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Cultural Differences and Economic Incentives: an Agent-Based Study of Their Impact on the Emergence of Regional Autonomy Movements

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Abstract

Explanations of the emergence of regional autonomy movements – political organizations seeking to express sub-state affinities and interests – often highlight cultural differences and economic incentives as important reasons driving regional elites and local politicians to form such organization and explain the support regional autonomy movements receive. In this paper I employ a specialized agent-based computer simulation as a laboratory for 'thought experiments' to evaluate alternative theoretical expectations of the independent and combined consequences of regional economic and cultural circumstances on the likelihood of regional mobilization. The simulations suggest that pronounced cultural differences and strong economic incentives contribute to the emergence of three independent yet related aspects of autonomy mobilization: the emergence of political boundaries, minority support, and minority clustering. Furthermore, these experiment indicate that the impact of cultural differences on the emergence of political boundaries may be contingent on the strength of the economic incentives, and visa versa.

Keywords:

Autonomy Movements, Ethno-Regional Mobilization, Constructivism, Agent-Based Modeling, Collective Identity

Introduction

1.1

The striking absence of clear and consistent theoretical foundations to explain the rise autonomist movements and the consequences of autonomist mobilization motivates this research. To be sure, the literature devotes significant attention to the circumstances driving regions, groups, and people to organize and demand autonomy. Alas, more often than not scholars disagree on the relative importance of economic and cultural characteristics, and even draw causal arrows in different directions.

1.2

This lack of scholarly consensus undermines the work of policy-makers and their attempts to develop appropriate responses to the demands of supporters of autonomy and self-

determination movements. Central governments are concerned, for example, that the devolution of power may encourage local elites and politicians to demand still more autonomy on behalf of ethnic, linguistic, or national minorities, and even encourage mobilization in regions with no autonomist tradition. Among other things, policy makers fear that regional autonomy mobilization will spin out of control, leading to massive support for secession and even to separatist violence. The central government, under these circumstances, would be forced to invest significant and increasingly ineffective resources in order to regain stability. From the state's point of view, regaining stability — either through violent repression, costly peaceful concessions, or by accepting the secession of a region — all lead to its potential disempowerment (and delegitimization), both politically and economically.^[1]

1.3

A regional autonomy movement is a political organization or a bundle of organizations seeking primarily to promote regional affinities and campaign for goals and interest associated with territorial units below the state level. The universe of regional autonomy movements is quite diverse, including political organizations seeking: secession and outright independence (e.g. Corsica, Basque); territorial readjustments or the uniting of a regional population with its homeland (e.g. Germans in Alto Adige, Catholics in Northern Ireland); the protection of cultural uniqueness and the allocation of political rights based on communal affiliations (e.g. Schleswig-Holstein, Åland); and political leverage to shield and promote regional economic interests (e.g. Northern Italy, Scotland). Regardless of the particular goals they strive to achieve, autonomy movements are similar in two important ways: (1) all these movements share an ambition to alter the structure of relations between the state and one or a group of sub-state regions ([de Winter 1998](#)) by negotiating for the transfer of more responsibilities and decision making power from the center to the region; and (2) all these movements mobilize public support by (re)evoking and enlisting, among other methods, local identities as part of their struggle to demarcate a political space ([Miodownik and Cartrite 2006](#)).

1.4

Establishing the mechanisms underlying the emergence of regional autonomy movements has always been a difficult task. Nevertheless, a large body of literature has emerged accounting for different aspects of regional autonomy mobilization. A large and non-exhaustive list of explanations of mobilization includes: economic, cultural, and political conditions; topography; world region; demographic patterns; globalization; inter-group antipathy; types of identities in conflict; political entrepreneurship; and outside intervention by irredentist or culturally related powers.

1.5

This paper advances our understanding of the inter-relations between two of the most prominent mechanisms – cultural differences and economic incentives — highlighted as bearing consequence to the emergence of regional autonomy movements. I use a specialized agent-based simulation as a laboratory for "thought experiments" ([Axelrod 1997](#), [Lustick et al. 2004](#)) to evaluate alternative theoretical expectations of the independent and combined consequences of regional economic and cultural circumstances on likelihood of regional mobilization.^[2] The agent-based model I develop does not presume to represent any empirical reality and is incapable of predicting the future of any specific state. Rather, this method is used to systematically evaluate existing theoretical explanations (based on empirical observation) for the emergence of regional autonomy movements across multiple virtual cases. Overall, I argue that explanation of regional autonomy demands needs to rely on a more careful and nuance understanding of the contingent and interactive effects of the cultural and economic factors characterizing the relationship between a specific region and the political center.

1.6

The article proceeds as follows. First, I review the literature and derive theoretical expectations regarding the independent and contingent effect of cultural and economic mechanisms on the emergence of regional autonomy movements. Then I describe the agent-based simulation environment I developed to test these hypotheses. This section is followed by a presentation of the experimental design and a review of the main results. I conclude with a discussion of some implications of this work for future research and theory building.



Cultural Differences, Economic Incentives and regional autonomy movements

Cultural Differences

2.1

Research consistently holds that there is a positive relationship between a region's cultural differentiation from the rest of the state and the emergence of regional autonomy movements ([De Winter and Türsan 1998](#); [Gourevitch 1979](#); [Hechter 1975](#); [Rokkan and Urwin 1983](#)). In other words, autonomy demands are more likely if the regional population share (or perceive) a common language, history, ethnicity, and/or religion distinctive from the rest of the inhabitants of the state. Autonomy movements attempt to make such communal affiliations the basis for the (re)allocation of political rights and privileges and to allow regions and peoples to conduct their own affairs with greater autonomy as part of the state or separately. For example, Basque political movements assert their right for autonomy and/or independence in Spain and France on the basis of a relatively distinctive language and ethnic background ([Ugarte and Pérez-Nievas 1998](#)). Similar motivations are behind the activities and demands of the Welsh regional autonomy movement that seeks — among other things — to promote the collective rights of Celtic speaking people in the region ([Christiansen 1998](#); [Lynch 1996](#)).

2.2

Other researchers have argued, however, that such cultural common denominators are not necessary to explain the existence of and support for regional autonomy movements ([Fearon and van Houten 2002](#); [van Houten 2000](#)). Although it seems likely to expect that autonomy mobilization would appear and be more pronounced the stronger the cultural differences, regions may seek autonomy for reasons unrelated to its population's cultural or ethnic background. The rise of autonomy mobilization and demands in Northern Italy in the late 1980s and 1990s is a good example. The *Lega Nord* attracted support, and even strong support, despite the small cultural differences between the Italian northern regions (e.g. Tuscany, Marche, Lombardy) and the wider cultural/linguistic/religious aspects of Italy. To be sure, the movement emphasizes and tries to politicize historical, cultural, and territorial identities, but this emphasis was no more than a tactical maneuver on the part of elites to help the advancement of the economic and political interests of the regions ([Giordano 2000](#); [Trachi 1998](#)).

2.3

The positions reflected in this debate suggest (as does the empirical record) that cultural differences increase the likelihood of regional autonomy mobilization, but are not necessary for mobilization. This expectation is expressed formally as:

Hypothesis 1: Cultural differences between regions and states increase the likelihood of the appearance of regional autonomy movements. Cultural differences, however, are not a necessary condition for the emergence of regional autonomy movements.

Economic Incentives

2.4

A strong consensual position in the literature asserts that economic incentives constitute a fundamental explanation for the emergence of regional autonomy movements. But scholars disagree on the economic conditions that can be said to provide incentives for demanding regional autonomy: whether a region's (absolute or relative) economic strength or weakness encourages that region to politicize that economic position and demand autonomy.

2.5

One approach argues that economically poor and less developed regions have strong incentives to demand autonomy and self-determination ([Hechter 1975](#); [Nielsen 1980](#); [Ragin 1979](#)); in other words, regional autonomy movements will emerge in the poorest regions — in places, for example, with the lowest GDP per capita. Demands for autonomy emerge in these regions — among other methods — as a way to pressure national governments to guarantee a continuous flow of subsidies and other economic transfers from the center. Moreover, regions may demand autonomy in order to gain political influence and improve their relative position on policy formulation and decision-making regarding the development of regional industries and the use

of local infrastructure. Furthermore, regional autonomy movements can emerge in regions with abundant natural resources if revenues from their exploitation are used for the purposes of national extraction and redistribution rather than invested back in the region.

2.6

There are many examples of relatively poor regions that have requested regional autonomy: Sardinia in Italy, Corsica in France, and Galicia in Spain, to mention just three relatively known cases. Writing in the 1970s, Michael Hechter argued that the emergence of regional autonomy movements and separatist mobilization among the "Celtic fringe" of the United Kingdom is one of the consequences of unbalanced economic development, or "cultural division of labor": a pattern of distribution of the most rewarding and prestigious social and economic roles amongst members of the dominant core group (i.e. English), with the concomitant social and economic marginalization of regionally concentrated groups (i.e. Scots and Welsh). Along similar lines, McCrone ([1998](#)) describes the rise of support for Scottish autonomist and separatist agendas in part as a reaction to the economic development policies of the conservative governments in the 1980s.

2.7

Other scholars disagree with this position, claiming that because of their interaction with the state and stronger regions, poor regions are more likely to enjoy economic gains and would therefore have fewer incentives to seek autonomy based on economic grievance. The strength of the economy, they argue, is the condition that would be more likely to increase the emergence of regional autonomy mobilization ([Giordano 2000](#); [Gourevitch 1979](#); [Harvie 1994](#); [Nairn 1977](#)). Demands in favor of autonomy and even separation are part of a struggle to influence decisions on the development and resource extraction of the region's extensive economic infrastructure. Another strong impetus for mobilization is the desire to have a stronger impact on decisions made in the center regarding the spending and redistribution of regional taxes and particularly on decisions concerning the use of regional revenues as subsidies (fiscal redistributions) transferred to the least affluent regions of the state.

