The Persistence of Inferior Cultural-Institutional Conventions[†]

By MARIANNA BELLOC AND SAMUEL BOWLES*

Economic institutions and cultures (including social norms) are often dynamically complementary, meaning that the persistence of each is facilitated by the presence of the other. The term "feudal society," for example, refers jointly to the economic relationship of lord and serf and to the norms of subordination and reciprocity that both contributed to the smooth functioning of the system and that were its cultural expression. This complementarity provides one mechanism for the long-term persistence of particular configurations of cultures and institutions. Given the institutional relationship of serf to lord (to continue the example), adopting the culturally prescribed norms of subordination and reciprocity was a best response for individuals in the two classes, respectively. And given this culture of subordination and reciprocity, conforming to the institutional arrangements defining serf and lord was also a best response. We refer to this pair of mutual best responses as a cultural-institutional convention.

Otherwise similar populations with differing recent histories may exhibit differing conventions: free cities coexisting with feudal manors in Germany and elsewhere during the thirteenth to fifteenth centuries, for example. Historians and social scientists have long asked why some cultural-institutional conventions appear independently multiple times in human history and persist over long periods—monogamy, markets, and primogeniture, for example—while others rarely emerge, and when they do tend to be short

*Belloc: Sapienza University of Rome, via del Castro Laurenziano 9, 00161, Rome, Italy (e-mail: marianna. belloc@uniroma1.it); Bowles: Santa Fe Institute, 1399 Hyde Park Rd., Santa Fe, NM (e-mail: bowles@santafe. edu). Acknowledgments: Thanks to the Santa Fe Institute Behavioral Sciences program for support of this work, and to Quamrul Ashraf, Roy Cerqueti, Sung-Ha Hwang, Suresh Naidu, and Peyton Young for comments. An online Appendix provides derivations and proofs of the main results, and additional citations to the literature.

[†] To view additional materials, and author disclosure statement(s), visit the article page at http://dx.doi.org/10.1257/aer.103.3.93.

lived (Parsons 1964). In reply, some economists simply extend invisible hand arguments to the selection of institutions. Thus Oliver Williamson (1985, p. 394) writes that "viable modes of economic organization ... ordinarily possess an efficiency advantage." The mechanisms that would account for this felicitous result, however, have remained elusive, and evidence of enduring institutional failure is widespread. Accounts of socially dysfunctional but enduring cultural practices suggest that invisible hand arguments work no better when applied to cultures (Edgerton 1992).

I. Why Do Inferior Cultures and Institutions Endure?

Given that culture and institutions are often implicated in explaining enduring poverty (e.g., Clark 2007; Acemoglu and Robinson 2012) a pressing question is: what accounts for the persistence of cultural-institutional conventions that are inferior in the sense that almost everyone could be made better off under an alternative set of technically feasible configurations? "Cultural inertia" is sometimes said to be the result of the transmission of learned behaviors from parent to child; but for plausible degrees of transmission this process alone would result not in persistence but in the dissipation of cultural differences between populations in a matter of just a few generations (see online Appendix). Moreover, in light of recent history, persistence cannot be an intrinsic characteristic of either culture or institutions. Examples include the precipitous demise of such well defended institutions as Communist Party rule in many countries and of apartheid in South Africa and the extraordinarily rapid spread or retreat of cultural practices such as female genital cutting in parts of Africa and the use of honorific pronouns in many European languages.

A more plausible answer—proposed in a variety of models and documented with historical and contemporary examples—is that a concentration of political power allows favored groups to command a larger slice by means of policies that result in a smaller pie (Sokoloff and Engerman 2000; Acemoglu 2003). The hypothesis that Pareto-dominated allocations are implemented as part of a strategy of distribution is readily motivated by problems of commitment. For example, an elite may resist moving to a Pareto-superior convention because there is no way that nonelites can commit to not exploiting the instability of that superior convention in order to introduce a further transition under which the elite would lose.

But there is another way that inferior culturalinstitutional conventions may persist indefinitely, one that relies on strategic complementarity rather than cultural transmission across generations or elite power. If individual conformity to the status quo institutions and cultural norms is a mutual best response, and if individuals update their behaviors noncooperatively, an inferior convention can persist simply because it is evolutionarily stable by dint of its being a mutual best response (Young 1998). This "bottom-up" mechanism for cultural-institutional persistence is complementary to the "top-down" models just mentioned. But the mechanisms accounting for persistence are diametrically opposite. In the top-down models, institutions persist because elites are organized and powerful enough to implement allocations that limit the claims of others. In our bottom-up model, inferior cultural-institutional conventions persist because nobody is organized in that sense, and the actions of individuals in conforming to or deviating from the status quo institution and cultural norm are entirely decentralized.

