economic incentives than black workers. While this fact has been documented for a long time (see Lansing and Mueller, 1967; Bowles, 1970; Bound and Holzer, 2000; Spilimbergo and Ubeda, 2001), there is no clear explanation for it. The difference in migration rates is even more puzzling when considering that black workers show many demographic characteristics which usually favor high migration rates: blacks have a lower level of home ownership, have a lower marriage rate, and experience higher unemployment rate than the rest of the population. Even after controlling for these characteristics, there is a significant difference in migration patterns between blacks and whites. Previous literature has suggested that some unobservable characteristics could be responsible or even that blacks and whites could have different utility functions (see Bowles, 1970).

Beyond the differences in migration patterns between blacks and whites, there is also a remarkable difference in the migration attitude among people who are born in different regions in the United States. In the years 1979-1988 only 3.53 percent of the population in the North-East moved, while in the West 6.58 percent of the population moved. The South and North-Central show intermediate values (4.37 percent and 4.89 percent); people born in the North-East moved less even after controlling for economic conditions and observable characteristics (Spilimbergo and Ubeda, 2001). While this difference is stark, there is no economic theory that can explain why different groups sharing the same economic conditions and the same observable individual characteristics should have different propensity to move.

The difference of migration habits between Europe and the United States is well documented (Eichengreen, 1993; Decressin and Fatás, 1995; Obstfeld and Peri, 1998) and has been used to evaluate the optimality of an optimal currency area. Some economists and many commentators attribute the difference to cultural reasons. For instance, *The Economist* (October

16, 1993) argues "Americans are still full of get-up-and-go. Witness the mass exodus from California in the past few years... The average American moves roughly twice as often as the average Briton. In the year to March 1991, the last period covered by the Bureau of Census, 41.5 million Americans, or 17 percent of the population moved home, and 7 million of them moved out of state. One result is that the unemployment differential between regions are far less persistent in America than in Europe. ...American mobility is partly a consequence of culture in a country that was built by immigrants and has thrived on economic opportunism..." . Other economists suggest that scarce labor mobility within European countries is a consequence of welfare systems and regulations (e.g. high unemployment benefits discouraging the unemployed from looking for jobs in other regions, or rental controls in several countries). While these explanations are valid at the individual level, they suffer serious problems of endogeneity at the aggregate level because institutions cannot be taken as exogenous at macro level. Why do European governments maintain this system of subsidies? Why did citizens of these countries vote for governments that implement regulations that discourage migration? The question is: why some communities are willing to pay more taxes to cover the unemployment benefits or to have an insurance against the need of moving?[2] Other economists point at transaction costs (e.g. selling and buying a house costs more in Europe than in the US.), rent control, as well as the cost of moving (see Oswald, 1996). However, again, it is not clear which is the cause and which is the effect. People move less because there are high costs of moving, but the costs of moving depend on the number of people who move. A housing market works better if the volumes are big enough, and a second hand market for furniture can exist only if the potential demand is big enough. Therefore, an explanation of differences in responsiveness of migration to economic incentives cannot take differences in the housing market as given.

While the previous evidence points at the existence of differences in migration propensity across large communities (even continents), there is also a consistent body of evidence at a more micro level. Some areas or villages develop a culture of migration which persists for a long time after the original reasons for migration disappeared. Massey et al. (1993) review the evidence. Moreover, Piore (1979) points out that the simple experience of migration seems to change the taste and the preferences of individual immigrants; along the same lines, Massey (1986) finds that once a Mexican worker has migrated he or she is very likely to migrate again even controlling for other observable characteristics.

In addition to a great variation in the *amount* of migration, there is considerable heterogeneity in the *destination patterns*. For instance, Las Animas and Guadalupe are two villages in the central plateau of Mexico, which share the same endowment of dry-land farming and 'excess' labor supply; moreover, both villages have shared a story of emigration since the beginning of the century (Mines and Massey, 1985). However, the patterns of emigration have been very different. Emigrants from Las Animas have formed sister communities in the United States; in contrast, emigrants from Guadalupe have never formed sister communities across the border. After interviewing people from both villages, Mines and Massey (1985) 'have not been

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[2]For a model where subsidies are used to deter migration between North and South see Spilimbergo, 1999.

able to uncover preexisting differences that might explain their divergent migrant experiences... ... It is [their] opinion that early US job contracts explain the different kinds of network migration. During the 1920s, migrants from both Guadalupe and Las Animas worked in agriculture jobs. But while almost all Guadalupeños worked in the fields, many Animeños found employment in steel mills near San Francisco, California. This difference in early migrant experience is the crucial factor accounting for the towns' later divergence in migrations patterns.' The authors conclude that existing economic models of migration cannot explain the different migration patterns across similar Mexican villages and that initial and apparently small shocks have long-lasting - more than 80 years - consequences.[3]

The previous examples (African-American vs non African-American, Americans born in the North East vs Americans born elsewhere, Europe vs US, and different Mexican villages) show how migration patterns are different across communities. Economists have proposed ad-hoc explanations, which often involve exogenous and/or non-testable factors. Different cultural factors or utility functions have been proposed to explain differences across communities in the US; different institutions to explain the differences between US. and Europe. The goal of the paper is to show how a simple model can explain different migration habits without the need of exogenous factors.