2.8

Catalonia in Spain is a good example of an affluent region with a strong regional autonomy movement. Constant strife over conflicting economic interests have always characterized the relationship between Catalonia's — mainly Barcelona's — growing affluent middle class and the kingdoms of Aragon and later Spain. These conflicts resulted in the emergence of support for Catalan's separatist agenda before and during the Spanish Civil War, and became a strong foundation and source of support for right of center (*Convergència Democràtica de Catalunya*, and *Unió Democràtica de Catalunya*) and left of center (*Esquerra Republicana de Catalunya*) Catalan autonomist and independist parties that have become the dominant political powers in the region since democratization in the 1970s ([Marcet and Argelaquet 1998](#)).

2.9

This literature then suggests that regional autonomy movements may indeed appear in either relatively poor or relatively affluent regions. When the economy is perceived as weak, regional autonomy movements will use mobilization to focus the government's attention and commitment to the protection and improvement of the local economy. However, it seems that perception of the economy as strong is associated with even stronger incentives for demanding autonomy. The more affluent regions, so it appears, may have an inherently stronger bargaining chip ([van Houten 2000](#)), pushing regional elites and entrepreneurs to leverage the state to transfer responsibilities and power to the region. The central government's response is dependent on revenues extracted from the affluent regions, in contrast to poor regions that heavily depend on economic redistributions from the center. It follows that regional autonomy demands would be even more likely to appear if the regional economic conditions are perceived as particularly strong, or in other words, if incentives associated with the economy are strong. Formally, then, I expect that:

Hypothesis 2: Strong economic incentives increase the likelihood of the appearance of regional autonomy movements.

Interactions

2.10

Thus far I have described cultural and economic conditions that arguably affect the emergence of regional autonomy movements. A fuller appreciation of the emergence and consolidation of regional autonomy movements requires the study of the combined and relative impact of these mechanisms. Two interactions follow from the previous discussion: (a) the impact of cultural differences under different economic incentives; and (b) the impact of economic incentives in regions with (or without) cultural differences.

2.11

The relationship between cultural differences and the emergence of autonomy demands is contingent on the strength of the of economic incentives that will otherwise be driving demands for autonomy: in the presence of strong economic justifications for mobilization, cultural reasons are relatively less important factors driving autonomy demands. However, if economic justifications for demanding autonomy are weak, cultural differences are the main, if not the only, stimuli of autonomy movements. Consequently, I expect to find the relationship as follows:

Hypothesis 3: Cultural differences strongly increase the likelihood of regional autonomy mobilization where economic incentives are weak yet only moderately increase the likelihood of the emergence of autonomy movements where economic incentives are strong.

2.12

The relationship between the strength of economic incentives and the emergence of regional autonomy movements varies by levels of cultural differences. The likelihood of mobilization in places without (or with very weak) cultural differences is quite small. Strong economic incentives, therefore, become the main reason for demanding autonomy in the absence of cultural justifications to do so. Consequently, I expect to find that:

Hypothesis 4: Economic incentives strongly increase the likelihood of the appearance of regional autonomy movements where cultural differences are weak, and moderately increase the likelihood of the emergence of autonomy demands where cultural differences are strong.



Ethniland: A Simulation of a Multi-Regional and Multi-Cultural State

3.1

The first step in evaluating the propositions discussed above involves the development of an agent-based simulation. For this project I use Ps-I, a modeling platform developed by Ian Lustick and Vladimir Dergachev ([Lustick 2002](#)).^[3] The simulation environment, that I will refer to as *Ethniland*, captures in composite form specific common features of multicultural or multiethnic states corresponding to the collection of elements determined in the literature to be critical in countries that are relatively predisposed to the emergence of regional autonomy demands.^[4]

3.2

The model shares some similarities with other simulations developed to explore related social phenomena, such as: the clustering and consolidation of opinion ([Latané and Nowak 1997](#)); enduring political disagreement ([Huckfeldt, Jonson and Sprague 2004](#)); cultural dissemination ([Axelrod 1997](#)); and the emergence of collective and shared identities ([Lustick 2000](#), [Rousseau and van der Veen 2005](#)). The most important dimension that sets apart this simulation from its aforementioned predecessors is that it is explicitly designed as a non-abstract space, one that resembles a "real world" political construct. While it does not presume to be an accurate representation of any concrete empirical reality and, therefore, is incapable of predicting the future of any specific state, *Ethniland* does provide heuristics exploring the circumstances and historical trajectories that may be more or less conducive to regional autonomy movements.

The topography of Ethniland

3.3

As displayed in Figure 1, the state, Ethniland, is located on a 66×66 square-shaped grid (4356 cells). The external edge of the grid is comprised of a fixed, unbroken, and impermeable array of 260 black-colored "border" cells. The 4096 agents within these borders comprise the polity. The agents in the current model are endowed with sets of characteristics that render them similar to agents presented by the work of Latané and Nowak (1997), Lustick (2000), Brichoux and Johnson (2002), and others.

3.4

Agents are defined by characteristics that may, in turn, affect agent's behavior (i.e. whether to remain activated or substitute an identity/interest for another one). Agents: exert *influence* on others; they vary by the value each attaches to the specific set of identities, preferences or attitudes it holds (*self influence*); and vary in their thresholds for discarding and exchanging states. Agent are arrays (not necessarily people) endowed with a repertoire or portfolio of different states (typically more than two) representing identity and interest preferences, one of which is "activated", visible to the other eight cells in its immediate neighborhood (Lustick et al. 2004; Lustick 2000; Rousseau and van der Veen 2005).

3.5

The polity, as will be described in more details below, is divided into four quadrants, not by boundaries but by changes in patterns of overlapping and shared political identities and political authority. The upper left, or Northwest (NW), quadrant represents the state's political core, two additional quadrants (Northeast and Southwest) approximate regions that have been fairly integrated within the state, and a fourth quadrant (Southeast) models a poorly integrated region which unique characteristics may, under some conditions, give rise to regional autonomy movements.

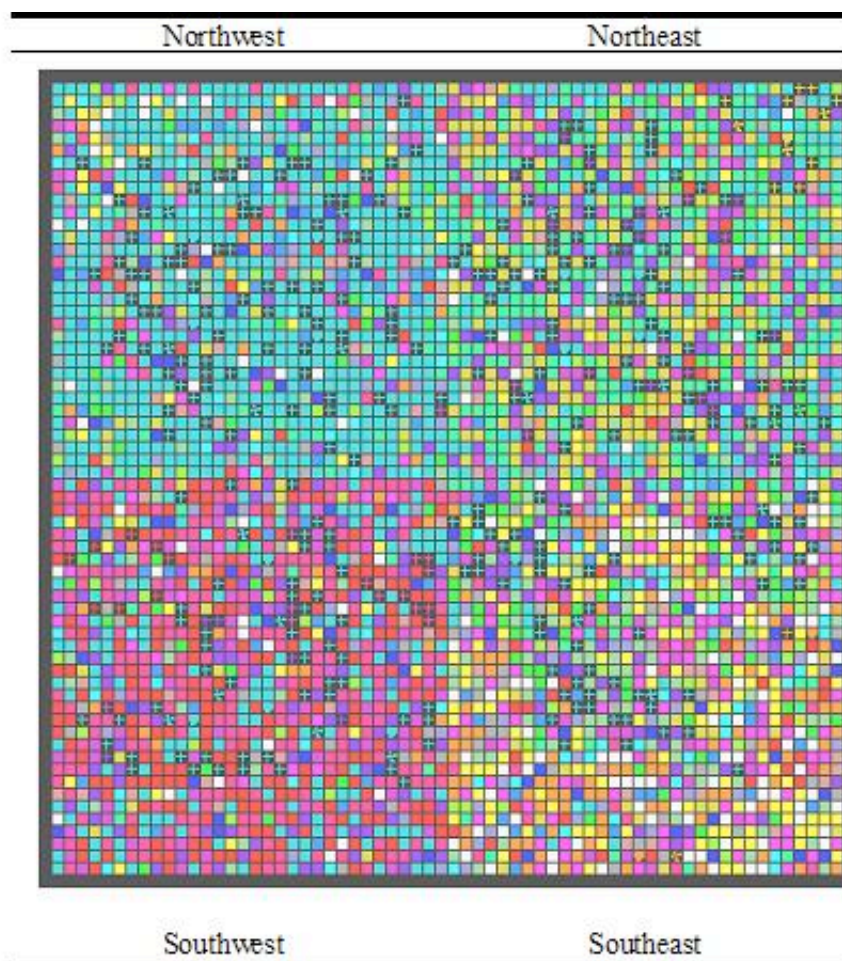


Figure 1. A typical configuration of *Ethniland* at $t=0$ a

3.6

Ethniland features a dominant, but not unitary, national bureaucracy of state authority structure that radiates from a dense institutional core in the Northwest into the other regions and

occupying on average 7% of the cells on the grid (see Figure 2).^[5] The institutions of the regime within the borders include a variety of relatively decentralized structures with overlapping loyalties in areas of identitarian, or cultural, diversity. The simulation also includes one (the southeast) area in which the regime appears as unresponsive set of institutions, in contrast to a regionally predominant identity group deprived of any substantial authority structure or equal representation of its own.

