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## **Adaptive Agents, Political Institutions and Civic Traditions in Modern Italy**

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### **Abstract**

Long duration historical studies have been formative in shaping comparative analysis. Yet historical processes are notoriously difficult to study, and their findings equally difficult to validate empirically. In this paper, I take Robert Putnam's work on Civic Traditions in Modern Italy and attempt to bridge the gap between the study's historical starting point and contemporary observations, using an agent-based model of social interaction. My use of a computational model to study historical processes - in this case the inculcation and spread of social capital - supports Putnam's claim of path dependence. Moving beyond Putnam's study, my results indicate that the formation of civic (or uncivic) communities is not deterministic, that their emergence is sensitive to historical shocks, and that the absence of political boundaries lowers aggregate levels of civicness in regions characterized by effective institutions. In addition, the simulation suggests that minor improvement to ineffective institutions - making them moderately effective - constitute a mid-level equilibrium trap with the least desirable social consequences.

### **Keywords:**

Agent-Based Model; Italy; Social Capital

### **Introduction**

#### **1.1**

Long duration historical studies ([Tilly 1975](#); [North 1981, 1990](#); [Greif 1992](#); [Bartlett 1993](#); [Greif, Milgrom and Weingast 1994](#); [Spruyt 1994](#); [Greif 1997](#)) have been formative in shaping comparative analysis. Yet historical processes are notoriously difficult to study, and their findings equally difficult to validate empirically. In this paper, I take an empirical study conducted by Robert Putnam ([1993](#)) and attempt to bridge the gap between a historical starting point and present-day observations, using an agent-based model of social interaction. I note at the onset that the model and accompanying analysis are no substitute for careful historical and empirical research. What the model does provide is a tool for making an argument - in this case Putnam's argument - explicit, by specifying a mechanism by which historical political units evolved into more or less civic regions in present day Italy. The model I develop also permits me to further test Putnam's argument by conducting counterfactual experiments to assess the impact of political boundaries, historical shocks, and institutional reform or change on the formation of civic or uncivic communities.

#### **1.2**

In *Making Democracy Work: Civic Traditions in Modern Italy*, Robert Putnam explores the reasons for the mixed success of Italy's experiment with regional government in the 1970s. Putnam finds that the northern regions of Italy are characterized by more effective, responsive and representative institutions, whereas institutions in the south of the country are ineffective, unresponsive, and less representative. He further notes that the variation in institutional performance corresponds closely to differences in civicness - i.e., political participation and sophistication, as well as social trust and tolerance - with northern regions displaying evidence of a more civic culture in contrast to a highly uncivic South. To explain these present-day differences, Putnam identifies

distinctions in the political regimes that characterized 14<sup>th</sup> Century Italy. These regimes varied in the extent to which they promoted a civic culture. The feudal monarchy founded by Normans in the *Mezzogiorno* (Southern Italy) and the Papal states (Central Italy) were the least civic of the four regimes. The ex-communal republics (North-east) and the communal republics (North-west) were the most civic. Putnam's hypothesis is that "... social patterns, plainly traceable from early medieval to present day Italy turn out to be decisive in explaining why, on the verge of the twenty-first century, some communities are better able than others to manage collective life and sustain effective institutions" ([Putnam 1993](#): 121).

### 1.3

Putnam's analysis has contributed to a burgeoning cottage industry of research on social capital ([Brehm and Rahn 1997](#), [Coleman 1988](#), [Paxton 1999](#)), defined in terms of *engagement*, *political equality*, *trust* and *tolerance*, and *membership in associations*. Societies with high levels of social capital are more likely to display greater political participation, political sophistication, and social trust, with important consequences for democratic transitions ([Barkan et al. 1991](#), [Bernhard 1993](#), [Booth and Richard 1998](#), [Boyle 1996](#), [Di Palma 1991](#), [Glaser 1997](#), [Kapil 1995](#), [Kotze and Du Toit 1995](#), [Kim 1997](#), [Monga 1995](#), [Muller and Seligson 1994](#), [Rice and Feldman 1997](#), [Weinbaum 1996](#)), the success of non-governmental organizations ([Reilly 1995](#), [Sullivan 1996](#)), clientelism ([Roniger 1994](#)), squatters ([Oxhorn 1995](#)), urban development ([McKay 1996](#)), ethnic conflict ([Bond et al. 1997](#), [Varshney 2002](#)) political rebellion ([Tamari 1990](#)), and environmental activism ([Wapner 1995](#)).

### 1.4

That said, scholars have raised some important concerns about Putnam's study. One such concern is noted by Tarrow ([1996](#)) who points to the inconsistency between Putnam's specification of political culture as a function of 14<sup>th</sup> Century political traditions and his measure of democracy as a function of present institutional performance. Tarrow's critique raises the issue of using data (gathered over a period of 30 years) to support an argument that seeks to link 14<sup>th</sup> Century political traditions to measures of democracy from present-day Italy. Putnam's work is therefore missing what Levi ([1996](#)) refers to as a mechanism for the production, maintenance, and growth of social capital - a mechanism that links the historical social context with the present social order, leaving the reader to infer how "civic" and "uncivic" communities in contemporary Italy emerged from their historical starting points.

### 1.5

The absence of such a mechanism is especially telling in Putnam's reference to complex social settings in which a more impersonal or indirect form of trust is required to overcome the problem of imperfect information. Social networks, Putnam contends, "... allow trust to become transitive and spread: I trust you because I trust her and she assures me that she trusts you" ([Putnam 1993](#): 169). As a result, "personal interaction generates information about the trustworthiness of other actors that is relatively inexpensive and reliable ... [and] a reputation for honesty and reliability is an important asset for any would be participant" ([Putnam 1993](#): 171). Yet the system of trust described by Putnam is more likely to be found in small social settings characterized by "strong" ties, accurate reputations, and strict punishments for defectors.

### 1.6

In complex social settings - characterized by high number of interactions - the likelihood that an individual is equally trusting or trustworthy as any other individual is low. Moreover, in such settings anonymous encounters are far more frequent - if not the norm - than encounters based upon transitive networks of trust ([Cohen, Axelrod and Riolo 2000](#)). Consider a society with a large number of members, each of whom may be trusting or suspicious - one salient component of social capital. Members of this society are randomly paired in each successive period, and must decide whether or not to engage in chance social encounters.<sup>[1]</sup> If institutions are effective - in that they prove to be a reliable source for reputational information - their use is likely to be widespread and individuals are less likely to rely on their own judgements about the reputations of others.<sup>[2]</sup> Whereas if institutions are unreliable - in that they provide inaccurate reputational information - individuals are more likely to rely upon their judgments and evaluations of others, which in turn are determined by how trusting they are of others.

### 1.7

Putnam's approach therefore presents three related problems. The first and most general concerns the absence of a mechanism for the production and transmission of social capital. The second is rooted in the assumption that transitive networks of trust suffice as mechanisms to provide individuals with reputational information in complex settings. And the third, concerns his failure to capture the interaction between individual attributes - which vary independently of institutional effectiveness - as well as variation in institutional effectiveness itself. In short, Putnam disregards how social capital emerges and spreads, how participants in complex social settings deal with imperfect information and overcome distrust, and how individual heterogeneity interacts with variation in institutional effectiveness.

## 1.8

This paper attempts to bridge the gap between historical and contemporary data by specifying a reasonable mechanism for the production and transmission of social capital, in the form of an agent-based computational model ([Casti 1998](#); [Gilbert and Terna 1999](#); [Holland and Miller 1991](#)). The model developed in the paper [\[3\]](#) builds on Axelrod's model of cultural influence ([Axelrod 1997](#)). It consists of agents with heterogeneous cultural attributes situated in a landscape with distinct institutional structures. Agents interact with their neighbors, and repeated agent interaction leads to the formation of civic or uncivic communities. The model permits the reader to assess how changes in institutional performance, historical shocks, and political boundaries affect the formation of culturally distinct regions - a "civic" North and an "un-civic" South in the case of Putnam's argument. While the simulation supports Putnam's claim of path dependence - that historical regimes correspond to different degrees of "republicanism and autocracy" that closely reflect the incidence of civicness in the 1970s - the results indicate that the formation of civic (or un-civic) communities is not deterministic, that their emergence is sensitive to historical shocks, and that the absence of political boundaries lowers aggregate levels of civicness in regions characterized by effective institutions. In addition, minor improvements to ineffective institutions - making them moderately effective - constitute a mid-level equilibrium trap with the least desirable social consequences. I note that the model constitutes a *simplified representation* of social processes that give rise to civic communities, and is one of numerous methods by which Putnam's argument may be represented and made explicit.[\[4\]](#) Yet my model provides a powerful mechanism that explains the production and trans-historical transmission of social capital.

