Evolutionary dynamics of nationalism and migration

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HIGHLIGHTS

- Evolution of nationalism and assimilation is modeled using replicator dynamics (RD).
- I study the existence of asymptotic or neutral stability in the state space.
- RD takes into account own population effects when an enclave of immigrants exists.
- In one set-up, evolution may depend on initial conditions and basins of attraction.
- Enclave makes assimilation less likely and allows for equilibria with polymorphism.

ARTICLE INFO

ABSTRACT

I present a dynamic evolutionary game model to address the relation between nationalism against immigrants and assimilation of the latter into the host country culture. I assume a country composed of two different large polymorphic populations, one of native citizens and the other of immigrants. A native citizen may behave nationalistically or may welcome immigrants. Immigrants may have an interest in learning the host country language or not. Evolution is modeled using replicator dynamics (RD). I also account for the presence of an enclave of immigrants in the host country. In the RD, the latter represents the immigrants' own population effect, which contribution to fitness is controlled using a parameter ρ, $0 \leq \rho \leq 1$, that represents the enclave size. In line with the empirical literature on migration, the existence of an enclave of immigrants makes assimilation less likely to occur. For large values of ρ, complete assimilation may not occur even if immigrants and natives share very close cultures and norms. Government policy regarding nationalism is modeled both exogenously and endogenously. A single or multiple asymptotically stable states exist for all cases studied but one in which the dynamics is similar to that found in the predator–prey model of Lotka–Volterra for competing species.

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1. Introduction

In the last years the development of econophysics and sociophysics has brought a different perspective for addressing traditional problems in mainstream economics and sociology [1–6]. A recent work with a strong link between economics and statistical mechanics can be seen in Ref. [7]. In the latter, a 2-spin Ising model used in statistical mechanics is compared with a 2-player normal form game used in game theory and an exact mapping is set between both models. Each player can choose one of two actions while each spin can be in one of two states. An "Ising game" matrix is built by replacing a player in the normal form game by a spin, the player action by the spin state, the utility function by (the negative of) the spin local energy and the Nash equilibrium by a physical equilibrium. All possible equilibrium configurations of the normal form game

can be recovered by the Ising model, including games with multiple Nash equilibria and games without a Nash equilibrium in pure strategies. Also games with a unique Pareto dominated Nash equilibrium (such as the prisoner's dilemma) can be recovered provided that a new linear coupling term is added to the local energy of each spin. Such an "altruistic" term depends on the other spin state having up to now no physical meaning.

In this paper, in the same vein, a socio-economics problem is modeled using non-linear dynamics in a set-up with many similarities with problems in statistical physics. I use an evolutionary game model to study how nationalism and assimilation evolve in a country composed of two different large polymorphic populations, one of native citizens and the other of immigrants, the latter coming from the same origin country. Similar to Ref. [7], each player is in one of two possible states. In the population of natives some individuals show a nationalistic behavior while others simply welcome immigrants. The population of immigrants has individuals who have an interest in becoming culturally assimilated through learning the language of the host country while other immigrants simply do not have such an interest and do not learn it at all. Based on Ref. [8], language learning is used in this paper as a proxy for the acquisition of the host country's culture by immigrants.

In Ref. [8] nationalism is classified as corporate, hegemonic or primordial nationalism, all having in common their emergence within the native society due to fears of "denationalization" of the host country culture as a result of the presence of immigrants. In my model, some natives exhibit a nationalistic behavior resulting from their xenophobia (feeling of hating the immigrants). Their reaction to this hate are their nationalistic attitudes against the immigrants, translated in my model through a tentative of boycotting them when immigrants try to use essential public services in the host country. Depending on the attitude of policy makers toward the prevention or not of nationalism as well as the interaction between natives and immigrants, nationalism may spread over time or even disappear.

The evolutionary game can be seen as a model governing the evolution of the struggle between two ideologies within each of the two interacting populations: the struggle between nationalist and pro-immigrant natives and the struggle between learner and non-learner immigrants. A recent work investigating ideological struggles within a single population living in the same country but without using a game theory approach is presented in Refs. [9,10]. In the latter, the country's population is divided into $n + 1$ subgroups of agents, n of those subgroups each follow a different specific ideology and the remaining subgroup is ideologically-free. The country's overall population varies in time following a Verhulst equation with positive growth rate. Competition among the ideologies (alternatively, opinions) is governed by equations like those of Lotka–Volterra. The evolution of each ideology takes into account the death rate of individuals, the unitary conversion from other ideologies or ideologically-free agents (by means of mass communication tools) and binary conversion (due to interpersonal contacts with other agents). The model allows us to study cases of mass-media societies, societies based on interpersonal contacts or a mix of both. Several issues are studied such as inertial growth, ideological tension and the so-called phoenix effect. The latter occurs when there is a resurrection of an extinct (or quasi-extinct) ideology by means of the equilibrium state associated with extinction becoming unstable (phoenix effect of first kind) or due to elimination of such an equilibrium state from the population state space (second kind).

In this paper, using a different approach, depending on the value of the parameters, the evolutionary game also displays a dynamics similar to that found in the Lotka–Volterra model for competing species. I also illustrate the resurrection of nationalism using a practical case from the recent history of migration. Studies on non-linear dynamics of systems of competing populations using generalized Volterra equations, with adaptation of the growth rates and competition coefficients can be seen in Refs. [11–13]. Extinction and substitution of extinct populations are examined in Ref. [14].

Regarding evolutionary game theory (EGT), it has been previously used to study other social and economic problems such as in Refs. [15–17] and has the key aspect of relaxing the mainstream economics paradigm that all agents are rational, also allowing us to study the problem dynamically, thus understanding which and how asymptotically stable states (also called evolutionary equilibria in Ref. [18]) can be achieved over time. A theoretical background on deterministic EGT can be found in Refs. [18–22].

I start the analysis with a benchmark model in which immigrants live dispersed across the country and the government policy toward preventing nationalism is exogenous, thus a policy dictated by the government. I then extend the benchmark model to study two specific cases: a first one in which a significant number of immigrants live in an enclave and meetings among them are more likely to occur and a second case where the country's policy toward nationalism becomes endogenous.

According to the empirical literature on migration [23,24], there is a negative correlation between immigrants' fluency in the host country language and the level of immigrant concentration living in the same area (an enclave of immigrants). My results show that such a negative correlation between assimilation and enclave size persists even in the framework of an evolutionary game model in which rationality is partially or even completely dropped from the assumptions.

The results also show that, when the policy toward nationalism is exogenous and immigrants live dispersed in the country, both populations become monomorphic in the long run for all but one case, while polymorphism may be an evolutionary equilibrium (EE) when immigrants live in an enclave. When the government's policy toward nationalism is made endogenous, nationalism can still survive but the EE that prevails in the long run is then dependent on the initial conditions of both populations and on the basins of attraction in the state space.

The remainder of the paper is organized as follows: in Section 2, I set up, solve and discuss the benchmark model, Section 3 introduces the existence of an enclave in the benchmark model, Section 4 makes the government policy endogenous, Section 5 compares the evolutionary game model with a sociophysics model of binary societies published in the literature and Section 6 concludes.