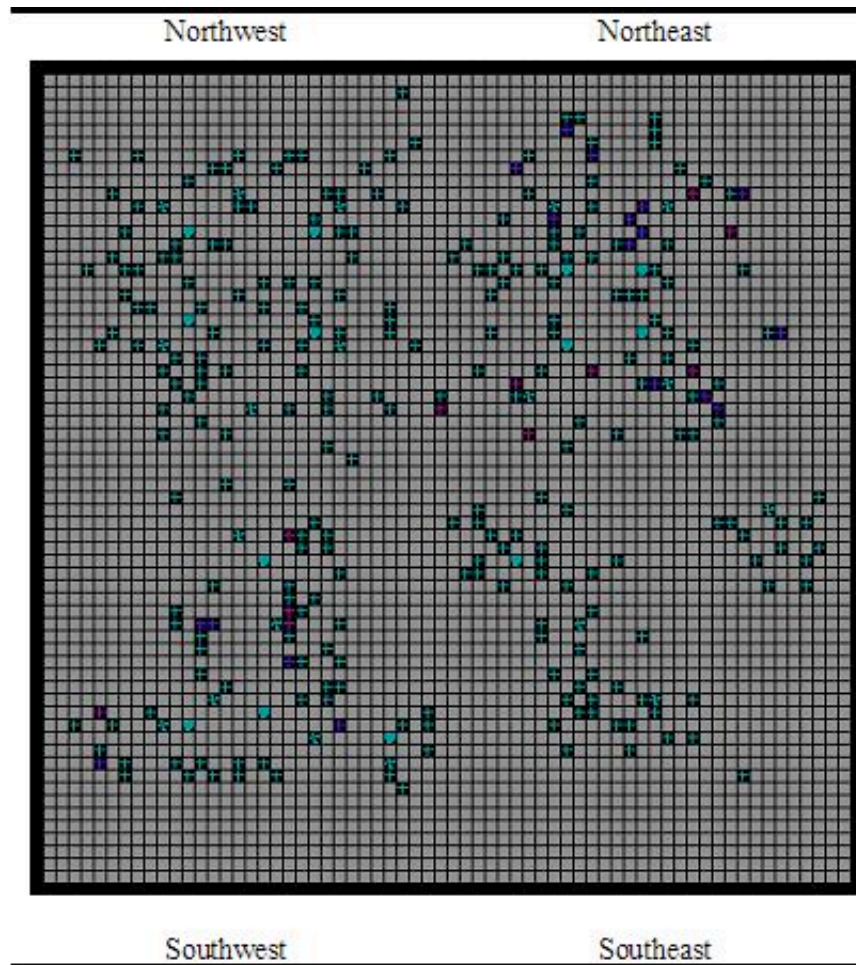


Figure 2. The National Bureaucracy or Authority Structure

3.7

All the "bureaucrats" at $t=0$ have the currently dominant, i.e., incumbent, identity, identity "5" (visually represented by turquoise color) in their repertoires and almost all of them are activated on that identity. Two other identities, identities 4 (purple) and 13 (blue), represent "loyal opposition" national identities. All national bureaucrats have these identities in their repertoires. The national bureaucracy is comprised of a web of more influential agents affecting more strongly the behavior of others. Top-echelon bureaucrats have an influence level of 4, compared to the influence of a basic agent, whose influence level is 1. Top-echelon bureaucrats are few in number, relatively centrally located within the radiating bureaucratic web, comprised (initially) of only the three national identities, and marked visually with a circle inside the normal agent square. Mid-echelon bureaucrats are marked with a spiral, have an influence level of 3, and a slightly larger repertoire of identities and interests reflecting more regionally prevalent preferences in addition to the national ones. Lower echelon bureaucrats, with an influence level 2, share in their repertoire both regionally prevalent preferences and parochial identities along with the three national identities.

3.8

Two regions, northeast and southwest (see figure 3), simulate relationships of multi-cultural states based on principles of multicultural liberalism and/or federalism. National identities were included within the repertoires of bureaucrats and basic agents regardless of their activation on more particularistic identities or the local prevalence of such identities within the repertoires of agents in that region. The tolerant and accepting relationship between the national state and the regions is represented in two ways: the representation, as explained above, of regionally

prominent identities and interests in the mid- and low-levels of the state's bureaucracy in those regions, and in the fact that the most prevalent regional identities in these areas enjoy a small separate regional authority structure. The loyalty of these regional officials to the central state is reflected in the presence of national identities in their repertoires. These separate authority structures can be identified as local arrays of officials activated on colors associated with regionally prevalent identities: "3" (olive) "15" and (light green) in the Northeast; "0" (red) and "11" (burgundy) in the Southwest.

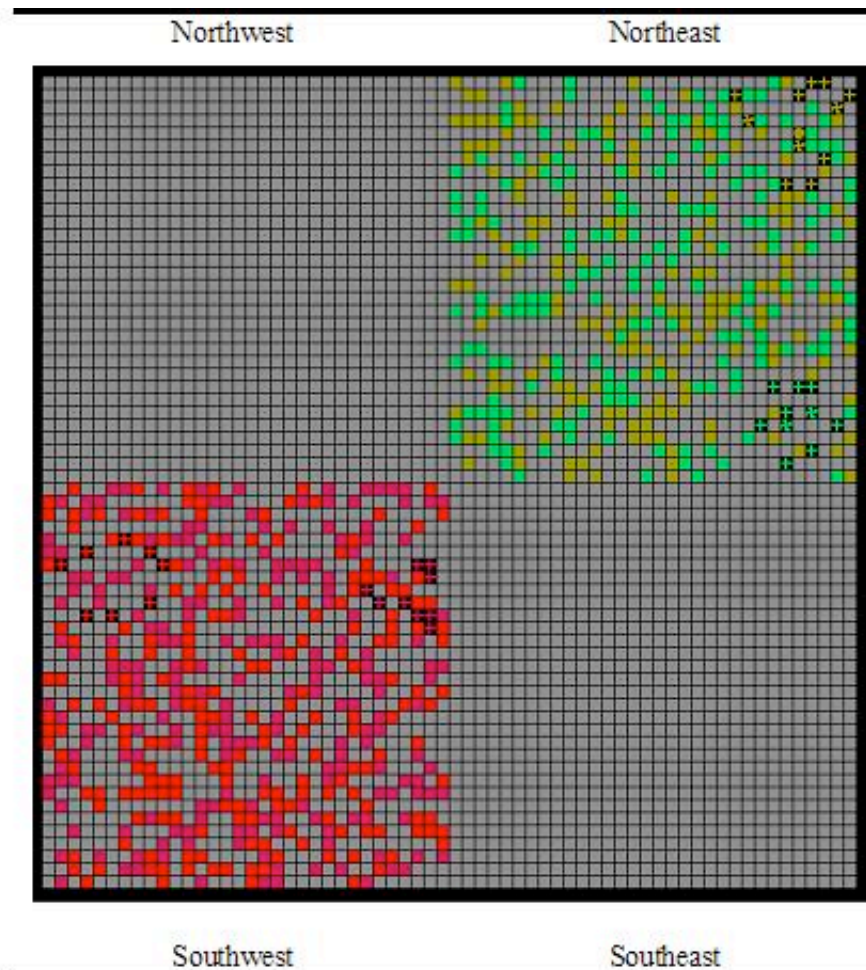


Figure 3. Regional identities and authority structure

3.9

Not all the regions of *Ethniland* enjoy an equally tolerant and cooperative relationship with the polity's core. Indeed, it is not uncommon to find states in the real world that implement asymmetrical standards towards groups and regions within the same country. In some cases, represented, as discussed above, in the configuration of the northeast and southwest quadrants, a state may empower some groups and regions while refusing to acknowledge and accommodate others. Examples may include Corsica that enjoys a relatively unique treatment from the French government or the Spanish "historic nationalities" (Basque, Catalonia, and Galicia) which historical rights, although still debatable, are recognized in the Spanish constitution. The southeastern quadrant (see Figure 4) simulates a region that is controlled by the state but inhabited by a disgruntled regional minority whose identity (10, orange) is present in the repertoires of a large share of the agents in this quadrant. The southeast features another regional identity (16, yellow) representing a historically distinct and somewhat antagonistic identity vis-à-vis the other regional identity. As is typical in many countries, this identity represents a regional ally favored by the regime against a regionally dominant identity. For example immigrants to Wales and Scotland in the 19th century and non-Sunni Arabs in French ruled Syria after the first world war or -groups favored by the state that uses them at times to enhance its influence in the regions. The close affiliation between the favored identity and the state is reflected in the inclusion of the three national identities (5, 4 and 13) in the repertoire of all the agents activated on identity 16.