## 1.9

The paper is organized in the following manner. Section [2](#) presents the computational model and provides a detailed description of the agents, the landscape and the rules governing interaction. Section [3](#) analyzes the simulation results, paying particular attention to the evolution of civicness over time and the formation of culturally distinct regions. I then examine how institutional effectiveness, historical shocks, and the absence of political boundaries affect aggregate levels of civicness. I also assess the degree to which cultural values are path dependent. I present my conclusions in Section [4](#) and discuss a number of extensions to the model in Section [5](#).

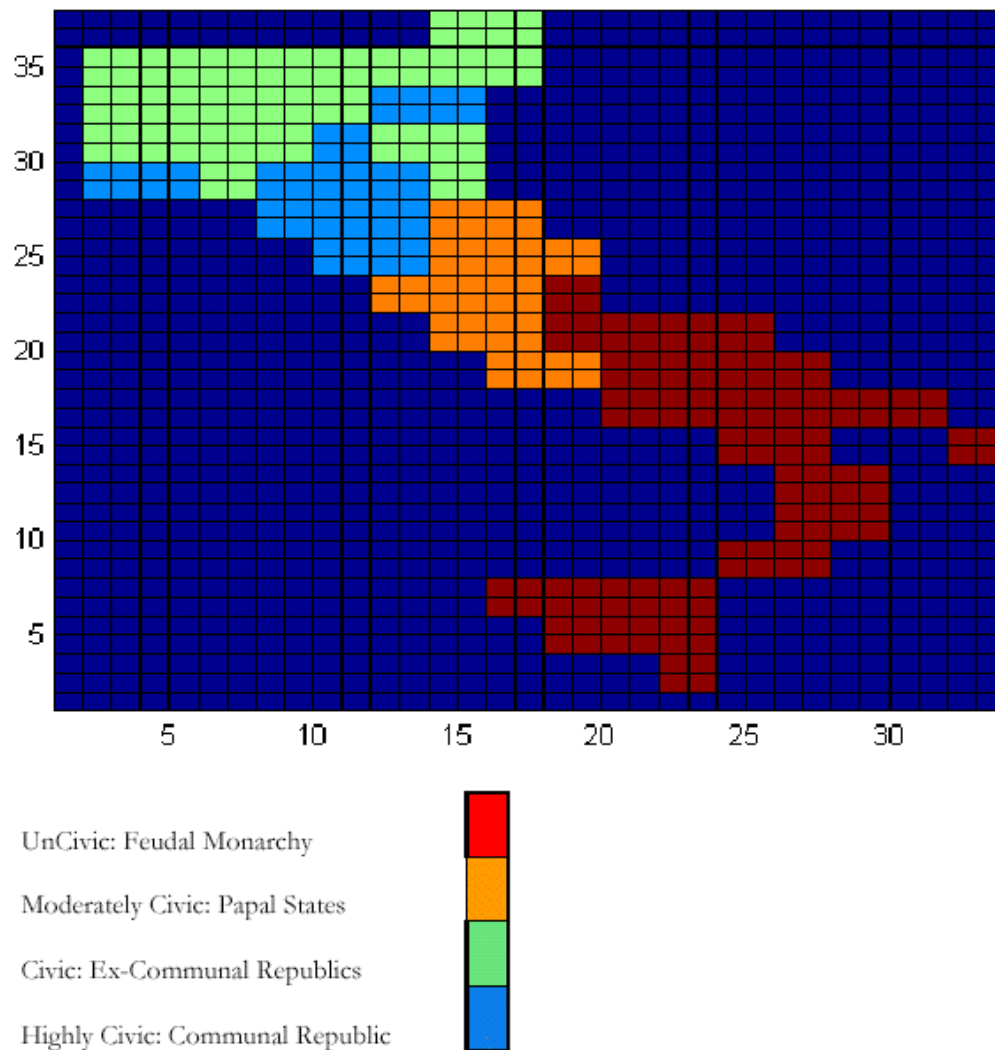


## The Agent-Based Computational Model

## 2.1

As with all models, agent-based models (ABM) are constructed by specifying simplified representations of the entities and processes of interest to the modeler. Their distinguishing feature is that they are constructed in a "bottom-up" manner ([Axelrod 1993](#), 1997; [Casti 1998](#); [Holland 1998](#)). That is, ABMs are defined in terms of entities and dynamics at a micro-level - at the level of individual actors and their interactions with each other and with their environment. The model developed in this paper (see the [Appendix](#)) is comprised of three components: (1) an environment, or landscape, that represents the geography of Italy and is divided into areas with four distinct institutional structures; (2) agents who occupy the landscape; and (3) heuristics, or rules, that govern agent interaction and adaptation.

### Inherited Institutional Structures: 14<sup>th</sup> Century Political Regimes



**Figure 1.** Map of Italy with Inherited Institutional Structures

*Note:* This figure shows the contours of model landscape - a geographic map of Italy divided into the four 14<sup>th</sup> Century regimes - featured in Putnam's Study. The landscape contains a total of 36 rows and 32 columns.

## 2.2

The model's landscape represents the map of "republican and autocratic" traditions in Italy (c. 1300) found in Putnam's study ([1993](#): 134). The landscape, presented in Figure [1](#), has a surface area of 320 contiguous sites and is host to a total of 320 agents (one agent per site). Although this representation does not accurately represent population densities, estimates drawn either from the 14<sup>th</sup> Century or 20<sup>th</sup> Century population fail to provide an accurate measure of population distributions over a period of seven-hundred years.<sup>[5]</sup> Thus, the model landscape is deliberately simplified for purposes of analytical exposition.

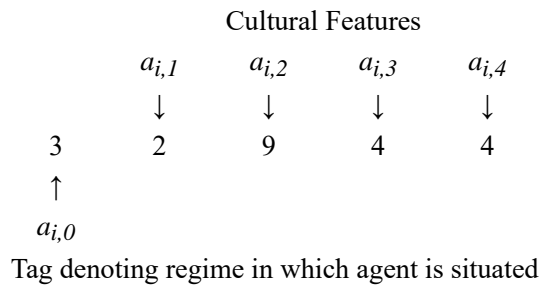
## 2.3

The landscape is partitioned into four regions that correspond to the distinct types of historical political regimes in 14<sup>th</sup> Century Italy. To reiterate, these include the ex-communal republics (North-west), the communal republics (North-east), the Papal-states (Center), and the feudal monarchy (South).<sup>[6]</sup> Institutions in each regime differ in terms of their effectiveness - the extent to which they furnish their inhabitants with accurate information on the reputations of neighboring agents, and thus in the extent to which they promote interaction among agents. In the communal republics - the most civic of all four regime types - institutions provide agents with reputational information that is highly accurate. In the ex-communal republics and Papal-states, reputational information is less accurate. Finally, in the feudal monarchy - the least civic of the four regimes - reputational information is least accurate.<sup>[7]</sup>