Our model is built on two observations: (1) agents care about economic (wages, unemployment rate, etc.) and social factors (presence of family, proximity to friends, etc.) in deciding whether to move or not; and (2) social factors are people-specific and not location-specific (people are socially integrated with other people and not with a specific place *per se*) as opposed to local amenities. Therefore, the social value of a specific place is given by the relationship with other individuals in the present and in the future. The utility of an individual depends on the action of other individuals (e.g. he cannot enjoy his friends if they decide to move away), and this generates the possibility of multiple equilibria. There are communities where people are used to moving so that the social cost of moving for the non-socially-integrated individual is low, and there are more stable communities where the social costs of moving are very high. The aggregate behavior with respect to migration differs across communities even though the individuals of both communities share the same preferences toward economic factors and social life.

A fundamental contribution of our approach is to show that different migration habits can be explained without (pseudo-)exogenous factors (e.g. different institutions, cost of moving, rent controls). A second important feature is that our model does not postulate different utility functions across communities and, instead, derives different aggregate behavior from the different interactions of agents within the community. Finally, this approach does not exclude other exogenous reasons to explain different migration patterns; in fact, other exogenous factors could reinforce the basic mechanism described in the paper.

The present model emphasizes social interaction as a source of endogeneity of migration

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[3]The sociological literature has increasingly emphasized the influence of sending communities on migration decisions; for a review see Lucas, 1997.

costs; other papers find other mechanisms that make moving costs endogenous. Carrington, Detragiache and Vishwanath (1996) formalize the idea that moving costs depend inversely on the number of immigrants already settled in the destination; so that once individuals with lower costs move, other individuals with higher moving costs move and migration occurs gradually over time; this would explain the patterns of the Great Black Migration of 1915-60, which took place in a period of narrowing income differentials between North and South. This model explains well the specific episode of the Great Black Migration but cannot generate persistently different patterns as those observed in the examples above. Kao and Sirmans (1977) and Massey, Alarcon, Durand and Gonzales (1987) find evidence of network externalities in Mexican immigrants' communities mostly because of information flows. This mechanism explains why immigrants tend to concentrate on specific locations and not why some communities are systematically more mobile than others. Our model is in the spirit of Ben-Porath (1980) who emphasizes the role of family connections in a variety of situations. Finally, our model has analogies with the model of relative deprivation of Stark (1990); however, our model is not based on relative status given that all agents are equal and income distribution does not have any role.

The empirical literature on migration has emphasized the role of family in determining decisions to migrate (for instance, Levy and Wadycki, 1973; Graves and Linneman, 1979; Spilimbergo and Ubeda, 2001). However, these papers do not draw the general equilibrium conclusions that migration habits are endogenous within communities. The contribution of our paper is to formalize this endogeneity in a general equilibrium framework.

In the next section, we consider first a bare-boned version of the model without exogenous costs of moving. Second, we present an extension with explicit costs of moving. Third, we discuss an extension of the basic model that allows for multiple equilibria in destination patterns of migration to explain why some communities form 'sister villages.' In the final section, we provide some policy and theoretical conclusions.

II. THE MODEL

This section develops a discrete-time model that relates geographical mobility, employment status and integration in the social environment (or friends and family - F&F- status). The main purpose of the model is to investigate the general equilibrium consequences of a simple migration model in which individuals care about economic and social factors.

The literature has shown that the decision to migrate depends on a variety of economic factors such as the individual's employment status, region-of-origin and region-of-destination unemployment rates, wage gain upon moving, etc. (for instance DaVanzo, 1978 and DaVanzo, 1981). In our model all these effects are captured by a wage differential w—the wage earned by an employed worker.

We capture the fact that attachment to family and friends living in the individual's region may discourage migration by assuming that a socially integrated individual obtains a utility M each period, and that an individual ceases to enjoy relatives and friends - and so loses M - when

he migrates. Numerous papers in the literature on migration determinants show the importance of family ties as disincentives to migrate (Mincer, 1978). In part because of data unavailability, most authors focus on the effect of the nuclear family. Greenwood (1985) surveys this literature. Recently, Spilimbergo and Ubeda (2001) provide evidence on the strong disincentive effect of extended family attachment using panel data from the PSID.