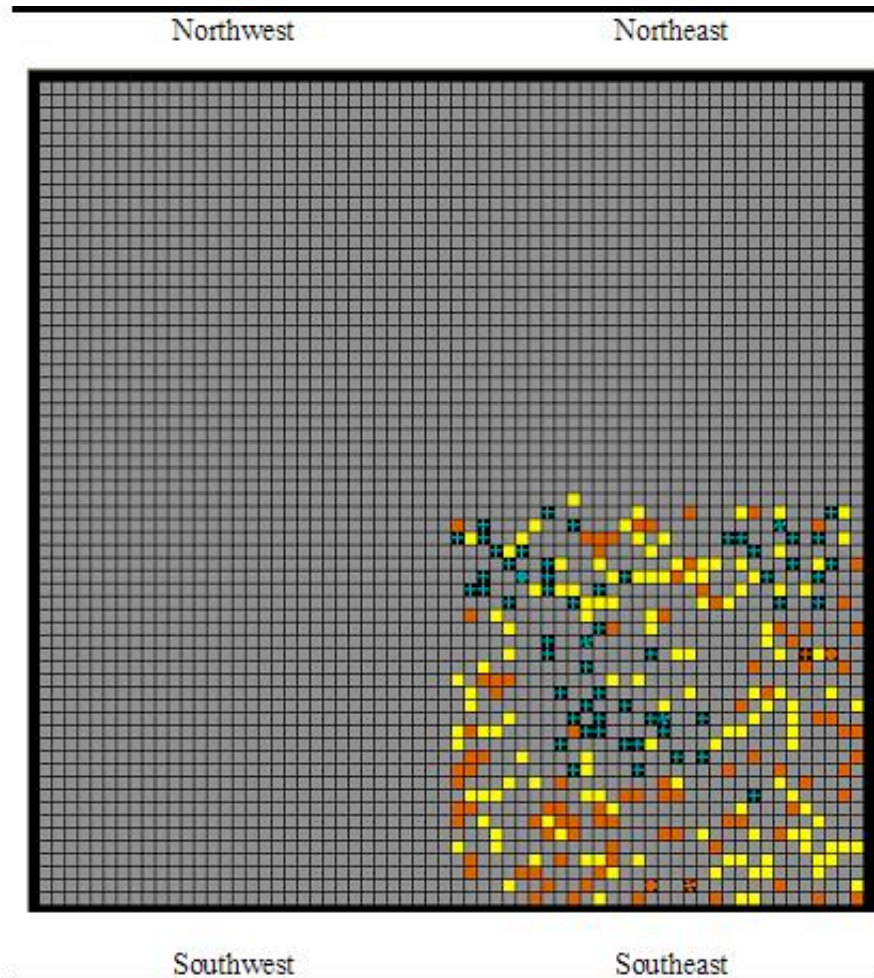


Figure 4. State bureaucracy and regional identities in the southeast region

Rules guiding interaction of agents

3.10

Once the agents in the simulation begin to interact they follow a set of simple algorithmic rules that determine whether to maintain or change their activation: rotation and trading of preferences as a function of changing relative advantages associated with each of the identities and with other local conditions. These substitutions of preferences may in turn emerge into patterns of local clustering and spatially diffused consolidation as some of identities coalesce into control of particular regions or lose their grip on those regions (see also [Latané and Nowak 1997](#), [Lustick and Miodownik 2002](#)). Underlining this approach is a notion that identities — held either individually by people or collectively by groups or states — are not fixed but rather are potentially open for evaluation and can change or solidify over time. The rules guiding agents' behavior are not designed as an operational definition of any one theory of social psychology, nor of constructivist identity theory for that matter. ^[6] The rules, nevertheless, are consistent with theories in social psychology and related fields that attempt to explicitly define and to describe condition affecting the formation and change of attitudes, opinions and identities. ^[7]

3.11

The updating rules combine local information on an agent's neighbors' patterns of identification as well as global incentives reflecting the attractiveness of identities and interests available within the simulation's spectrum. In essence, then, agents are affected by the composition of their social surrounding (prevalence of identity and influence of their eight immediate neighbors) and by global information (available through a "mass media" mechanism) on rewards (or punishments) one can accrue for public identification with one identity group or interest or other. These global incentives, in other words, provide agents with an idea of the price, or potential "return on investment" it could expect from various "behaviors" vis a vis identity activation, and therefore, can be taken as an indication of incentives, economic among other, that may drive agents to attach political value to dormant regional identities and interests.

3.12

On updating time-steps each agent computes identity weights for each of the identities in its repertoire and the activated identities of the eight agents surrounding it (the agent's Moore neighborhood), taking into account global incentives for these identities and the influence levels of all the agents in the neighborhood.^[8] The calculations of the relative "weight" of each identity lead each agent, depending on whether the "weight" satisfies its endogenous thresholds, to: remain activated on its currently activated identity; rotate into activation an alternative identity from its repertoire; substitute an identity from outside its repertoire for one inside its repertoire; or, in cases of a fairly overwhelming discrepancy in favor of an identity not in its repertoire, simultaneously substitute and activate on an identity previously absent from its repertoire.^[9]

Outcome Variables

3.13

In this project I conceive three outcome variables to highlight separate yet related aspects of autonomy mobilization: the emergence of political boundaries; support for the regional identity; and clustering of the regional identity. These measures provide, separately and in combination, an account of the emergence of a regional autonomy movement in the southeast quadrant.

Political Boundaries

3.14

The first of the outcome variables is modeled as the transformation of some agents into border cells or political boundaries — small spatial zones of separation comprised of unchangeable "border" agents. The transformation of agents into border cells represents, therefore, an important aspect of autonomy mobilization in the real world — the fact that it affects the salience of regional issues by separating communicative spaces representing realms of regional and non-regional influence, identification and interests.

3.15

The mechanisms that drive the emergence of political boundaries are similar to those that result in the appearance of other forms of social boundaries. The production of boundaries may be the result of processes that take place at the state, group and/or individual levels. Tilly (1998 p. 10), in his account of the production of inequality, suggests that two mechanisms that he calls *exploitation* and *opportunity hoarding* drive the appearance of social boundaries. According to this account the emergence of boundaries is driven by the alienation and exclusion of regions and populations from enjoying their share in the goods provided by the state. However, Tilly stresses, boundaries emerge not only externally (i.e. as a result of a group being bounded by the center) but are also produced by internal processes. In particular, boundaries are driven by a sustainable ability to support and enhance networks of activities among the members of the bounded group. From an individual perspective, the emergence of boundaries is related to psychological processes of self-identification and categorization that crystallize in the entrenchments of institutionalized expressions of in-group and out-group affiliations (Lamont and Molnár 2002).

3.16

Although there is very little consensus regarding the necessary and sufficient conditions for the emergence of regional autonomy movements (i.e., economic incentives, cultural differences, political institutions and more), most theoretical frameworks embed a common set of fundamental assumptions, reflected in the brief discussion above. These assumptions generally require the satisfaction of three conditions: alienation, nontrivial size, and isolation from its peers and antagonistic relations with others.

3.17

The alienation rule assumes that regional autonomy movements will rarely appear without a deep polarization in society and the alienation of one or more identities from the central political realm. Political boundaries are less likely to appear in the most integrated regions and are more likely to appear if and when integration fails. In order to satisfy the alienation rule agents are required to be part of a minority group and no more than 20% of the agents in that

group are allowed to have the dominant national identity in their repertoire.^[10]

3.18

The second condition presumes that autonomy mobilization will be quite rare without the subordination of small, but not negligible, identities. Political boundaries, therefore, can only emerge on behalf of an identity with a substantial activated presence in the state. To satisfy the non-trivial size requirement political boundaries can emerge only on behalf of identities (excluding the dominant one) activated by 10% or more of all agents.^[11]

3.19

Lastly, the third condition supposes that regional autonomy movements will appear only in regions that are subject to social and political tensions that serve to politicize certain identities or interests; in other words, political boundaries are more likely if people, for example, are isolated from their peers and have strong antagonistic relations with others, a fact that may increase the political saliency of their identity. To satisfy the third condition an agent is eligible for transformation into a border-cell only if it is significantly isolated from its other peers: if at least 3 of the agents it interacts with are activated on an identity other than its own.

3.20

Having satisfied the requirements of these three rules does not constitute a sufficient condition for the transformation of eligible agents into border cells. In fact, in order to have a hard test of the hypotheses, a fourth and last rule must be implemented. The rule sets a small probability between 10% and 30% for the emergence of boundaries.

Minority support

3.21

The second outcome measures the public identification with the regional identity, i.e. the number of agents in the southeast region activated on the identity representing the regional minority (number 10, orange) by the end of each run. One important aspect of any successful autonomy campaign is the support it receives from the general public. Indeed, the willingness of individuals to take personal risks and express alternative preferences, even when such are a minority within the population, is seen as a necessary condition for the emergence of successful, even revolutionary, mobilization (e.g. [Kuran 1991](#), [Brichoux and Johnson 2002](#)).

Minority clustering

3.22

The third outcome accounts for the degree of clustering of regional minority identification. While support for the regional minority may, at times, be quite large, the relatively diffused or concentrated distribution of regional minority support may have a significant impact on mobilization. Research suggests that minority longevity is preserved, among other ways, by the emergence of homogeneous clusters that reinforce in-group affinities by isolating the bulk of the group from persuasive pressures coming from the outside ([Latané and Nowak 1997](#); [Axelrod 1997](#)).^[12]

3.23

Measuring the clustering of the regional identity is somewhat more difficult than counting the number of agents activated on identity 10. To account for clustering we begin by assessing individual agent's degree of isolation: the extent to which an agent encounters others that express preferences for the same identity as it does. The smaller the number of these agents the more isolated the agent is. Isolation ranges from 0 when an agent is fully surrounded by others activated on the same identity to 8 if none of its neighbors express the same identity preference. The degree of clustering of the regional identity is measured by aggregating the isolation scores of agents activated on the regional identity: the smaller the aggregate-number the larger the degree of clustering of the regional identity.



4.1

To evaluate the theoretical propositions presented in this paper I used *Ethniland* to generate 5000 trajectories — possible "futures" or "histories". While maintaining the main characteristics that render each run a model of a multi-regional and multi-ethnic state, "versions" of the simulation varied along the principal parameters under investigation, i.e. cultural differences and economic incentives, as well as by some relevant controls. By running initial snapshots repeatedly under varying conditions, it is possible to test the robustness of specific outcomes and use conventional statistical procedures to analyze the results.