## The Agents

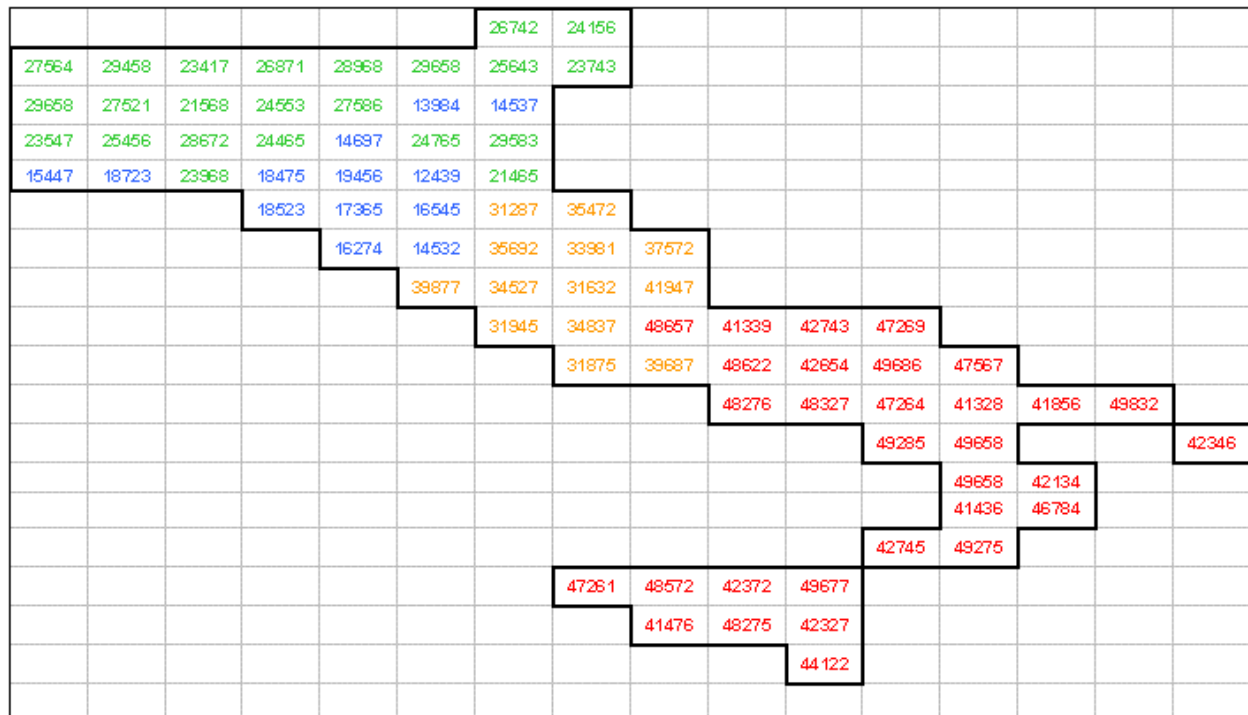
## 2.4

A population of agents represents individual citizens in each of the four historical political regimes. Each agent is characterized by five features  $a_0, a_1, \dots, a_4$  where  $a_0$  denotes a tag identifying an agent's geo-political location, and  $a_1, a_2, a_3, a_4$  denote four "cultural" features. In the communal republics and ex-communal republics, agent tags are set to 1 and 2, respectively. Agents in the Papal states have tags set to 3, whereas agents in the feudal monarchy have tags set to 4. The four cultural features correspond to the (four) dimensions of civicness used by Putnam - *engagement, political equality, trust, and membership in associations*.<sup>[8]</sup> Each of these features may take one of nine values that represent the agent's level of civicness on the given feature, with "1" being the lowest possible level of civicness and "9" the highest possible level. Initial agent features are randomly assigned to eliminate cultural bias from the model. Agents are stationary, despite historical evidence of large-scale population movements in Italy between the 14<sup>th</sup> and 20<sup>th</sup> Centuries, to minimize the complexity of the model.<sup>[9]</sup>



**Figure 2.** Description of an Agent

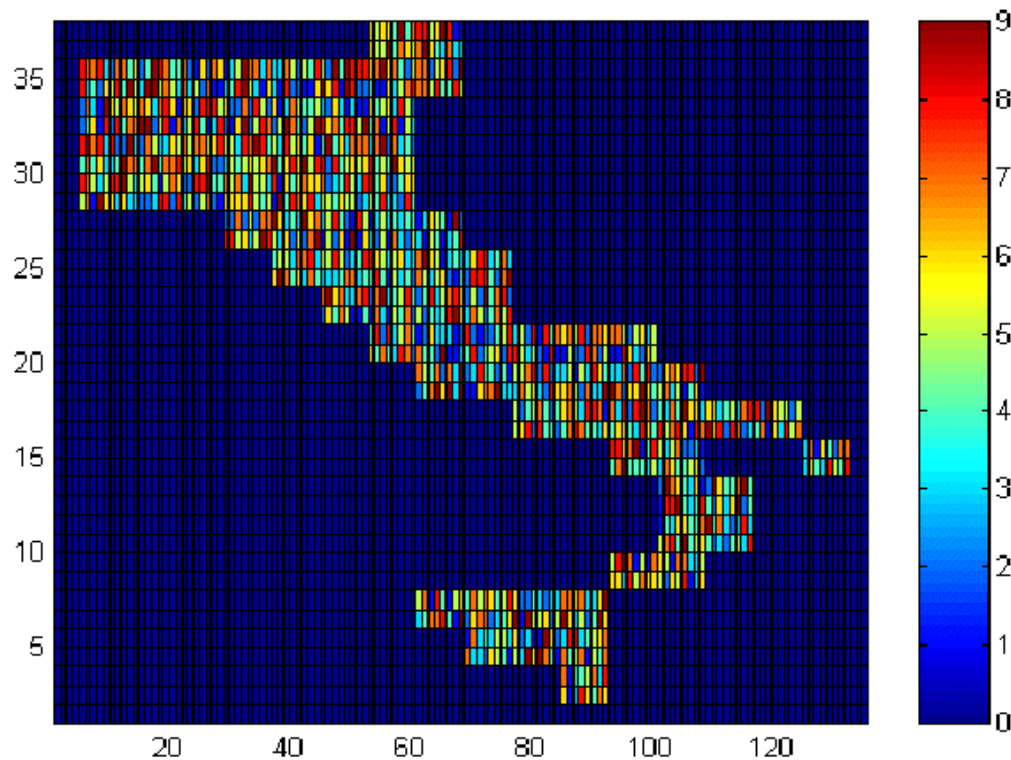
*Note:* An agent  $i$  is comprised of 4 cultural features that correspond to the four dimensions of civicness used by Putnam - *engagement, political equality, trust, and membership in associations*. Each feature may assume one of nine values that represent the agent's level of civicness on the given feature, with "1" being the lowest possible level of civicness and "9" the highest possible level of civicness on a given feature. Agents also carry a *tag* or extra feature identifying their geo-political location. In the communal republics and ex-communal republics, agent tags are set equal to 1 and 2 respectively. Agents in the Papal-states have tags set equal to 3, whereas agents in the feudal monarchy have tags equal to 4.



UnCivic: Feudal Monarchy	
Moderately Civic: Papal States	
Civic: Ex-Communal Republics	
Highly Civic: Communal Republic	

**Figure 3.** The Landscape: 14<sup>th</sup> Century Political Institutions with Typical Initial Population of Agents

*Note:* The model landscape is populated with agents. Each cell on the landscape represents one agent. The actual size of the landscape is twice that of the picture presented here, containing a total of 36 rows and 32 columns and is host to 320 agents.



**Figure 4.** Map of Italy with Randomly Generated Population

*Note:* The map in this figure is generated by MATLAB and displays a population of 320 agents with randomly assigned cultural features. In this figure, each cultural feature on an agent is assigned a color to denote its value, as indicated by the key to the right of the map. Four adjacent cells on the map represent one agent. Agent tags are not displayed.