There are other ways in which our approach is distinct. First, we explicitly model the interactions of cultures and institutions and their coevolution rather than treating institutional or cultural dynamics in isolation. Second, we consider large populations without political differentiation, so that no single actor (for example, an "elite") has any appreciable influence on outcomes. Third, both the persistence of cultural-institutional conventions and transitions between them are captured in the same model, without the intervention of exogenous changes. Finally, in contrast to many of the classical game theoretic treatments, our agents, while strategic, have limited cognitive capacities, updating their culture and institutions on the basis of past distribution of institutional and cultural traits in the population rather than foresight.

Whether these differentia specifica of our model are taken to be features rather than bugs will, of course, depend on the questions at hand. But we think that the resulting model provides insights complementary to the top-down approach in the understanding of such durable institutions as land tenure, inheritance systems, and property rights more generally, as well as employment contracts and marital practices. It also provides important insights into bottom-up "cultural-institutional tipping events" resulting in rapid transitions. An example is the end of apartheid in South Africa: individual firms and trade unions were privately working out the terms of a nonracial order years before the ruling National Party freed Nelson Mandela and conceded nonracial elections (Wood 2000).

II. A Bottom-up Model of Cultural-Institutional Persistence and Innovation

We study the evolutionary dynamics of culture and institutions in an economy with two classes. These are large subpopulations whose z members are paired randomly to interact in a noncooperative game governed by a set of institutions. The classes may be employees and employers, sharecropping farmers and landlords, slaves and slave owners, independent farmers and government officials, and so on. As these examples suggest, these class relations are asymmetric. The alternative economic institutions governing relations between the classes are one of two contracts, which are implemented by the members of the second class (whom we call the Bs) in each of the pairs just mentioned. The first class (the As) may adopt two alternative social norms. To represent the complementarity between cultures and institutions and the possibility of the persistence of inferior culturalinstitutional conventions, we assume that some contract-norms matches are more productive than others and can be Pareto-ranked.

For concreteness, think of a somewhat idealized rendition of the institutional structure and culture of two firms, Volkswagen and Fiat (Jürgens 2002; Nuti 2011). In the former, an institutional structure based on a works-council and comanagement matches with a work force with norms of cooperation with management, resulting in high levels of productivity and, as



FIGURE 1. EXPECTED PAYOFFS OF MEMBERS OF CLASS *i*

a result, mutual gains. In the latter, a top-down management structure is matched with an oppositional workers' culture resulting in reduced productivity. What is important for our model is not only that the idealized Volkswagen match Pareto-dominates the Fiat match, but that the two matches are best responses for owners and workers alike. Given the oppositional culture of Fiat's workers, the owners would do even worse if they implemented a comanagement structure; a militant oppositional culture would not benefit Volkswagen's workers; and so on.

We index contracts and norms by j = 0, 1 and classes by i = A, B, and represent the payoffs to the four possible cultural-institutional matches as $\pi_{11}^i > \pi_{00}^i > \pi_{01}^i = \pi_{10}^i = 0$ for both classes, where, for example, π_{10}^i is the payoff of an individual in class *i* implementing contract 1 (adopting norm 1) when his partner from the other class adopts norm 0 (implements contract 0), and payoffs are normalized so that the two "mismatches" are zero. Expected payoffs for members of class *i* implementing contract *j* (or adopting norm *j*) are given by $v_j^i = (1 - \phi_{-i})\pi_{j0}^i + \phi_{-i}\pi_{j1}^i$, where ϕ_{-i} denotes the fraction of individuals in the other class (*-i*) who implemented contract 1 (adopted norm 1) in the previous period. Expected payoffs lines are shown in Figure 1.

The state space for this process (shown in Figure 2) is all possible combinations of the number of individuals in the two classes, respectively, adopting norm 1 and implementing contract 1, $(z\phi_A^*, z\phi_B^*)$. The two matches with nonzero payoffs are Pareto-ranked Nash equilibria, and in the Markov process that



FIGURE 2. STATE SPACE AND TRANSITIONS

represents this model the states (denoted $\{0, 0\}$ and $\{z, z\}$) in which all members of both classes adopt one or the other of these two profiles are absorbing when all individuals best respond.

Following matching, members of each class have the opportunity to update their contracts and norms. To ensure that the process is acyclic, we let the revision process be asynchronous (as in Binmore, Samuelson, and Young 2003) with all members of one class updating first, followed by updating of the other class. When revising their contracts and norms, best responding individuals maximize their expected payoffs based on the distribution of, respectively, norms and contracts in the sub-population with which they are matched in the previous period.