Cultural differences

4.2

The southeast region's cultural differentiation from the rest of the state was represented by the prevalence of agents that have (at time zero) a latent preference for identity 10, the regional identity. These, in other words, are agents that express preference for other identities and interests yet have the regional identity as part of their repertoire. The larger the number of agents latently subscribed to the regional identity the more differentiated the southeast from other parts of the state. Overall, the randomized 5000 versions of the simulation produced significant variation along this dimension: the number of agents subscribed to identity 10 varied between 343 and 733 (33% and 72%) of the 1024 agents in the southeast quadrant.

Economic incentives

4.3

Another experimental parameter varied the level of the economic benefits that may result from open association with the regional identity. Recall that agents consider local information about the prevalence of an identity/interest in their immediate social surroundings in addition to information on how rewarding (or damaging) public identification with one or another identity group or interest would be. To introduce variation in the strength of economic incentives, each iteration combined signals on the general attractiveness of any identity or interest (global incentives) with the likelihood that these signals would change. The range of the incentives varied randomly between (-3) and (+3) and the likelihood that incentives would change in any time-step varied between 0.5% and 1%.

4.4

In addition to the parameters representing cultural differences and economic incentives, the simulations varied on several other important control parameters: (a) the public support for the regional identity at time zero, i.e. the number of agents in the southeast activated on identity 10 (between 68 and 131 agents, or 7%–13% of the agents in the quadrant); (b) the size of the regional branch of the state's bureaucracy, i.e. the sum of all the "bureaucrats" activated on the national identity (5) (between 32 and 84 or 3%–8% of the regional agents); and (c) the size of the regional leadership, i.e. agents with stronger level of influence that are activated on identity 10 (between 0 and 6 or 0%–2% of the region).

4.5

Each of the 5000 iterations evolved during one of four time periods (58, 108, 158, and 208 time steps) starting with a rapid "scrambling" of the global incentives during the first eight time steps. The scrambling adds an aspect of randomness — thus accounting for the kind of unpredictable "accidents" that may have a significant impact on the unfolding of historical events. For each of the iterations, I used a statistical monitor to collect data on the distributions of regional identities, the clustering of regional identities, and the transformation of agents into border-cells, all of which are going to be discussed next.

4.6

Before turning to discuss some results let me briefly describe two examples of what may be considered "typical" runs. In figures 5 and 6, the right is the initial arrangement of agents at time zero, while the picture on the left shows the configuration of the landscape after 58 time steps.

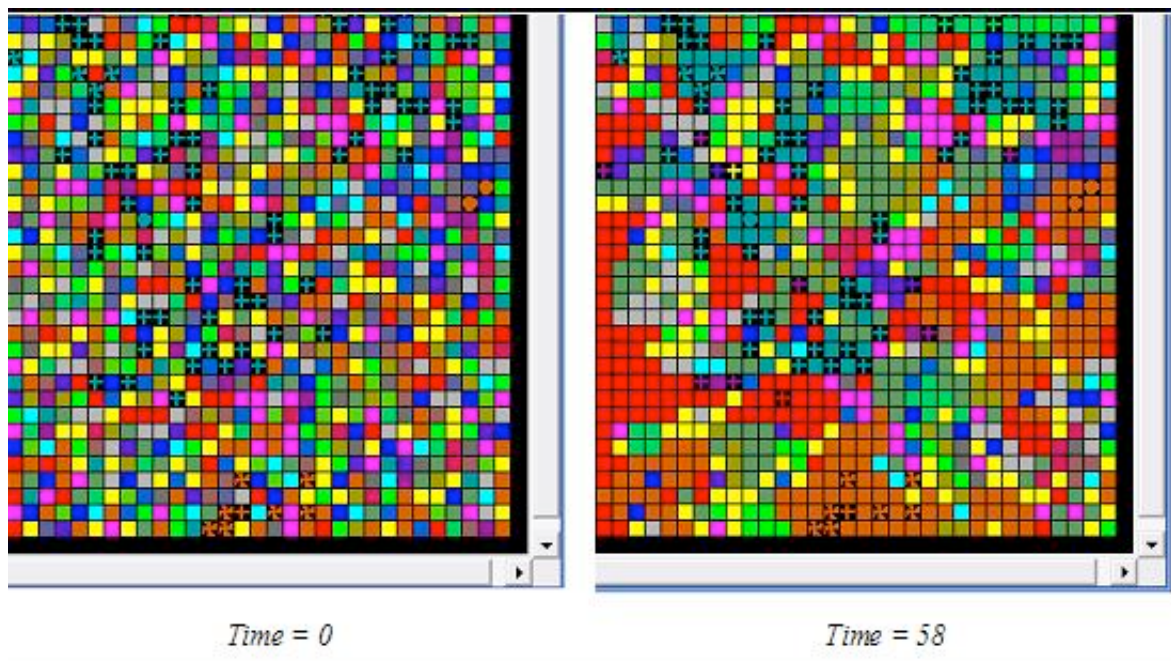


Figure 5. A run with low minority support, and clustering and no political boundaries (run 1)

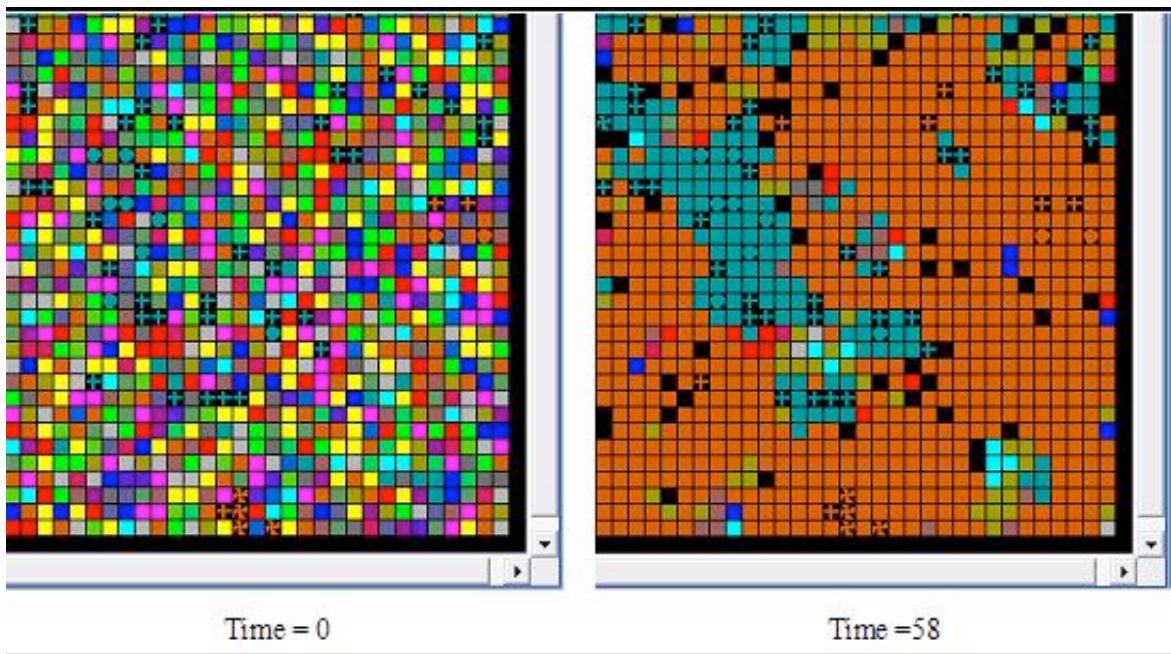


Figure 6. A run with large minority support, strong clustering and political boundaries (run 38)

4.7

It is evident in figure 5 (run number 1) that after 58 time steps this iteration did not lead to strong support for the regional identity, significant clustering, or the emergence of border-cells indicating political boundaries. However, the iteration presented in figure 6 (run 38) that began evolving from a similar spatial configuration of the agents (although with slightly more latent subscription) resulted in a significantly different outcome: strong support for the regional minority, strong minority clustering, and the emergence of political boundaries (black cells).

4.8

Figure 7 presents a comparative outlook of the diffusion and decline in support for the regional identity in the two iterations described above. The red dots represent the number of agents in the southeast activated on identity 10 for each of the 58 time-steps. Initially both iterations register a slight increase in the support for the regional minority, probably as a result of very localized small clusters of minority identification. As time moves forward we notice a diverging pattern that should be attributed to the different conditions (cultural, economic etc.) affecting the interaction of agents. The early support for the regional minority crumbles in the first iteration, but rises very quickly reaching a plateau in the second example.



Figure 7. Diffusion and decline of minority support (runs 1 vs. 38)

Results

5.1

Let me turn now to discuss how the results highlight some of theoretical relationships discussed in previous sections. Table 1 presents three statistical models estimating the impact of the different parameters on the three dependent outcomes: an OLS regression assessing the support for the regional minority (model 1); an OLS estimating the effect of the theoretical variables on the clustering of the regional minority (model 2); and a Logit estimation of the likelihood for the emergence of political boundaries (model 3). For each of the outcomes a first model is estimated including all the theoretical predictors (A) and a second, more accurate model with only the statistically significant predictors. Given the nature of the data and the large number of observations, statistical significance was flagged using a very conservative (high) statistical threshold ($p < .0001$): most coefficients in each of the three models were either highly significant or far from being statistically significant at all.