## 2.5

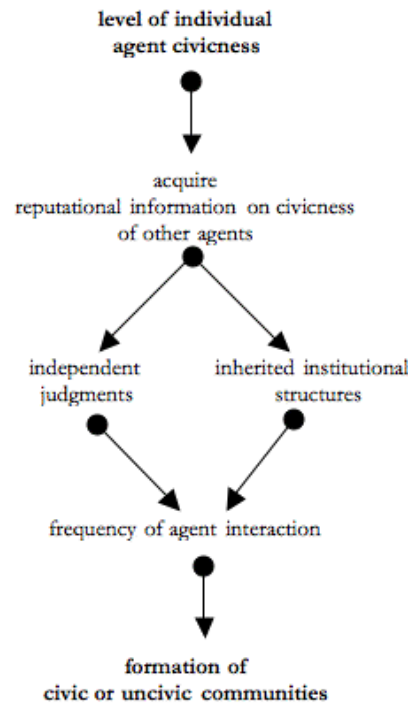
Figure 2 provides an illustration of a typical agent  $i$ . The agent is located in the Papal-states ( $a_{i,0}=3$ ), has an extremely low level of civiness on her first feature ( $a_{i,1}=2$ ), an extremely high level of civiness on her second feature ( $a_{i,2}=9$ ), and moderate levels of civiness on her third ( $a_{i,3}=4$ ) and fourth ( $a_{i,4}=4$ ) features. Figure 3 depicts a typical initial population of agents in the landscape. In Figure 4, the digits comprising each agent are displayed graphically, with each cell representing one feature on an agent, and four consecutive cells representing an entire agent (tags are not graphed in this figure). Maps akin to Figure 4 will be used throughout the paper to display civic change.

## Agent Interaction

## 2.6

In order to generate social capital, agents must interact with their neighbors. The frequency of agent interaction is a function of both inherited institutional structures and individual agent characteristics, and repeated agent interaction leads to the formation of either civic or uncivic communities. This dynamic is represented in Figure 5.





**Figure 5.** Schema of the Computational Model

## 2.7

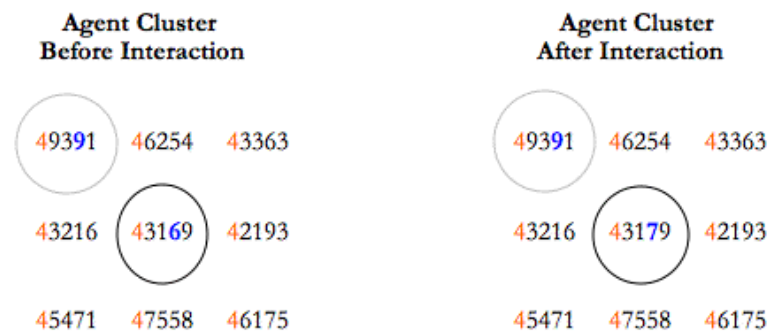
More formally, I randomly select an agent  $i$  and randomly select a cultural feature  $a_{i,k}$  where  $k = 1, \dots, 4$ . Next, I randomly select a neighbor  $j$  (from the same political regime) to interact with  $i$ , and select the corresponding cultural feature  $a_{j,k}$  on  $j$ .<sup>[10]</sup> The level institutional efficacy within  $i$ 's home region - the reliability of reputational information - is given by  $\alpha$  and equals  $1 - a_{i,0}\theta$  (since  $i$  and  $j$  must be citizens of the same political regime,  $a_{i,0} = a_{j,0}$ ). The parameter  $\theta$  is drawn from the interval  $[0.125, 0.25]$ . When  $\theta$  is drawn from the low end of this interval, institutions in each of the four regimes are most effective ( $\alpha$  equals 0.875 if  $i$  were located in the communal republics, 0.75 in the ex-communal republics, 0.625 in the Papal states and 0.5 in the feudal monarchy). In contrast, when  $\theta$  is drawn from the high end of the interval, institutions in each of the four regimes are least effective ( $\alpha$  equals 0.75 if  $i$  were located in the communal republics, 0.5 in the ex-communal republics, 0.25 in the Papal states and 0 in the feudal monarchy).<sup>[11]</sup>

## 2.8

The likelihood of agent interaction is given by  $\delta = 0.1 [(1 - \alpha) a_{i,k} + \alpha a_{j,k}]$  such that  $i$ 's decision to interact with neighbor  $j$  is a convex combination of her own level of civiness and reputational information on  $j$  provided by institutions in  $i$  and  $j$ 's home region. Note that  $i$ 's initial level of civiness is randomly defined, whereas the accuracy of reputational information made available to  $i$  is a function of inherited institutional structures. Where institutions are effective ( $\alpha$  is high),  $i$ 's decision to interact relies more heavily on reputational information about  $j$  (and only minimally on her own level of civiness). Correspondingly, where institutions are ineffective ( $\alpha$  is low),  $i$ 's decision to interact with  $j$  relies more heavily on her own level of civiness (and only minimally on reputational information about  $j$ ).

## 2.9

If  $i$  interacts with someone who is more civic than herself, she in turn becomes more civic (if  $a_{i,k} < a_{j,k}$  then  $a_{i,k} = a_{i,k} + 1$ ). If she interacts with someone who is less civic than herself, she becomes less civic (if  $a_{i,k} > a_{j,k}$  then  $a_{i,k} = a_{i,k} - 1$ ). Finally, if she interacts with someone who is equally civic, interaction has no effect. Note that only  $i$ 's level of civiness may change as a result of interaction, a simplification made to ensure that cultural change is initiated voluntarily.<sup>[12]</sup>



**Figure 6.** An Example of Agent Interaction

*Note:* An agent  $i$  is selected to initiate interaction (circled in black), and a neighbor  $j$  is selected to interact with  $i$  (circled in grey). The third feature (in blue) is selected for interaction on both agents. If  $\theta=0.225$ , the agents interact with 63% probability. In the event that interaction occurs,  $i$  increases her level of civicness on the selected feature by +1, and  $i$  is consequently denoted by the string 43179 while  $j$ 's features remain unchanged.

## 2.10

Figure 6 provides an example of agent interaction. An agent  $i$  denoted by the string of 5 digits (43169 - tag plus four cultural features) is randomly selected to interact with neighbor  $j$  denoted by (49391). The third feature has been selected for interaction on both agents. We set  $\theta$  equal to 0.225, the agents interact with 63% probability, and interaction results in an increase in  $i$ 's level of civicness on the selected feature;  $i$  is consequently be denoted by the string 43179. <sup>[13]</sup>



## Analysis

### 3.1

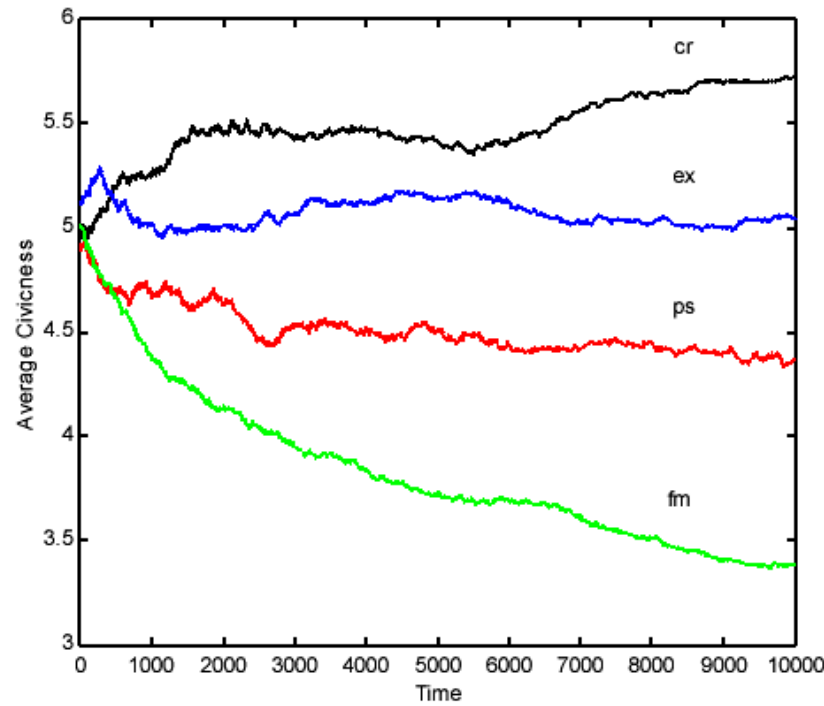
To reiterate, the landscape of 320 contiguous sites is initially seeded with agents whose cultural features - their propensity to interact with other agents - is randomly determined. Each agent is located in one of four political regimes, which differ in terms of institutional efficacy - the transmission of reputational information. An agent's location, therefore, determines the degree to which she relies on her own levels of trust or upon reputational information in determining whether or not to interact with a potential partner. A single run of the model consists of 10,000 episodes, with each episode providing 100 opportunities for randomly selected pairs of agents to interact. Each set of results presented below is based upon averages from 10 runs of the model (with  $\theta$  set equal to 0.225 unless otherwise noted), while figures depict the dynamics of single, representative runs.