Another F&F effect has been considered in the literature. Greenwood (1969) considers that if an individual's family and friends have migrated from region i —current region of the individual— to region j in the past, it is more likely that the individual moves out of region i, and decides to go to region j rather than to another region. Indirect evidence on the importance of this effect was found by several authors using census data, as the coefficient of the stock of past migration from i to j was strongly significant in a regression with dependent variable the current amount of migration from i to j (see Greenwood, 1969 for the US, Greenwood, 1973 for India, and Levy and Wadycki, 1973 for Venezuela). The findings of Mines and Massey (1985) can also be explained along these lines. For the sake of simplicity, we do not include this F&F effect in our basic model. However, in section II.D we extend the model to allow for this F&F effect, showing that the main results of this framework can be extended to this case.

A.   Setting

Our economy consists of an infinite number of workers who live for ever. Each worker has an employment status L_t, a F&F status F_t and lives in a region R_t at each period t. We consider the simplest case in which L and F can take only two values each, i.e., each period a worker can be either employed (e) or unemployed (u), and either integrated (m) or non integrated in the social environment (s).

Each individual maximizes an expected utility function, which is given by the discounted sum of wage plus social satisfaction:

$$\sum_{t=0}^{\infty} \frac{W(L_t) + S(F_t)}{(1+r)^t},$$

where $W(e) = w > 0$, $S(m) = M > 0$ and $W(u) = S(s) = 0$.

The timing of the model is as follows: at the beginning of each period, every worker is told what his employment status and social integration status are going to be this period if he stays; given this information, he chooses whether to stay in the current region or move to another one.

If a worker moves to another region, he can find a job upon arrival with certainty.[4] However, a worker loses utility from social integration for the current period whenever he moves

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[4]In this, we depart from Harris and Todaro (1970) in one important respect. In Harris and Todaro (1970), urban wages are higher than rural wages and a new migrant is not certain to find a job upon arrival because there is urban unemployment.

In contrast, we suppose that workers can find a job upon arrival. We make this assumption because it is supported by empirical evidence (Banerjee, 1991) and because it makes the model

to a new location. These assumptions allow a trade-off between economic and social factors using binary variables. We should stress that we use binary variables just for convenience and our conclusions do not depend on this assumption.[5]

If a worker with status (F, L) does not move, the probability of changing employment status is π_L and the probability of changing social integration status is π_F, for $L = m$, s, and $F = e$, u. These two events are assumed to be independent. In this way, a Markov process with four states is defined.

B.   Analysis

We restrict our study to symmetric steady state equilibria. The optimal decision is straightforward in three of the four situations a worker can face at the beginning of a period. A worker who knows that he is going to be unemployed and non socially integrated this period if he does not move, i.e. $(F, L) = (s, u)$, chooses to move to another region so that he gains employment status and loses nothing in social integration, i.e. $(F, L) = (s, e)$. A worker who knows that he is going to be integrated and employed this period if he stays, i.e. $(F, L) = (m, e)$, will stay since by moving he loses social integration but gains nothing in employment status. A worker who knows that he is going to be employed and not integrated this period if he does not move, i.e. $(F, L) = (s, e)$, will be indifferent between moving or not; he is going to be employed and not integrated this period whatever he chooses.

The choice of a worker, who knows that he is going to be integrated but unemployed this period if he does not move, depends on what he expects the individuals living in the same area will do when faced with this same decision. Imagine that a worker believes that q is the probability that a person chooses to move when facing this decision. Notice that in this case $\pi_m = \pi_e q$, $q \in \{0, 1\}$, where π_m is the probability of becoming single, and π_e is the probability of becoming unemployed. To solve this problem, we use the following lemmas.

Lemma 1 *Let A and B be strategies from time 0 to ∞. Assume that $r > 0$. If strategy A is preferred to strategy B, then there exists some time $\bar{t}$ such that for all $t > \bar{t}$ and for any policies C and D from time t on, the compound strategy "follow A until t and then adhere to C" is preferred to the compound strategy "follow B until t and then adhere to D".*

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more tractable. Note that we could allow for the possibility of not finding a job immediately upon arrival without altering the fundamental results of our paper. We only need to assume that the expected wage is higher if a worker is willing to move to another location—and not necessarily that employment occurs immediately with certainty.

[5]Note that the strict binary choice of the social variable could suggest the interpretation of the social variable as representing married vs single individuals. This would imply that more mobile communities and societies have higher divorce rates. In order to avoid this strict (and somewhat misleading) interpretation, we stick to more general and encompassing terminology of social integrated versus non-socially integrated.