Table 1: Statistical models of Minority Support, Minority Clustering, and Political Boundaries

Model 1 (OLS)
Regional Minority

Model 2 (OLS)
Regional Minority

Model 3 (Logit)
Political Boundaries

	Support (t=end)		Clustering (t=end)		(t=end)	
	(A)	(B)	(A)	(B)	(A)	(B)
	B (S.E.)	B (S.E.)	B (S.E.)	B (S.E.)	B (S.E.)	B (S.E.)
<i>Cultural Differences</i>	.40* (.04)	.40* (.02)	-.16 (.06)	-.15* (.03)	.008* (.001)	.008* (.001)
<i>Economic Incentives</i>	.17 (.14)	.14* (.04)	-1.28* (.22)	-1.17* (.04)	.021* (.003)	.021* (.003)
<i>Cultural Differences* Economic Incentives</i>	-6.07×10 ⁽⁻⁵⁾ (.00)		8.30×10 ⁽⁻⁵⁾ (.00)		-2.3×10 ⁽⁻⁵⁾ * (.0000)	-2.3×10 ⁽⁻⁵⁾ * (.0000)
<i>Regional Leadership</i>	.62 (.78)		-4.31* (1.21)	-4.73* (1.21)	-.022 (.015)	
<i>State's Bureaucracy</i>	-.26 (.26)		-.97 (.41)		-.002 (.005)	
<i>Regional ID Support</i>	2.19* (.29)	2.45* (.20)	2.16* (.45)	2.21* (.45)	.023* (.006)	.03* (.004)
<i>Regional ID Clustering</i>	.04 (.04)		.20* (.06)	.21* (.06)	.001 (.001)	
<i>Time</i>	.14* (.03)	.14* (.03)	-.18* (.05)	-.18* (.05)	.003* (.001)	
<i>BC transformation Probability</i>					-5.5 X 10 ⁽⁻⁵⁾ (.000)	
<i>Constant</i>	-258.15* (36.41)	- 255.83* (23.74)	484.90* (56.43)	416.12* (43.06)	-10.08* (.79)	-9.92* (.65)
<i>F</i>	70.48	140.37	140.72	186.54		
<i>R²</i>	.10	.10	.18	.18		
<i>2</i>					542.10	536.56
<i>Log-likelihood</i>					2405.85	2408.63
<i>Predicted correctly</i>					76.7%	76.7%

* $p < 0.001$

5.2

By and large the results of these simulations support the expectations expressed in the first and second hypotheses and tentatively support the third and fourth propositions. Each of the three statistical models presented in the table suggests that cultural differences are strong predictors of the emergence of autonomy demands; this pattern is robust across all three conceptualization of the outcome variable. In other words, cultural differences increase the overall support the regional minority receives, are positively associated with a more significant clustering of this minority, and increase the likelihood of border-cell transformation, i.e. the emergence of political boundaries. Similarly, all three statistical models suggest that the strength of the economic incentives is positively associated with the three conditions epitomized as approximating the emergence of autonomy movements. [\[13\]](#)

5.3

The impact of cultural differences and economic incentives is robust even when one accounts for other explanations of the outcome variables. Nevertheless, each of the three models reveals additional parameters affecting the specific aspects of autonomy mobilization. Model 1 suggests that the level of support for the regional minority at the beginning of the run and the

length of each run impacts the overall level of support at the end. According to model 2 significant regional minority clustering results, as with the support the regional identity receives, from the combination of strong economic incentives, wide cultural differences, and initial levels of regional identity support. In addition, clustering of the regional minority identity at the end of each run is affected, obviously, by the level of initial clustering as well as by the prevalence of the regional leadership, that seem to play an important role in affecting the diffusion and spatial organization of the support the regional identity receives. Lastly, model 3 suggests, unsurprisingly, that cultural differences, economic incentives, the level of initial support and the length of each run affect the emergence of political boundaries; other variables that were positively associated with support for the regional identity and minority clustering do not affect the emergence of political boundaries directly. Interestingly, the probability for border cell transformation I used (between 10–30%) was not a statistically significant predictor of the emergence of political boundaries.^[14] Central to our purpose here is the fact that model 3 returns a statistically significant coefficient for the third and fourth hypotheses that anticipated an interaction in the effect of cultural differences and economic incentives on the emergence of political boundaries.

5.4

The third hypothesis anticipated that the impact of cultural differences would be more pronounced in regions with the weakest economic incentives for mobilization. The interaction term included in model 3 lends statistical support for this proposition. To illustrate this interaction let us consider figure 8 below that plot results calculated on the basis of model 3(B).

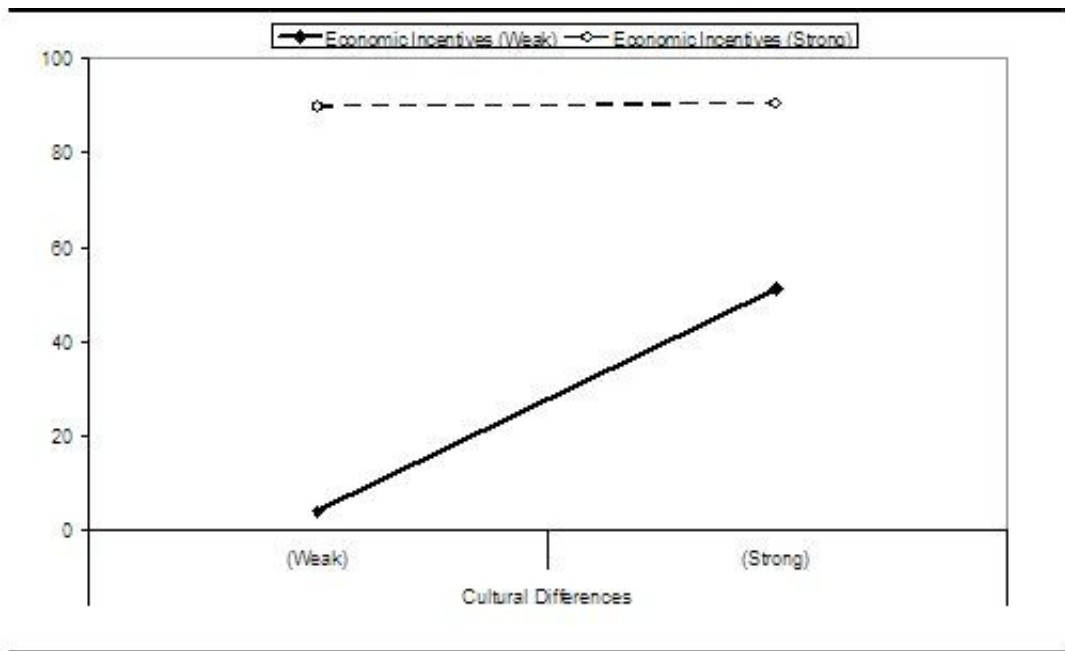


Figure 8. Effect of cultural differences on political boundaries by economic incentives

5.5

Figure 8 clearly shows a sharper rise in the appearance of political boundaries in situations with only weak economic incentives for mobilization — i.e. if demands for autonomy cannot be justified and sustained by the expectation of great economic returns. The pattern suggests that the impact of cultural differences on the emergence of political boundaries is significantly more pronounced if economic incentives are weak (hypothesis 3).

5.6

It has already been noted that the likelihood of autonomist mobilization rises as the strength of economic incentives increases (Hypothesis 2). Model 3, however, indicates that the positive impact of the economy on the emergence of political boundaries varied by the regional level of cultural differentiation. This data pattern corroborates the expectation described in the fourth hypothesis according to which economic incentives would have a more pronounced impact on the appearance of regional autonomy movements in the least culturally distinctive regions. To illustrate this interaction consider figure 9 below.

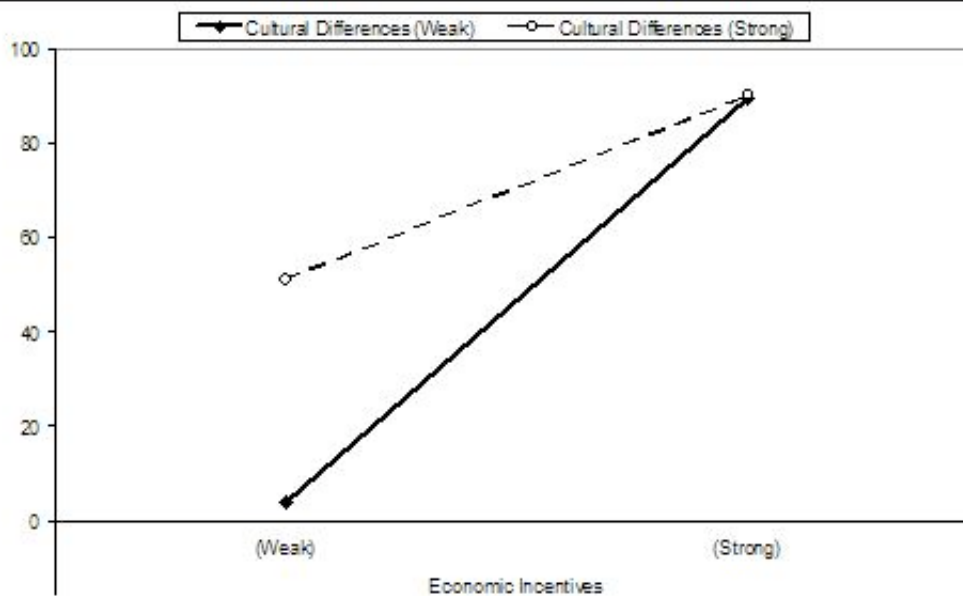


Figure 9. Effect of economic incentives on political boundaries by cultural differences

5.7

Autonomy movements, as we have seen (and as we know) appear sometimes even in the most impoverished regions. In some places, the economy is the sole reason for demanding autonomy. In others, economic incentives are secondary to cultural factors that drive regional mobilization and justify autonomy demands. Figure 9 suggests that that political boundaries emerged more frequently if the economic incentives for mobilization were strong. However, the strength of the economic justifications added almost nothing to the likelihood of mobilization when cultural conditions were strong. Under such conditions, culturally-based factors (i.e. the desire to attain political representation for a group, regain historic privileges, protect religious rights, etc.) are among the main drivers for the emergence of regional autonomy movements. Economic incentives appear to increase the prospects of regional autonomy movements when cultural motivations are strong, but their impact on their impact is more pronounced in regions without any apparent (cultural) reasons to seek autonomy. In such places, economic incentives may be the only motivation and justification driving the emergence of demands for autonomy.