### Emergence of Culturally Distinct Regions

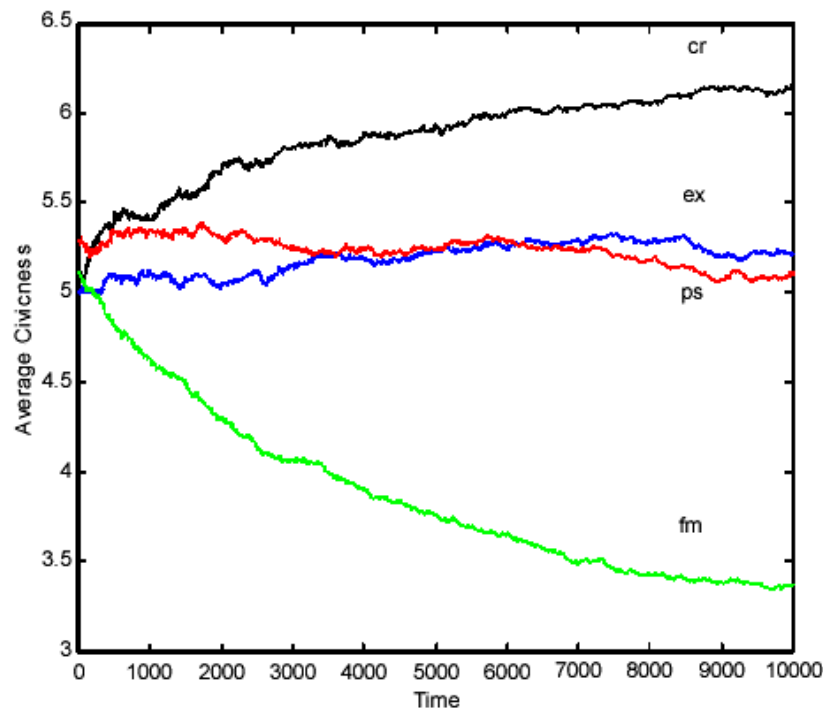
### 3.2

To begin with, I find that the initial cultural mix does not determine the degree to which agents in a particular regime become more or less civic over the course of the simulation. Figures 7a and 7b track the evolution of aggregate civicness in each of the four political regimes during two independent runs of the model.





(a)



(b)

**Figure 7.** Evolution of Civicness by Region

*Note:* Figures 7a and 7b depict changes in the aggregate level of civicness in each of the four regions - (cr) denotes the communal republics, (ec) the ex-communal republics, (ps) the Papal-states, and (fm) the feudal monarchy - for two independent runs of the model ( $t=10,000$ ,  $\theta=0.225$ ).

### 3.3

In Figure 7a, aggregate civicness in the feudal monarchy is initially higher than civicness in the Papal-states and ex-communal republics. Yet as agents interact, aggregate civicness in the feudal monarchy steadily declines until it becomes the least civic of all four regimes. Moreover, while differences in institutional effectiveness are effectively built into the model, this does not preclude variation in the levels of civicness across regions. Figure 7b illustrates that for over half the duration of the simulation ( $t=0$  to  $t=6,000$ ), aggregate civicness in the Papal-states exceeded levels of civicness in the ex-communal republics, but then a gradual reversal of trends occurred.

Likewise, a comparison of both figures illustrates that aggregate levels of civiness in the ex-communal republics and Papal-states differ by approximately (0.7) in Figure 7a, but only by (0.15) in Figure 7b. This suggests that disregarding the mechanisms which generate civiness, as Putnam does, leaves us with a snapshot of a deterministic outcome - a picture that altogether overlooks the growth and decay of civic life over time.

### Institutional Effectiveness

#### 3.4

As noted earlier, institutions in each of the four political regimes differ in the extent to which they promote civic life. In the context of the model, institutional effectiveness is measured by the accuracy of reputational information provided to agents who seek to interact with other agents. Where institutions are effective, agents rely more heavily on reputational information, and less on their own levels of interpersonal trust in determining whether to interact with a potential partner. This is reversed in the case of ineffective institutions.

#### 3.5

I find that as institutional effectiveness ( $\alpha$ ) decreases, variation in aggregate levels of civiness within the feudal monarchy far exceeds that in other regimes, such as the communal republics. This result may be explained in the following manner. In the absence of effective institutions, most agents rely on their own levels of trust in others. Small improvements in institutional effectiveness (in areas where institutions are weak) consequently lead to large improvements in the quality of reputational information and thus to more positive interactions. These effects are especially pronounced with ineffective institutions - such as those found in the feudal monarchy - and imply that institutional reform should first focus on improving least effective institutions.

**Table 1:** Institutional Effectiveness and Aggregate Civiness

	<b>Communal Republics</b>	<b>Ex-Communal Republics</b>	<b>Papal States</b>	<b>Feudal Monarchy</b>	<b>Civic Change</b>
$a_{i,0} =$	1	2	3	4	
$\theta=0.125$	6.0284 ( $\alpha=0.875$ )	5.7750 ( $\alpha=0.750$ )	5.54740 ( $\alpha=0.625$ )	5.0609 ( $\alpha=0.500$ )	14899
$\theta=0.175$	5.8683 ( $\alpha=0.825$ )	5.4655 ( $\alpha=0.650$ )	4.80571 ( $\alpha=0.475$ )	4.2887 ( $\alpha=0.300$ )	14279
$\theta=0.225$	5.8091 ( $\alpha=0.775$ )	5.1734 ( $\alpha=0.550$ )	4.36719 ( $\alpha=0.325$ )	3.3728 ( $\alpha=0.100$ )	13011
$\theta=0.250$	5.7990 ( $\alpha=0.750$ )	5.0948 ( $\alpha=0.500$ )	4.10208 ( $\alpha=0.250$ )	2.9072 ( $\alpha=0.000$ )	13894
$\sigma^2$	<b>0.0112</b>	<b>0.0958</b>	<b>0.3991</b>	<b>0.9207</b>	

*Note:* Cells display aggregate levels of civiness from 10 runs of the model ( $t=10,000$ ) for various values of  $\alpha=1-a_{i,0}\theta$ , as well as levels of civic change for various values of  $\theta$ . A change in an agent's level of civiness on any given feature constitutes an instance of "civic change."