Proof. It follows immediately from the form of the utility function as a *discounted* sum and from the boundedness of the value from following any strategy. ∎

Lemma 2 *Consider a stationary problem with two alternative actions a and b each period. Let A_t be the strategy of choosing every period from t on action a and B_t be the strategy of choosing every period from t on action b. Let $x(Y_t)$ be the best action to take at $t-1$ if from t on strategy Y_t is compulsory, for $Y = A, B$. Then $x(A_t) = x(B_t)$, i.e., the best action at $t-1$ is independent of which strategy is compulsory from t on.*

Proof. *By stationarity, the optimal strategy is "always choose a" or "always choose b". Then it is not possible that simultaneously $x(A_t) = b$ and $x(B_t) = a$. Suppose that for some $\bar{t}$, $x(A_{\bar{t}}) = a$ and $x(B_{\bar{t}}) = b$. Then, for all t, $x(A_t) = a$ and $x(B_t) = b$. Thus for any t, the best strategy from 0 up to $t-1$ is "choose a from 0 to $t-1$" if strategy A_t is compulsory, while the best strategy from 0 to $t-1$ is "choose b from 0 to $t-1$" if B_t is compulsory. This contradicts the previous lemma.* ∎

Using these lemmas, we can solve the choice problem of the integrated but unemployed worker just by determining his optimal choice at time t assuming that he will always decide to change region after t whenever faced with the prospect of being unemployed and integrated for the incoming period.

Consequently, we define the value functions corresponding to two alternative policies. Let V_{FL} be the value of the strategy "change region whenever integrated and unemployed" for a worker who knows that he is going to be in employment status L and in social situation F during this period if he does not move to another region. Note that $V_{su} = V_{se}$ because, as argued above, any non integrated and unemployed individual moves immediately and so becomes non integrated and employed. Also note that $V_{mu} = V_{se}$ because by the definition of V_{FL} an integrated and unemployed individual follows the policy of moving and so becomes non integrated and employed.

The following relations hold:

$$V_{se} = \frac{w + \pi_s\left(1 - \pi_e\right)V_{me} + \left[1 - \pi_s\left(1 - \pi_e\right)\right]V_{se}}{1 + r} \tag{1}$$

and

$$V_{me} = \frac{w + M + \left(1 - \pi_e q\right)\left(1 - \pi_e\right)V_{me} + \left[1 - \left(1 - \pi_e q\right)\left(1 - \pi_e\right)\right]V_{se}}{1 + r}. \tag{2}$$

Equation (1) follows from the fact that a non integrated and employed individual will get a wage w and will become integrated and remain employed (m, e) with probability $\pi_s\left(1 - \pi_e\right)$

at the end of the current period, while he will be (s, e), (s, u), or (m, u) otherwise, which are all equivalent in terms of value under the strategy considered. Similarly, equation (2) shows that an integrated and employed individual in his current location will get social satisfaction M and wage w at the end of the period, and will keep his current status with probability $(1 - \pi_e q)(1 - \pi_e)$ while otherwise will become (s, e), (s, u), or (m, u), enjoying value V_{se}.

Next, let V'_{mu} be the value of a worker who is integrated and unemployed this period and does not move now, but follows the above policy of moving whenever integrated and unemployed after this period. In the current period, the worker will enjoy social satisfaction M but no wage. He will keep his social integration and find a job for the next period with probability $(1 - \pi_e q)\pi_u$, while he will become (s, e), (s, u), or (m, u) otherwise, which again corresponds to the same value V_{se} because the strategy reverts to moving whenever becoming (m, u) from next period on. Thus,

$$V'_{mu} = \frac{M + (1 - \pi_e q)\pi_u V_{me} + [1 - (1 - \pi_e q)\pi_u] V_{se}}{1 + r}. \tag{3}$$

To determine whether a worker will decide to move or to stay we need to determine the sign of $y \equiv V_{se} - V'_{mu}$. From equations (1) and (2) we obtain:

$$V_{me} - V_{se} = \frac{M + [(1 - \pi_e q)(1 - \pi_e) - \pi_s(1 - \pi_e)](V_{me} - V_{se})}{1 + r}, \tag{4}$$

which simplifies to:

$$V_{me} - V_{se} = \frac{M}{1 + r - (1 - \pi_e q - \pi_s)(1 - \pi_e)}. \tag{5}$$

Equation (5) has an easy interpretation. Under the policy of moving whenever unemployed and socially integrated, the extra benefit of state (m, e) over state (s, e) is the social satisfaction M from integration properly discounted. If the extra benefit were enjoyed for only one period, the discount rate would be $(1 + r)$. But since the benefit may last longer or terminate, the discount rate is reduced by the difference in the probabilities of these two possibilities, which is just $(1 - \pi_e q - \pi_s)(1 - \pi_e)$.[6] The benefit increases as M or the probability of remaining at (m, e) increase, or as r or the probability of moving from (s, e) to (m, e) decrease. The corrected discount factor is always positive and so it is the extra benefit of (m, e) over (s, e). From (1) and (3),

$$V_{se} - V'_{mu} = \frac{w - M + [\pi_s(1 - \pi_e) - (1 - \pi_e q)\pi_u](V_{me} - V_{se})}{1 + r}. \tag{6}$$