Concluding remarks

6.1

In this paper I employed a specialized agent-based computer simulation as a laboratory for "thought experiments" designed to evaluate alternative theoretical expectations with particular emphasis on the independent and combined consequences of regional economic and cultural circumstances on the emergence of three related aspects of regional autonomy mobilization: support for the regional minority, clustering of the minority group, and the emergence of political boundaries.

6.2

Cultural differences add to the likelihood of regional autonomy mobilization, but are not a necessary condition for the articulation of autonomy demands (Hypothesis 1). As I argued in the literature section, autonomy demands are more likely to emerge if the regional population shares a common culture, history, ethnicity, or religion that is distinctive from the rest of the inhabitants of the state. Autonomy movements attempt to make such communal affiliations the premise for the allocation of political rights and privileges, and these affiliations provide the justification for allowing regions and peoples to conduct their own affairs with greater autonomy as part of the state or separately. Researchers have argued, however, that such cultural common denominators are not necessary for justifying the existence and activities of regional autonomy movements. Demands for autonomy can be asserted even in the least culturally-differentiated regions as well, and even in places that are not culturally distinctive from other regions and from the political center (e.g., Northern Italy).

6.3

The first hypothesis was strongly supported with the simulation–data. The three indicators of autonomy mobilization used in the experiments: support for mobilization, minority identification, and the emergence of political boundaries are more likely to appear in culturally distinctive regions, as shown in the simulated data. As anticipated, however, the simulations suggest that autonomy demands might also appear for reasons that have little or nothing to do with cultural differences. Put differently, distinctive cultural, historic or ethnic identities are not necessary conditions of mobilization.

6.4

Moreover, I argued that the impact of cultural differences on regional autonomy mobilization would be more pronounced in regions with the weakest economic incentives for mobilization (Hypothesis 3). The impact of cultural differences on the emergence of autonomy mobilization is contingent on the existence (or absence) of strong economic incentives for mobilization. If economic incentives for mobilization are strong, cultural justifications are *relatively less important* factors behind the motivation for demanding autonomy. However, if economic justifications for demanding autonomy are scarce, cultural differences are the main, if not the only, catalyst for autonomy movements. The simulation results partly support this expectation. The data shows that the impact of cultural differences on the emergence of political boundaries separating the region from other parts of the state was more pronounced if economic incentives for mobilization were weak. Notice that cultural differences contributed to a rise in the appearance of political boundaries when economic incentives were either weak or strong, but affected a much sharper increase in the frequency of mobilization *only when the economic incentives were weak*. In other words, cultural differences play a significant part in explaining mobilization, particularly when no other incentives motivate regional politicians to demand autonomy.

6.5

Demands for recognition and accommodation of culturally distinctive regions are very common. Notwithstanding this normative grounding, results of the simulations suggest that cultural differences are not necessary condition for mobilization. In some places, cultural differences are the primary and even the only justification for mobilization. In others, cultural differences are relatively less important, particularly if regional politicians are exposed to other (mainly economic) incentives to demand autonomy.

6.6

Strong economic incentives increase the probability of regional autonomy mobilization. In other words, autonomy demands are more likely to emerge in the most prosperous regions where the economic incentives for mobilization are the strongest (Hypothesis 2). Researchers agree on the impact that economic justifications can have on the articulation of political movements that demand autonomy, but disagree on the specific economic conditions that are consequential to the emergence of such movements: whether a region's economic relative domestic strength or weakness encourages regions to politicize the economic position and demand autonomy. The literature seems to suggest that regional autonomy movements can appear in *either* poor or affluent regions. However, incentives for mobilization would be stronger in the more affluent regions that can take advantage of the economic circumstances and push the central government—whose operation depends on revenues collected from the affluent regions — to make more concessions in favor of those regions. It follows then, that the more affluent regions would have stronger economic incentives to demand autonomy.

6.7

The second hypothesis was strongly supported by the agent–based simulations. The simulated data suggest that, as expected, support for mobilization, the identification with the regional minority and the appearance of political boundaries are all more likely when economic incentives are strong. However, the simulations also indicate that autonomy demands could sometimes emerge even in the most impoverished regions — i.e., when economic incentives for mobilization are relatively weak.

6.8

In addition, I anticipated that economic incentives would have a more pronounced impact on the appearance of regional autonomy movements in the least culturally distinctive regions (hypothesis 4). The impact of strong economic incentives on the emergence of regional

autonomy mobilization (and on the appearance of political boundaries in particular) vary by levels of cultural differences. If cultural justifications for demanding autonomy are strong, then economic incentives are less critical for regional mobilization. On the other hand, in the absence of (or very weak) cultural reasons for demanding autonomy, the strength of the economy becomes the main justification for demanding autonomy.

6.9

Results of the agent-based simulations corroborate this expectation, showing that the strength of the economic incentives has a more pronounced impact on mobilization in the least culturally distinctive regions. The odds of autonomist mobilization rise as the strength of economic incentives increases. However, the economy is hardly ever the one and only explanation. The simulations show that autonomy movements appear sometimes even in the most impoverished regions. In some places, the economy is the sole reason for demanding autonomy. In others, economic incentives are secondary to cultural or political factors that drive regional mobilization and justify autonomy demands.

6.10

To conclude; I began this paper by pointing to the striking absence of a clear and consistent theoretical foundation appropriate for future policy guidance on how should central governments approach elites and political movements that demand stronger autonomy for the groups or region. The literature, I have argued, devotes significant attention to exposing circumstances that affect the emergence (and success) of regional autonomy movements but scholars disagree on the relative importance of some of these alternative mechanisms. This lack of scholarly consensus hinders the efforts of policy-makers to respond to demands raised by supporters of autonomy and self-determination, since for every policy recommendation, there are studies showing that it would either work well or work terribly.

6.11

This study demonstrates that some of the fears may be justified while others overstated. In this paper, I began to unpack the effects of two factors – cultural differences, and economic incentives – that are believed to be major facilitators of regional mobilization. It suggests that explanation of regional autonomy demands and any analysis of the presumed effects of specific institutional arrangements on their rise, and trajectory need first and foremost to rely on more careful, nuance and dynamic understanding of the independent and interactive effects of other crucial factors that characterize the relationship between a specific region and the political center.



Appendix A: Summary of patterns of political influence and identification in *Ethniland* at time 0

<i>Region</i>	<i>Agent class</i>	<i>Repertoire</i>	<i>Influence Percent</i>	
<i>Northwest</i>	Regime Bureaucrats	{[Regime]}	4	0.4
	Regime Bureaucrats	{[Regime], Other}	2, 3	8.5
	Regime supporters	{[Regime], Other}	1	52.9
	Other agents	{Regime, [Other]}	1	38.2
<i>Northeast</i>	Regime Bureaucrats	{[Regime]}	4	0.4
	Regime Bureaucrats	{[Regime], Regional, Other}	2, 3	6.1
	Regime supporters	{[Regime], Regional, Other}	1	31.7
	Regional	{Regime,	4	0.1

	authority structure	[Regional]}		
	Regional authority structure	{Regime, [Regional], Other}	2, 3	2.1
	Regional agents	{Regime, [Regional], Other}	1	35.8
	Other agents	{Regime, Regional, [Other]}	1	23.8
<i>Southwest</i>	Regime Bureaucrats	{[Regime], Regional}	4	0.4
	Regime Bureaucrats	{[Regime], Regional, Other}	2, 3	6.3
	Regime supporters	{[Regime], Regional, Other}	1	27.4
	Regional authority structure	{Regime, [Regional]}	4	0
	Regional authority structure	{Regime, [Regional], Other}	2, 3	1.7
	Regional agents	{Regime, [Regional], Other}	1	39.9
	Other agents	{Regime, Regional, [Other]}	1	24.3
<i>Southeast</i>	Regime Bureaucrats	{[Regime]}	2,3,4	6.0
	Regime supporters	{[Regime], 16, 10, Other}	1	11.0
	Regional Entrepreneurs	{[10], Other}	2,3,4	1.0
	Regional agents	{Regime, [10], Other}	1	9.1
	Regional agents	{Regime, [16], Other}	1	12.6
	Other agents	{Regime, 10, 16 [Other]}	1	61.2

[] Active identity; {} identities in repertoire.