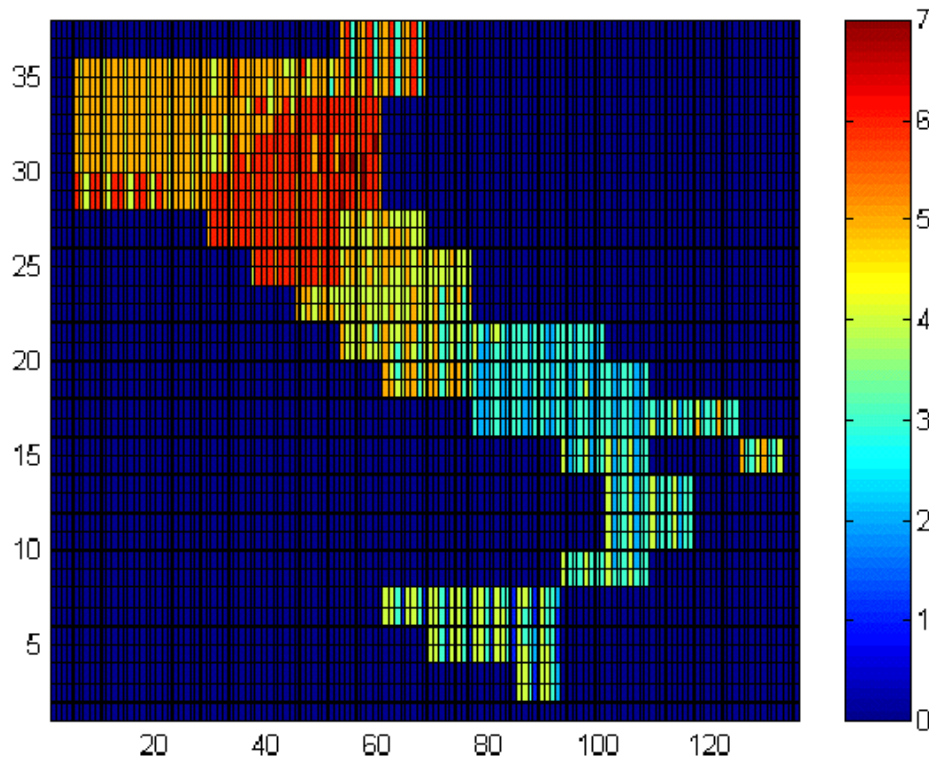
#### 3.6

I also find that levels of civic change - changes to agent civiness on any given feature - are non-linear: high levels of change occur when institutional effectiveness is high, low levels of change occur when effectiveness is moderate, and modest levels of change occur when institutions are ineffective. When institutions are highly effective, it is likely that an institutional bias exists - with all types of agents (trusting, ambivalent, and distrusting) relying heavily on reputational information and interacting frequently. This stands in marked contrast to moderately effective institutions, in which trusting individuals are split between relying on reputational information and their own proclivity to trust others. As a result, they interact less frequently, while ambivalent and distrusting individuals interact infrequently. And when institutions are ineffective, trusting individuals rely entirely upon their own judgments and interact frequently, whereas ambivalent and distrusting individuals interact

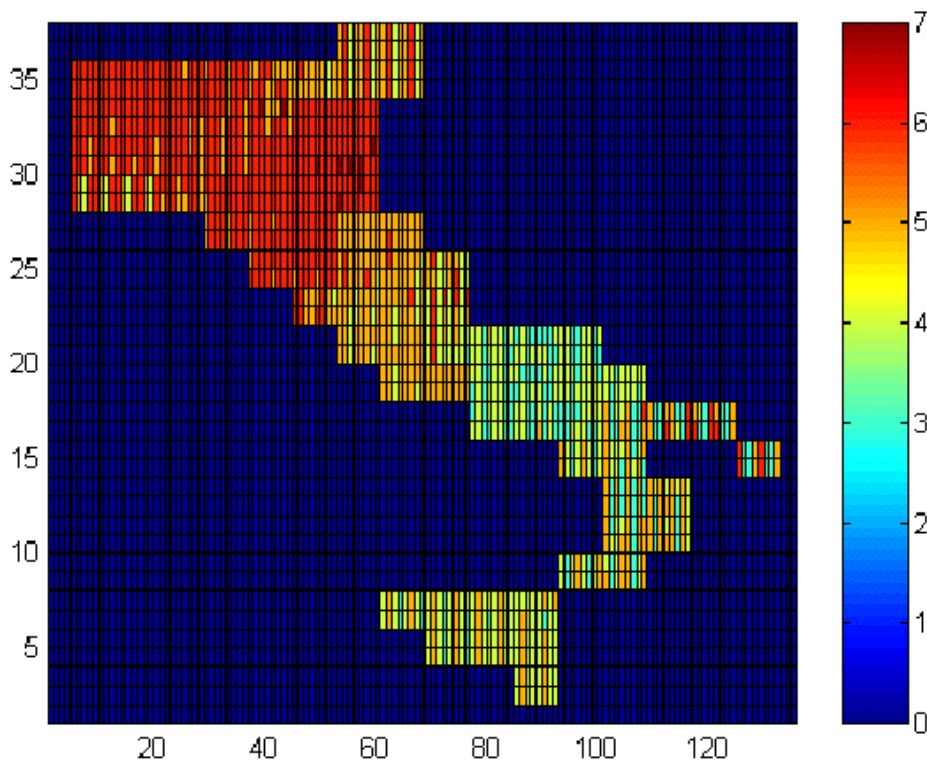
infrequently. What this suggests is that moderately effective institutions are a "curse" of society, because they fare worse in promoting civic life than ineffective institutions.

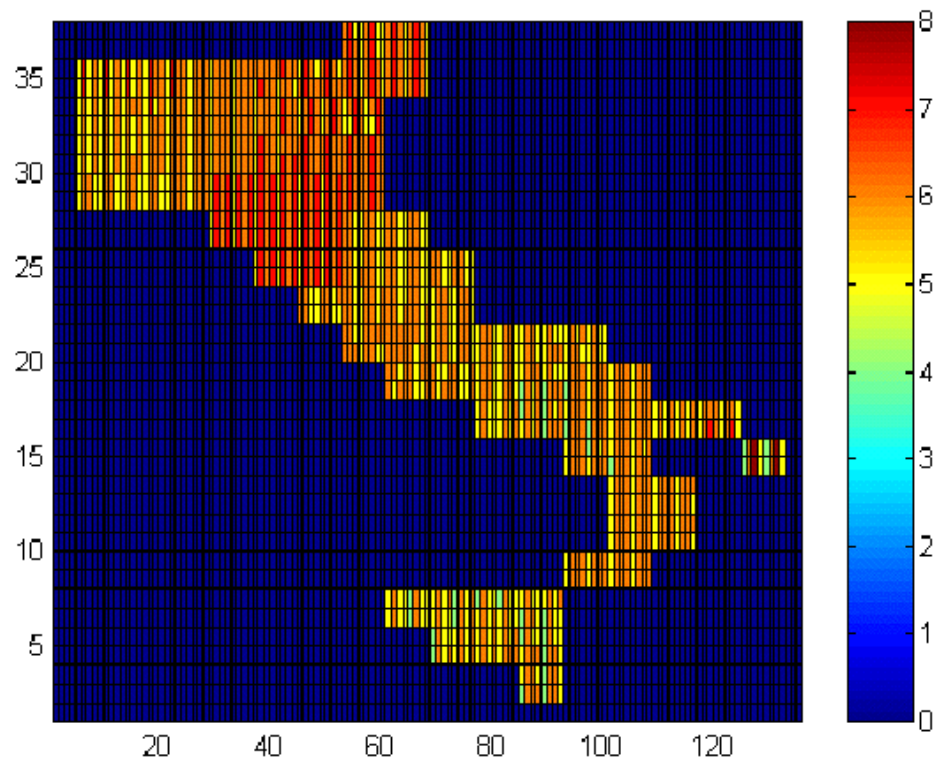
### 3.7

Lastly, I find that differences in aggregate levels of civiness across regions are most pronounced for values of  $\theta > 0.175$ . This finding reinforces my conclusion that the jump from high to intermediate levels of  $\theta$  - from ineffective to moderately effective institutions - has less of an effect on aggregate levels of civiness, than the jump from intermediate to low levels of  $\theta$  - from moderately effective to highly effective institutions. Table 1 presents a summary of these results, and Figures 8 (a, b, and c) present colormaps that depict changes in aggregate civiness for three values of  $\theta$ .



(a)  $\theta = 0.25$  (ineffective institutions)



(b)  $\theta = 0.175$  (moderately effective institutions)(c)  $\theta = 0.125$  (highly effective institutions)**Figure 8.** Comparative Institutional Effectiveness

*Note:* The maps in Figures 8 (a-c) are generated by MATLAB and display a population of 320 agents. Each cultural feature on an agent is assigned a color to denote its value, as indicated by the key to the right of the map. Four adjacent cells on the map represent one agent, and agent tags are not displayed. The figures display levels of civiness from one run of the model ( $t=10,000$ ) for the specified value of  $\theta$ .

### Regime Boundaries

#### 3.8

Next, I examine the effects of boundaries on the emergence of civic and un-civic communities. Under closed political boundaries, an agent may only interact with a neighbor from her own political region. In the absence of boundaries, agents may interact with neighbors from any of the four political regimes. Results from the simulation, summarized in Table 2, indicate that aggregate levels of civic change - the number of times each agent experiences a shift in the value of a feature - are higher when agent interaction is not confined by regional boundaries. Given more opportunities to interact, this seems to be a rather straightforward result.