The difference between V_{se} and V'_{mu} is the wage w minus the social satisfaction M enjoyed this period plus the difference in expected utility of state (m, e) over state (s, e) for the next period. This difference in expected utility is equal to the difference between the probability of

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[6]The probability of keeping (m, e) but not changing from (s, e) to (m, e) minus the probability of leaving (m, e) and changing from (s, e) to (m, e).

moving from states (s, e) and (m, u) to state (m, e), times the advantage of being at state (m, e) over being at state (s, e). Since all these values are calculated as accruing at the end of the period, the proper discount factor in this case is just $1 + r$.

Substituting,

$$y \equiv V_{se} - V'_{mu} = \frac{w - M + \frac{\pi_s(1-\pi_e)-(1-\pi_e q)\pi_u}{1+r-(1-\pi_e q-\pi_s)(1-\pi_e)}M}{1+r}. \tag{7}$$

This equation shows the way in which the optimal migration decision depends on the behavior of other individuals, q. A worker who knows that he is going to be integrated and unemployed this period unless he changes region, chooses to move if y is positive, and to stay if it is negative. That is, rearranging equation (7), we get that he chooses to move if and only if,

$$w - M > \underbrace{\frac{(1 - \pi_e q)\pi_u - \pi_s(1 - \pi_e)}{1 + r - (1 - \pi_e q - \pi_s)(1 - \pi_e)}M}_{\text{future discounted expected gains if staying}}. \tag{8}$$

The economic interpretation of condition (8) is clear. An unemployed but socially integrated worker decides to migrate to get a job if the immediate gain from moving $w - M$ is greater than the future discounted expected gains of staying, which is the difference in the transition probabilities to social integration and employment depending on whether the worker decides to move or to stay as shown above. Note that only the dynamic consequences of moving or staying depend on the others' behavior represented by q.

There are two stable equilibria if y is negative whenever $q = 0$, and y is positive whenever $q = 1$: one equilibrium with $q = 0$, in which no integrated worker moves, and another equilibrium with $q = 1$, in which every would-be unemployed worker moves so that everybody is employed.

From (8) it follows that there are two equilibria if simultaneously,

$$\rho_1 < \frac{w - M}{M} < \rho_2 \tag{9}$$

where

$$\rho_1 = \frac{(\pi_u - \pi_s)(1 - \pi_e)}{1 + r - (1 - \pi_e - \pi_s)(1 - \pi_e)} \tag{10}$$

and

$$\rho_2 = \frac{\pi_u - \pi_s(1 - \pi_e)}{1 + r - (1 - \pi_s)(1 - \pi_e)}. \tag{11}$$

In words, the discounted future relative gains of staying when $q = 1$, ρ_1, should be less than the immediate relative gains of migrating, and these should be less than the future discounted

relative gains of staying when $q = 0$, ρ_2.

For (9) to hold, it is necessary that the range $\rho_2 - \rho_1$ be positive, i.e., that the discounted future gains of staying be larger if the others stay than if the others move. To analyze this possibility note that the numerator in ρ_1 is less than in ρ_2 and that the denominator in ρ_1 is greater than that of ρ_2. Thus, the range $\rho_2 - \rho_1$ will be positive if the probability that an unemployed gets a job without moving is greater than the probability of becoming socially integrated, $\pi_u > \pi_s$. In this case, for multiple equilibria to appear the immediate gains of moving should be positive $w > M$. If instead, $\pi_u < \pi_s$ but $\pi_u > \pi_s(1 - \pi_e)$, the range will still be positive, and multiple equilibria exist when w and M are not too dissimilar. Finally, if $\pi_u < \pi_s(1 - \pi_e)$, both numerators are negative so that the range is positive if the denominators are not too far apart. In this case w should be less than M.

A little of algebra shows that the range is positive if and only if $(1 + r)\pi_u > \pi_s(1 - \pi_e)(1 - \pi_e - \pi_u)$. Thus, if the range $\rho_2 - \rho_1$ were not positive for some parameter values, by increasing any of the parameters r, π_u or π_e, or by decreasing π_s, the range would eventually become positive. However, the range $\rho_2 - \rho_1$ is not increasing in r. For r large enough, the range is decreasing in r. In particular, if $\pi_u > \pi_s$, for any parameter values, the smaller r, the larger the range $\rho_2 - \rho_1$. The derivation is presented in Appendix A.