Appendix B: agent updating rules

B.1

Each mutable agent updates its activation on every other time step. On each updating time step each agent counts all activated identities in its neighborhood (including its own identity), taking into account each agent's *influence*, as well as the global *incentives* (used in this model to operationally define economic incentives) assigned to the identities. Incentives are produced for the landscape exogenously by a random number generator and can fluctuate within a certain pre-defined range ((-3) to (3) in this paper. The probability of a change in the incentive value for any one of the identities in the simulation's spectrum is set for each one of the 5000

iterations on a random number between 0.5% and 1% (the probability of change during the first 8 time-steps or the "scrambling" period was set on 50% for all the iterations).

B.2

This operation returns an "identity weight," or "count," for each activated identity in an agent's neighborhood.

$$Identity\ weight_i = \sum_{\substack{activated[A] = i \\ A \in neighborhood}} Influence[A] + incentive_i \quad (1)$$

In addition to calculating the relative weight of each identity in its neighborhood, agents must also identify candidate identities that could be discarded, rotated, swapped out, or acquired. A *discard candidate* is the identity with the smallest count in an agent's repertoire (including the active identity):

$$Discard\ candidate = \operatorname{argmin}_{i \in repertoire} identity\ weight_i \quad (2)$$

A *swapout* candidate is the identity with the smallest count among the agents' nonactive identities (i.e., all excluding the active identity):

$$Swap-out\ candidate = \operatorname{argmin}_{\substack{i \in repertoire \\ i \neq activated}} identity\ weight_i \quad (3)$$

A *rotate* candidate is the identity with the highest count among all the subscribed identities:

$$Rotate\ candidate = \operatorname{argmax}_{i \in repertoire} identity\ weight_i \quad (4)$$

Finally, an *acquire* candidate must not be part of the subscribed set and is the one with the highest count in the identity spectrum:

$$Acquire\ candidate = \operatorname{argmax}_{i \notin repertoire} identity\ weight_i \quad (5)$$

B.3

As time progresses the repertoire of active agents evolves according to the following rules. In this example the triggering thresholds for each operation are those assigned in *Ethniland* for the most basic agents.

1. If the count of the activated identity equals or is larger than the count for any other identity, the agent's repertoire and activated identity stay the same.
2. If the count for the rotate candidate is larger than or equals two, the agent activates on the rotate candidate.
3. If a discard candidate and an acquire candidate have been defined and the count for the acquire candidate is equal to or larger than seven, the agent discards the candidate identity and activates the acquired identity.
4. If both swap-out and acquire identities have been defined, and the count of the acquire identity is equal to or larger than five, the acquire candidate replaces the swap-out candidate in the agent's repertoire.

New repertoire =

$$\left[\begin{array}{ll}
 \text{countactivated} \geq \max \text{count}_i, & \text{old repertoire.} \\
 \text{countrotate candidate} \geq 2, & \text{activate(rotate candidate).} \\
 \text{countacquire candidate} \geq 7, & \text{activate(acquire candidate),} \\
 \text{unsubscribe(discard candidate).} & \text{subscribe(acquire candidate),} \\
 \text{countswapout candidate} \geq 5, & \text{unsubscribe(swap-out candidate).} \\
 \text{Otherwise} & \text{old repertoire.}
 \end{array} \right. \quad (6)$$

Border cell transformation rules

B.4

1. Alienation: To satisfy this requirement an agent is eligible for transformation into a border-cell if its activated identity is defined as an *oppositional identity* (OI): (a) it is not the *dominant identity* (DI), and (b) no more than 20% of the agents in that identity group are also subscribed to the DI. The following is a formal expression of (a), the first condition, where [A] denotes an agent, and i denotes any of the identities in model:

$$OI_i = \text{TRUE IF } \sum_{DI \in \text{repertoire} \ \& \ [A]_i \neq DI} [A]_i < 0.2 \cdot \sum_{[A]_i \neq DI} [A]_i \quad (7)$$

2. Non-trivial size: an agent is eligible for transformation into a border-cell if its activated identity is defined as a *subordinate identity* (SI): any identity (but not the DI) activated by 10% of more of all agents. Formally, the second condition can be expressed as follows:

$$SI_i = \text{TRUE IF } \sum_{[A]_i \neq DI} [A]_i > 0.1 \cdot \sum [A] \quad (8)$$

3. Isolation: To satisfy the third condition an agent is eligible for transformation into a border-cell only if it is significantly isolated from its other peers: if at least 3 of the agents it interacts with are activated on an identity other than its own. The isolation of an agent [A] is the sum of all the agents [B] that are part of (\in) its neighborhood, as long as their activated identity (B) differs from the identity activated by the central agent (A).

$$\text{isolation}[A] = \sum_{\substack{B \in \text{neighborhood } [A] \\ \text{activated}(B) \neq \text{activated}(A)}} \text{agent}[B] \quad (9)$$

4. Probability: The rule sets a small probability (p) for agent transformation. Each iteration of the simulation was assigned a random probability between 10% and 30%. The last condition is implemented to prevent over/under-prediction of the likelihood of the emergence of political boundaries. The fourth and last condition is expressed formally as follows,

$$\begin{array}{ll}
\text{IF} & OI_{activated(A) = \text{TRUE}} \\
\text{AND} & SI_{activated(A) = \text{TRUE}} \\
\text{AND} & (isolation[A] \geq 3) \\
\text{THEN} & 30\% \geq P_{transformation[A]} \geq 10\%
\end{array} \tag{10}$$

Clustering:

B.5

The degree of clustering of the regional identity is measured by aggregating the isolation scores of agents activated on the regional identity: the smaller the aggregate-number the larger the degree of clustering of the regional identity. Clustering for identity (A) is the sum of all isolation values over all agents activated on that identity.

$$Clustering(A) = \sum_{activated(A) = true} Isolation[A] \tag{11}$$



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Notes

¹ See Lustick et al. (2004) and Brancati (2006) for useful reviews of these positions.

² Important work on themes related to autonomy movements include: work on mobilization (Lustick et al. 2004; Bhavnani and Backer 2000; Epstein, Steinbruner, and Parker 2002; Lustick and Miodownik 2002; Srblijinovic et al. 2003); identity diffusion (Axelrod 1997; Lustick 2000; Rousseau and van der Veen 2005); the emergence of ethnocentrism (Axelrod and Hammond 2003); and the endogenization of borders and emergence of ethnic conflict (Cederman 1997, 2002).

³ PS-I is available for download without any charge at: <http://ps-i.sourceforge.net>. A user manual is available from the "simulation software" section at <http://www.polisci.upenn.edu/abir>.

⁴ The simulation is described in much more details in Miodownik (2005). The simulation is modeled after the simulation employed by Lustick et al. (2004). All templates used to run the simulations described in this paper are available from the author upon request.

⁵ Appendix A presents average distributions for each of combinations in Ethniland.

⁶ For conceptual debates surrounding constructivism and using agent-based modeling in developing constructivist identity theory see Lustick (2000), Lustick et al. (2004) and Rousseau and van der Veen (2005).

⁷ This processes have been extensively studied and described in theories on conformity, social impact, social identity and self-categorization (Asch 1956; Latané, 1981, Tajfel and Turner 1986; Turner, Hogg, Oakes, Reicher, & Wetherell 1987).

⁸ Agents in these experiments update synchronously. Indeed there may be some good theoretical reasons to chose one asynchronous over synchronous modes of updating (e.g. [Latané and Nowak 1997](#) p. 56). Indeed some more work may be required in the future to explore how this specific model is affected by a different mode of updating. Nevertheless, both Latané and Nowak (p. 57) and Lustick and Miodownik ([2005](#), pp. 29–30) show that the anticipated effect on aggregate clustering and consolidation (phenomena related to those studies here) of choosing synchronous or asynchronous modes of update is in fact not as strong as it is usually expected.

⁹ Full technical details and formal notations for this as well as the other rules described in this section appear in Appendix B.

¹⁰ See Appendix B for full technical details and formal notations.

¹¹ Since the size of countries and the sizes of disaffected populations within those countries vary widely, the 10% rule for the minimum size of what we refer to as a “subordinate identity” cannot be considered absolute. Instead the rule used to calculate the minimum size of a regionally disgruntled minority capable of producing secessionism is 40% of the ratio of the population of the region to the total population of the state. Thus, the SE quadrant of the model represents 25% of the entire state. Forty percent of that is 10%, so the minimum size of an activated group in the model capable of producing secessionism is 10% of the size of the model or 409 agents. Roeder ([2003](#)) presents an extensive discussion of the statistical issues involved in coding secession for comparisons across large and small states. Roeder's findings, though arrived at with different techniques and for somewhat different purposes, are consistent with our coding rules.

¹² Huckfeldt, Johnson, and Sprague ([2004](#)) recently argued and demonstrated that societal level opinion diversity is preserved even though individuals are exposed to persuasive information that challenges their held opinion. Huckfeldt et al. attribute this persistence to the influence of one's social network on the evaluation of counter attitudinal positions. People are able to resist counter-attitudinal information because they discuss it with people supportive of their own position within their network. The seeming contradiction between the two lines of research can be resolved if one considers the network of supportive discussants as a cluster of likeminded opinions. It is important to note, however, that Huckfeldt et al. ([2004](#)) work diverges from other studies that tend to expect the elimination of diversity and find its endurance a possible yet relatively rare phenomenon ([Latané and Nowak 1997](#), [Axelrod 1997](#)).

¹³ The negative signs of the coefficients for cultural differences and economic incentives in the clustering model (model 2) are in the expected direction. Recall that high scores on the clustering variable indicate low clustering while smaller values of this variable are an indication of significant clustering.

¹⁴ It did, of course, affect the likelihood that any particular agent will transform into a border-cell, and therefore probably the aggregate number of border-cells. This result, however, is not part of the analysis of this paper.



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