**Table 2:** Political Boundaries and Aggregate Civiness

Regional Boundaries	Communal Republics	Ex- Communal Republics	Papal States	Feudal Monarchy	Civic Change
No	5.3369	5.3242	4.3479	3.4736	16971
Yes	5.8091	5.1734	4.3672	3.3728	13011

*Note:* Cells display aggregate levels of civiness from 10 runs of the model ( $t=10,000$ ,  $\theta=0.225$ ) without political boundaries and 10 runs of the model with political boundaries, as well as associated levels of civic change. A change in an agent's level of civiness on any given feature constitutes an instance of "civic change."

#### 3.9

Less obvious is the finding that in the absence of boundaries, aggregate levels of civiness are significantly lower in the communal republics, only slightly higher in the ex-communal republics, but remain unchanged in the Papal-states and the feudal monarchy. This suggests that when agents from different regimes interact with each other differences in institutional effectiveness become even more salient. One potential implication of this finding is that regional integration is most desirable when differences in institutional efficacy are minimized.

## Historical Shocks

### 3.10

An alternative test of Putnam's argument involves the introduction of historical shocks or contingencies at periodic intervals. Such shocks can be interpreted as invasions, wars, or changes in the character of the political regime - to name a few possibilities. I introduce historical shocks in the communal republics at various episodes ( $t=1,000, 3,000, 5,000$  and  $7,000$ ) to assess their impact on the formation of civic communities. The shocks I introduce reduce the average civiness of an agent by 30%, although one could envision shocks that increase average civiness as well.

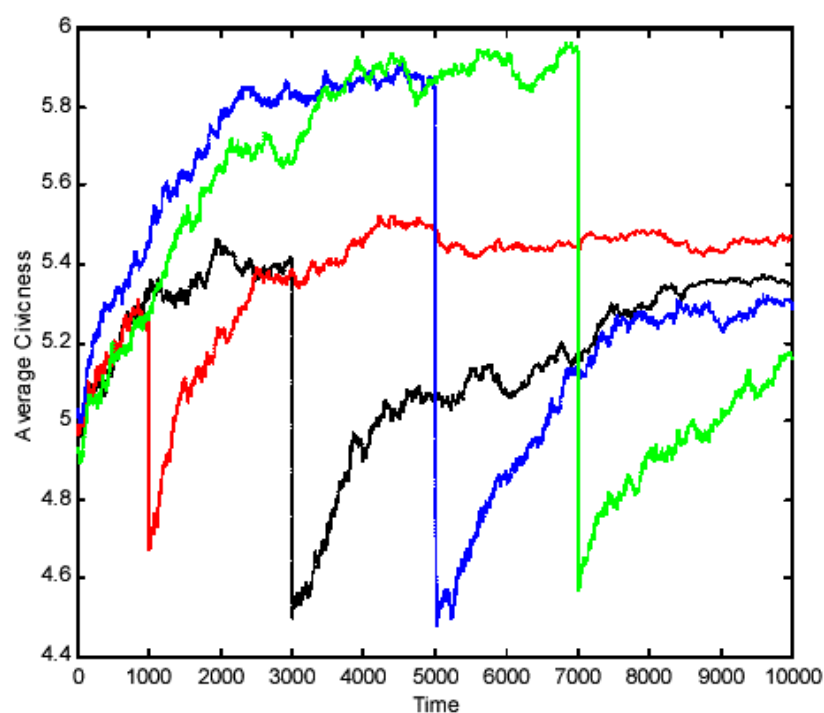
**Table 3:** Historical Shocks and Aggregate Civiness

Timing of Shock	Communal Republics	Ex- Communal Republics	Papal States	Feudal Monarchy	Civic Change
1,000	5.4760	5.1033	4.3854	3.0840	13661
3,000	5.3413	5.3016	4.9740	3.2461	15200
5,000	5.2837	5.2935	4.8438	3.2520	15682
7,000	5.1587	5.4429	4.7760	3.6348	16274

*Note:* Cells display aggregate levels of civiness from four independent runs of the model ( $t=10,000, \theta=0.225$ ), and associated levels of civic change for agents in the communal republics. Shocks that reduced aggregate agent civiness for the republic's inhabitants by 30% were introduced at  $t=1,000, t=3,000, t=5,000$  and  $t=7,000$ . A change in an agent's level of civiness on any given feature constitutes an instance of "civic change."

### 3.11

Results from the simulation are summarized in Table 3, whereas the dynamics of historical shocks are depicted in Figure 9. On average, introducing a shock leads to a decline in the aggregate level of civiness of 0.55 for agents in the communal republics, when compared to results from runs in which no shocks were introduced, all else being equal. Results also indicate that the later the shock is introduced, the less likely the region is to approach prior levels of civiness. The earlier the shock is introduced, however, the lower the total level of civic change in the region, despite the higher aggregate and final level of civiness. This suggests that societies with high levels of civiness which experienced historical shocks late in their development are less likely to recover to pre-shock level of civiness. These societies are also more likely to fall behind others that had relatively lower levels of civiness, but experienced historical shocks earlier in time. The relevance of this finding to former colonies is apparent.



**Figure 9.** Evolution of Civiness with Historical Shocks

*Note:* The figure displays changes in the aggregate level of civiness from four independent runs of the model ( $t=10,000$ ,  $\theta=0.225$ ) for agents in the communal republics. Historical shocks that lowered the civiness of the republic's inhabitants by 30% were introduced at  $t=1,000$ ,  $t=3,000$ ,  $t=5,000$ , and  $t=7,000$ .

## Path Dependence

### 3.12

Finally, I attempt to determine whether institutions, as defined within the context of the model, are embedded in cultural norms and therefore resistant to change. To do so, I run the model for 10,000 episodes, and then increase the effectiveness of institutions in the South (and similarly decrease the effectiveness of institutions in the North) - making institutions in the feudal monarchy the most effective, and those in the communal republics the least effective. If indeed historic political structures are the source of differences in political culture - as Putnam claims - then recent changes in institutional effectiveness should not lead to major changes in the aggregate levels of civiness in these regions.

**Table 4:** Assessing Path Dependence

Number of Episodes	Communal Republics	Ex-Communal Republics	Papal States	Feudal Monarchy	Civic Change
<b>16,000</b>	6.0962	5.3207	5.1667	3.4023	14414
<b>17,000</b>	5.7163	5.0380	4.5521	3.6074	14025
<b>18,000</b>	5.6827	4.7962	3.8750	3.6367	14113
<b>19,000</b>	6.2260	5.2582	4.9115	3.3359	14353
<b>Experiment Average</b>	<b>5.9303</b>	<b>5.1033</b>	<b>4.6263</b>	<b>3.4956</b>	<b>14226</b>
<b>Average Without Experiment</b>	<b>5.8091</b>	<b>5.1734</b>	<b>4.36719</b>	<b>3.3728</b>	<b>13011</b>

*Note:* Results from the experiment with institutional change reflect aggregate levels of civiness from four independent runs of the model ( $t=10,000$ ,  $\theta=0.225$ ). In each case, the model was run for 10,000 episodes after which institutional effectiveness was reversed, making institutions in the feudal monarchy the most effective, and those in the communal republics the least effective. The model was then run for an additional 6,000, 7,000, 8,000 or 9,000 episodes to assess the impact of institutional change. Aggregate results from the experimental runs are compared to aggregate results presented in Table 1. A change in an agent's level of civiness on any given feature constitutes an instance of "civic change."

### 3.13

Results from this experiment are presented in Table 4. I find that changes in institutional efficacy have little if any effect on aggregate levels of civiness in the institutionally strong communal republics and ex-communal republics, and only a moderate effect in the institutionally weak Papal-states and feudal monarchy when compared to results from previous runs (all else being equal). Less obvious, is that while aggregate levels of civic change increase significantly - resulting in higher levels of interaction among agents - the increase in agent interaction does not lead to a corresponding increase in civiness. This result suggests that certain cultural norms are resistant to change despite greater interaction among agents, and supports Putnam's hypothesis of path dependence.