C.   Model with an Exogenous Moving Cost

We can easily introduce exogenous moving costs in the model. Assume that workers have to pay a cost k each time they move. This cost could derive from transportation, settlement expenditure, and job search in new locations.[7] The value of a non integrated and unemployed worker is no longer equal to that of a non integrated and employed worker if a worker must pay a cost k each time he moves. If the moving cost were very high, no worker would ever want to move. Let's then assume that at least some workers move, i.e., that k is not so large to deter from migrating even to the non integrated and unemployed workers.

The optimal decision is clear in three out of four situations a worker may face at the beginning of a period. A worker who knows that he is going to be unemployed and not socially integrated this period if he does not move, i.e. $(F, L) = (s, u)$, decides to move so that he becomes employed, i.e. $(F, L) = (s, e)$, as we are assuming k is not large enough to deter him from moving. A worker who knows that he is going to be integrated and employed this period if he does not move, i.e. $(F, L) = (m, e)$, decides to stay since by moving he loses social integration and has to pay the moving cost but gains nothing in employment status. A worker who knows that he is going to be employed and not integrated this period if he does not move, i.e. $(F, L) = (s, e)$, prefers not to move, since he would not change status neither in employment nor in social integration and would incur in the moving cost.

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[7]Typically this cost is incurred before the worker gets the wage in his new job, so that borrowing constraints may prevent some workers to move. However we assume there are no borrowing constraints, as the aim of the paper is not to study the role of imperfect capital markets on migration and employment.

To solve the only case left, we again apply lemmas 1 and 2, which continue to hold as their proofs do not assume zero moving costs but rely on the nature of the dynamic problem (stationary with bounded discounted payoffs), which has not changed. From lemmas 1 and 2, in order to determine the optimal choice of an integrated and unemployed worker we can just consider his current period choice assuming that from next period on he will have to change region whenever faced with the prospect of becoming integrated and unemployed again. Thus, defining the values V_{FL} and V'_{mu} as above, the worker will move if and only if $V_{se} - k > V'_{mu}$.

Because of the moving cost, equality of V_{se}, V_{su} and V_{mu} no longer holds, but instead we have $V_{su} = V_{se} - k$ and $V_{mu} = V_{se} - k$. Thus, equations (1) and (2) have to be modified to take into account that the state will switch for next period to (m, u) or (s, u) with probability π_e, so that the value will be $V_{se} - k$. The new equations with exogenous moving costs are:

$$V_{se} = \frac{w + \pi_s(1 - \pi_e)V_{me} + [1 - \pi_s(1 - \pi_e)]V_{se} - \pi_e k}{1 + r} \tag{12}$$

and

$$V_{me} = \frac{w + M + (1 - \pi_e q)(1 - \pi_e)V_{me} + [1 - (1 - \pi_e q)(1 - \pi_e)]V_{se} - \pi_e k}{1 + r}. \tag{13}$$

Similarly, equation (3) has to be modified to take care of the fact that for next period, with probability $1 - \pi_u$ the worker will continue to be unemployed (states (m, u) or (s, u)) so that the value will be $V_{se} - k$. The new equation with exogenous moving cost is:

$$V'_{mu} = \frac{M + (1 - \pi_e q)\pi_u V_{me} + [1 - (1 - \pi_e q)\pi_u]V_{se} - (1 - \pi_u)k}{1 + r} \tag{14}$$

Now, as in our previous analysis with zero exogenous moving cost, $V_{me} - V_{se}$ is given by (5). We need to determine the sign of $V_{se} - k - V'_{mu}$. Substituting,

$$V_{se} - k - V'_{mu} = \frac{w - M + \frac{\pi_s(1 - \pi_e) - (1 - \pi_e q)\pi_u}{1 + r - (1 - \pi_e q - \pi_s)(1 - \pi_e)}M - [1 + r + \pi_e - (1 - \pi_u)]k}{1 + r}. \tag{15}$$

We conclude that a worker who faces the prospect of being unemployed and socially integrated this period if he does not move, will decide to migrate to get a job if and only if,

$$w - M - \frac{[\pi_s(1 - \pi_e) - (1 - \pi_e q)\pi_u]}{1 + r - (1 - \pi_e q - \pi_s)(1 - \pi_e)}M > [1 + r + \pi_e - (1 - \pi_u)]k. \tag{16}$$

In words, a worker will move if the static plus dynamic gains from moving (excluding exogenous moving costs) exceeds the direct plus indirect exogenous moving costs. The indirect exogenous moving cost comes from the difference in future expected exogenous moving costs depending on whether he moves now or he does not. It is equal to the probability of becoming unemployed after next period if he moves now (π_e) minus the probability of becoming employed

after next period if he instead decides to stay now $(1 - \pi_u)$, all multiplied by the cost k.

Note that an exogenous moving cost k is equivalent to a reduction in the wage differential of $[1 + r + \pi_e - (1 - \pi_u)]k$. Note that the magnitude of this reduction does not depend on the moving behavior of others (q).

Therefore, there are two stable equilibria if the following inequalities hold,

$$\rho_1 < \frac{w - [1 + r + \pi_e - (1 - \pi_u)]\,k - M}{M} < \rho_2, \qquad (17)$$

where ρ_1 and ρ_2 were defined in (10) and (11).

In words, the discounted expected future relative gains from staying if the others move, ρ_1, should be less than the immediate relative gains from moving corrected by the presence of exogenous moving costs, and these should be less than the future discounted expected relative gains of staying when the others stay, ρ_2. Since the range in (17) is the same as in (9), the analysis at the end of the previous section on the existence of multiple equilibria applies also to the case of exogenous moving costs.

Note that only the future gains of moving or staying (excluding the exogenous moving costs) depend on the behavior of others, so that the phenomenon of multiple equilibria in migration is intrinsically dynamic.

D.   Explaining 'sister villages'

Although the previous models focus on multiple equilibria in migration *rates* between villages without considering destination patterns, the framework can easily explain why migrants move to a specific location in some cases and not in others. For instance, Mines and Massey (1985) have documented multiple equilibria in the destination patterns in two otherwise similar Mexican villages: people from Las Animas have formed sister communities in the US, while people from Guadalupe have not.[8]

To explain multiple equilibria in destination patterns, we can extend our framework even without leaving the simple framework of binary state variables in employment status and social integration status. Consider a worker who is to decide whether to migrate to places where his family and friends have previously migrated or to migrate somewhere else without that spatial constrain. Although moving to locations where his family and friends have previously moved

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[8]There are other models trying to explain the destination of migrants. Previous literature has highlighted the trade-off between migrating to a specific location, so maximizing network externalities but increasing locational risks for the household, and migrating to different location, decreasing locational risk but renouncing to network externalities.

Daveri and Faini (1999) provide a nice review of this literature and test a model of risk-averse households using data from South Italy. However, unlike previous models, our framework focuses on the possibility of multiple equilibria in destination patterns.

reduces somewhat his current level of social integration, this reduction is considerably smaller than that of moving to a place with no family and friends. In terms of our framework, an individual maintains a high level of social integration, enjoying social satisfaction M, when he moves to places where family and friends already migrated, while he will be non-integrated if he moves somewhere else. However, a worker can find a better job if he does not constrain his job search to a specific location with friends and family. To capture this in a simple way, we may assume that a worker can find a job with probability one upon arrival in this case while he finds a job with a lower probability u if he decides to constrain his migration to a location with family and friends.[9]

This re-interpreted model is formally identical to the model in the previous sections. Only that it does not apply to the decision on whether or not to migrate, but to the decision of where to migrate: either to places where family and friends have previously moved or somewhere else. In the same way, there will be multiple equilibria in location patterns. An equilibrium corresponds to the case of sister cities and migration chains: migration goes to particular locations where family and friends have already moved in. A worker who is to leave his village has a strong incentive to move to such locations, in order to maintain a high level of social integration, although at the expense of losing some economic opportunities elsewhere. There is also an equilibrium with dispersed migration in which migration does not concentrate in any particular locations. In this equilibrium, a migrant finds that he has insufficient family and friends in any place in the wider destination area to prevent him from losing most of his social integration upon moving, so that he has a greater incentive to be guided by economic interest and so preserve the pattern of dispersion of migration destinations.

III. CONCLUSION

We have developed a model of double matching in the labor market and in the social environment which can generate multiple equilibria. Our model is based on the classical view that the decision to migrate is equivalent to investing (Sjaastad, 1962). As other theoretical and empirical papers have shown, social detachment is among the costs of moving. Our main point is that this cost depends on other people's behavior. The resulting externality can generate multiple equilibria. In this manner, we can explain the behavior of different communities as well as the persistence of migration patterns. While previous theoretical and empirical works have considered non-economic determinants of migrations, we have presented a general equilibrium model where migration patterns are determined endogenously.

Our model explains the persistence of migration patterns but it does not tell why some communities are in a specific equilibrium. As it is common in multiple equilibria models, history picks the equilibrium. There are many examples of how history determines equilibria. For instance, Funkhouser (1997) has documented how the civil war in El Salvador has determined

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[9]Footnote 4 applies here again. An alternative interpretation is that a worker decides whether or not to accept a job that requires him to leave his social environment. This way, multiple equilibria in destination patterns would arise even if the probability of finding a job in a place increased with the presence of family and friends.

the amount of migration across different regions. In the introduction, we have mentioned how two Mexican villages (Guadalupe and Las Animas) have reached very different equilibria in destination patterns.