## Discussion

### 4.1

The observations made by Putnam's critics have merit. Goldberg (1996) suggests that in the decades after Italian unification, the Fascist State used southern resources (through a combination of fiscal, tariff, and social welfare legislation) for northern economic and political development. In other words, he proposes that the South has been "manipulated" and "dominated" by the North since unification. In a similar vein, Tarrow (1996) claims that Putnam pays insufficient attention to the role of the state in shaping political culture and the very changes in state-building and strategy that have occurred since the medieval period. He also points to the high correlation between civiness and the existence of Catholic and socialist parties that were established in the late 19th Century. Sabetti (1996) suggests that the origins of civic culture in Italy are older than medieval times and that there is likely to have been more fluctuation in the civiness of regions than is suggested by the logic of path dependence, or by Putnam's application of this logic. He notes that civic traditions in the South were not completely undermined by the Norman monarchy, just as civic traditions in the North were not completely erased by the dissolution of the



communal republics. And finally, Levi (1996: 46) states that "historically given structures and experiences affect choices, but they must be continually reproduced to have the same effects they had in the past - suffice it to say that Putnam, in my view, fails both in his application and his understanding of path dependence."

## 4.2

The model allows us to explore these observations by tracing the emergence of civic life over time. First, by analyzing how different institutions interact with heterogeneous individuals, the model provides insight into why contemporary Italy is characterized by a civic North and an un-civic South. The findings indicate that this result is unlikely to have been deterministic, since small changes in the course of history - as exemplified by the analysis of historical shocks - may significantly affect the development of civic communities. Results from the simulation also indicate that small improvements in institutional effectiveness can lead to big improvements in the quality of reputational information and thus to more positive interactions among agents.

## 4.3

Second, results from the simulation demonstrate that the absence of political boundaries increases the aggregate level of agent interaction, but decreases civiness as trusting and trustworthy agents from civic regimes interact with agents from uncivic regimes who are less likely to share these traits. One implication of this finding is that regional integration should occur only when levels of institutional efficacy are similar across regions. Following the example of the European Union, harmonization works better when institutional symmetry across units exists beforehand (Harrop 2000; Pederson 1994). How feasible this actually is remains open to question.

## 4.4

Third, the analysis of historical shocks in the communal republics suggests that societies with high levels of civiness which experience shocks late in their development are less likely to recover to pre-shock level of civiness. These societies are more likely to fall behind others that had relatively lower levels of civiness, but experienced historical shocks earlier in time. Thus the earlier the shock, the better the prospects for building civiness over time. Parallels to the colonial experience, particularly for countries in Sub-Saharan Africa and Latin America, are unmistakable (Emerson 1969; Prosser 1982; Yansane 1980).

## 4.5

Fourth, the simulation lends some support to Putnam's claim that historic political structures are the source of differences in political culture between the civic north and the un-civic South of Italy. Once levels of civiness in each of regimes in the model approximate "actual" levels of civiness from Putnam's study, the introduction of institutional change has no significant impact on the political culture of the South or that of the North. It follows that historical structures need not be continually reproduced, as Levi suggests, but rather that such structures may be resistant to change once embedded in a particular cultural context (Arthur 1989; Goldstone 1998; Liebowitz and Margolis 1995; Mahoney 2001; North 1990; Pierson 2000).



## Conclusion

### 5.1

Extensions of this model can control for population density in order to determine the extent to which differences in individual regions drive the results presented in this paper. If population matters, this introduces a new dimension to study of social capital, not to mention changes in our views about the social and political effects of urban life and population growth. For instance, is a densely populated country like India likely to develop a more civic culture than sparsely populated Canada? Will democracy flourish in densely populated Nigeria but not in the Sudan?

### 5.2

A number of additional measures may be introduced to enhance the model. In its current form, the model's interaction topology is deliberately local. While this could be justified in previous centuries, such an assumption is clearly less applicable in modern times, given a high level of communication and migration across regions. Another extension would involve conducting parameter sweeps with initial populations that are more (less) civic - created by reducing the interval from which cultural attributes are drawn - rather than seeding agents with random features. Similarly, one may assess the effects of meta-agents - entrepreneurs whom neighbors are more likely emulate or interact with, or even an agent representing the state. Alternatively, one may move beyond the confines of the current model to introduce mobile agents, define more complex institutions, and introduce endogenous mechanisms for institutional change, different rules to govern agent interaction, and alternative landscapes.



## Appendix: Algorithm for the Simulation

1. *Initialize*. Initialize the outer boundaries of a landscape [0..32, 0..36, 1..5] and define eight possible directions for a search [north, south, east, west, northeast, northwest, southeast, southwest]. Delineate the 4 historical regimes. Set the value of  $\theta$ .
  2. *Populate*. Populate the landscape, with a tag for the first feature of each agent identifying geopolitical location; assign initial values for the remaining four features randomly between 1,..., 9. Code agents in empty areas 0 on all features.
  3. *Select agents for interaction*. Randomly select an agent  $i$  from one of the four political regimes, and randomly select one of her (maximum of) 8 neighbors  $j$  (From the same political regime). Repeat selection until a neighbor is found for agents with less than 8 neighbors. Select the same feature  $k$  on both agents. Use  $\delta$  to determine the probability and associated outcome of interaction. If interaction occurs, update  $a_{i,k}$ . Continue the process of agent selection and interaction for the specified number of events/episodes. During each event, randomly select one agent and a neighbor. An episode consists of 100 events.
  4. *Collect Data*. Define each agent by her average level of civicness. Compute aggregate civicness across all agents for each political regime. This measure can be based on averages from multiple runs of the model.
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## Notes

- <sup>1</sup> Assume that two individuals  $a$  and  $b$  have been selected to interact in period 1, and that  $a$  has no information on  $b$ 's type. In a society with a large number of members,  $a$  is more likely to seek information on the trustworthiness of  $b$  from an institution, since the transaction costs of searching for some other individual  $c$  who is both familiar with  $b$  and trusted by  $a$  are likely to be prohibitive. The degree to which  $a$  will rely on information about  $b$ 's trustworthiness will depend in large measure upon the perceived effectiveness of the institution itself.
- <sup>2</sup> My definition of institutions as mechanisms to provide individuals with reputational information on potential interaction partners is deliberately narrow in this paper.
- <sup>3</sup> The simulations reported in the paper were run on MATLAB. Please contact the author for the program code.
- <sup>4</sup> An alternative method is to model state-led assimilation which would differ from the strictly local interaction topology modeled here. The state could be modeled as a distinct cultural string communicating with "villages" within its territory, thereby introducing tension between the decentralized mechanism for cultural change specified here and a central actor.
- <sup>5</sup> Population estimates from the 13<sup>th</sup> Century are available for a number of major cities, although these cities do not account for each of the contemporary regions of Italy.
- <sup>6</sup> Putnam does not include Sardegna in his depiction of 14<sup>th</sup> Century Italy. As a result, I left Sardegna out of the model.
- <sup>7</sup> I note at the outset that the boot-shaped landscape introduces some peculiarity into the simulation, particularly in the form of boundary effects.
- <sup>8</sup> To measure civicness, Putnam assesses the vibrancy of associational life, the incidence of newspaper readership across the Italian regions, regional differences in turnout in successive public referenda, and the incidence of preference voting (which reflects clientalistic obligations).
- <sup>9</sup> One can therefore think of agents as individuals in established territorial domains or "villages," to borrow a term used by Axelrod (1997: 99) in his model of social influence. Mobile agents can be introduced in the model, although this remains a task for future research.
- <sup>10</sup> Agent  $i$  may have a maximum of eight neighbors, although if  $i$  was to be located on an edge or a region's boundary she may have fewer than eight neighbors. I later relax this condition, and permit agents to interact

across political boundaries although the edge effects remain.

<sup>11</sup> This assumes that the least effective institutions have the greatest room for improvement.

<sup>12</sup> I assume that the effect of interaction is one-sided to avoid forced cultural change, that is change imposed by  $a$  on  $b$ . The assumption can be relaxed in future versions of the model.

<sup>13</sup>  $a_{i,0}=4$ ,  $\theta=0.225$ , and  $\alpha=0.1$   $a_{i,3}=6$  and  $a_{j,3}=9$ , so  $\delta=0.1(0.9*6 + 0.1*9)=0.63$ .



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