The paper has several implications: at the micro level for the design of policies, it suggests the importance of social factors in explaining the migration dynamics of different groups; and, at macro level, it has implications for optimal currency areas. In regard to welfare state, the individual costs of mobility, which are endogenously determined, are different across groups, so the same incentives to move could have different outcomes across groups or countries. In regard to migration policies, some immigrant groups tend to cluster more than others and this feature tends to perpetuate itself, so some immigrant groups 'grease' the labor markets more than others (Borjas, 2001). Second, regional labor mobility has recently attracted new research interest because it is a key factor in evaluating the size of an optimal currency area (Mundell, 1961). For instance, Eichengreen (1993) finds that "in Europe, workers are less sensitive to economic incentives (the elasticity of migration with respect to unemployment differential is twice as large in the United States than in the United Kingdom or in Italy.") Eichengreen argues that "low levels of labor mobility in Europe reflect not only legal restrictions, but also culture, language, and history." Our model shows that the low labor mobility can be even harder to change because a region with a history of low regional labor mobility will probably have low mobility also in the future. This is quite pessimistic about European regional unemployment. Europeans seem to be in the equilibrium where $q=0$, so they are less responsive to economic incentives. Therefore, a policy which hinges on economic incentives will have a smaller effect unless the economic incentives are big enough to induce a jump to the new equilibrium. In summary, our model can shed new light on the debate on optimal currency areas because it models explicitly the social costs of moving rather than assuming them in an exogenous fashion; this allows us to write an explicit welfare function that can be used to rank different migration equilibria.

Finally, to keep our model simple we have not introduced endogenous costs of moving such as externalities in the housing market or endogenous transfers such as unemployment benefits or rent control. Both kinds of mechanisms reinforce the stability of the two equilibria we have discussed. Future research could model explicitly the market externalities and the political mechanisms which reinforce the multiple equilibria discussed in this paper.

DISCOUNT RATE AND THE RANGE OF TWO EQUILIBRIA

This appendix shows how the range in (9) varies with r.

$$
\begin{aligned}
\frac{\partial}{\partial r}(\rho_2 - \rho_1) =\ & \frac{(1-\pi_e)\pi_s - \pi_u}{[r+\pi_e+(1-\pi_e)\pi_s]^2} - \frac{(1-\pi_e)(\pi_s-\pi_u)}{[r+\pi_e+(1-\pi_e)(\pi_s+\pi_e)]^2} \\
=\ & \{[(1-\pi_e)\,\pi_s - \pi_u]\,[r+\pi_e+(1-\pi_e)(\pi_s+\pi_e)]^2 \\
& -(1-\pi_e)(\pi_s-\pi_u)[r+\pi_e+(1-\pi_e)\pi_s]^2\} \\
& \times [r+\pi_e+(1-\pi_e)\pi_s]^{-2}[r+\pi_e+(1-\pi_e)(\pi_s+\pi_e)]^{-2} \\
=\ & \{[(1-\pi_e)\pi_s - \pi_u] \\
& \times \{[r+\pi_e+(1-\pi_e)\pi_s]^2 \\
& +2[r+\pi_e+(1-\pi_e)\pi_s][(1-\pi_e)\pi_e)] + [(1-\pi_e)\pi_e]^2\} \\
& -(1-\pi_e)(\pi_s-\pi_u)[r+\pi_e+(1-\pi_e)\pi_s]^2\} \\
& \times \{[r+\pi_e+(1-\pi_e)\pi_s][r+\pi_e+(1-\pi_e)(\pi_s+\pi_e)]\}^{-2} \\
=\ & -\{\pi_u\pi_e[r+\pi_e+(1-\pi_e)\pi_s]^2 + 2[r+\pi_e+(1-\pi_e)\pi_s] \\
& [\pi_u - (1-\pi_e)\pi_s](1-\pi_e)\pi_e + [\pi_u - (1-\pi_e)\pi_s][(1-\pi_e)\pi_e]^2\} \\
& \times \{[r+\pi_e+(1-\pi_e)\pi_s][r+\pi_e+(1-\pi_e)(\pi_s+\pi_e)]\}^{-2}
\end{aligned}
$$

The sign of $\frac{\partial}{\partial r}(\rho_2 - \rho_1)$ is that of the numerator. The numerator is a quadratic function in r, with negative coefficient on r^2. Thus, for all r above some value $\bar{r}$, $\frac{\partial}{\partial r}(\rho_2 - \rho_1) < 0$. In particular, if $\pi_u > (1-\pi_e)\pi_s$, the numerator is negative for any positive value of r. Therefore, $\frac{\partial}{\partial r}(\rho_2 - \rho_1) < 0$ for all $r \geq 0$.

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