But individuals are boundedly rational, and with probability $\sigma > 0$ they adopt the norms or institutions that are not the best response, with σ strictly decreasing in both the cost of deviating from the best response and the agents' degree of rationality (defined below).

Following Blume (2003), the probability of deviating from the best response when the population is at $\{0, 0\}$ is:

(1)
$$\sigma_i(\Delta_0^i, \beta) = \frac{1}{1 + e^{\beta \Delta_0^i}}, \text{ with } i = A, B,$$

where $\Delta_0^i = \pi_{00}^i - \pi_{10}^i$ is the cost of deviation from the status quo culture or institution at {0, 0} (see Figure 1). We interpret β as a measure of rationality because the larger is β , the smaller the probability that the individual will deviate from the best response. When $\beta = 0$ the agent randomizes between the two alternatives, and as β goes to infinity, the individual never deviates. Of course, individuals may have noneconomic reasons to deviate from the status quo even in the absence of cognitive failures; so, strictly speaking, β measures the degree to which agents maximize their expected payoffs.

For sufficiently rational individuals, once a population is in the neighborhood of either of the two absorbing states, the associated convention may persist over very long periods. The reason is that, for sufficiently large populations and sufficiently rational agents, the expected waiting time for a realization of sufficient nonbest responses to tip the process from the neighborhood of one convention to the basin of attraction of the other will be very prolonged. Culturalinstitutional conventions are perpetuated in every period; inertia is not involved, as individuals have just a single-period memory.

III. Impediments to Pareto-Improving Cultural and Institutional Change

To study transitions from the inferior $\{0, 0\}$ to the superior $\{z, z\}$ convention, we first determine the minimum numbers of deviant members of each class, such that with sufficiently rational agents, the population will enter the basin of attraction of the superior convention. The basin of attraction of a state is the set of states from which, for the above dynamics and sufficiently rational agents, the revision process we have just described leads to that state. For sufficiently rational individuals, beginning near the convention $\{0, 0\}$ the state following updating will almost always lie within quadrant 1 in Figure 2 and, because agents have just a one-period memory, even an unlikely substantial excursion away from the convention will have no lasting effect.

But suppose that, from the initial state $\{0, 0\}$, $z\phi_B^*$ of the *B*s deviate from the status quo institution and offer contract 1 instead of best responding with contract 0, where $z\phi_B^*$ is the smallest number such that the *A*s' best response is to switch to norm 1 and $\phi_B^* = \Delta_0^A/(\Delta_0^A + \Delta_1^A)$. (See Figure 1. Since *z* is large we may avoid notational clutter by abstracting from integer considerations.) In response, each *A* will adopt norms 1 with probability $1 - \sigma$. But as β goes to infinity σ goes to zero, so there exists some finite $\hat{\beta}$ such that for $\beta > \hat{\beta}$, as a result of the

As' updating, with virtual certainty we will have $z\phi_A \ge z\phi_A^*$, where $z\phi_A^*$ is the smallest number such that the *Bs*' best response is to switch to contract 1 (with $\phi_A^* = \Delta_0^B / (\Delta_0^B + \Delta_1^B))$). When this occurs, the population will be in the set of states for which both classes' best responses will lead to $\{z, z\}$ (quadrant 4, Figure 2). Thus, the minimum number of *Bs* implementing contracts 1 sufficient to escape from the inferior convention is $z\phi_B^*$. Analogous reasoning applies to the minimum number of innovating *A* members, $z\phi_A^*$, sufficient to induce a transition to $\{z, z\}$. It follows that from the initial state $\{0, 0\}$, the basin of attraction of the superior convention is composed of quadrants 2, 3, and 4 in Figure 2.

Because deviations from the best response contract or social norm are independent, expected waiting times for a transition from one absorbing state to the other induced by each of the classes, respectively, are approximated by the inverse of the probability that in a given period the number of deviants of that class will be sufficient to enter the basin of attraction of the other convention. For large populations and sufficient rationality, this probability is approximated by P_i , the likelihood that exactly the minimum number of innovators in class $i(z\phi_i^*)$ will occur (Binmore, Samuelson, and Young 2003). Our results are not affected by taking account of the probability that larger than minimal numbers deviate:

(2)
$$P_i = \begin{pmatrix} z \\ z\phi_i^* \end{pmatrix} (\sigma_i)^{z\phi_i^*} (1 - \sigma_i)^{z - z\phi_i^*}, \quad i = A, B.$$

Hence, the expected waiting time for a transition is the inverse of the probability that the number of innovators in at least one class will be sufficient to tip the population to the basin of attraction of $\{z, z\}$, that is,

(3)
$$E[W] = (P_A + P_B - P_A \times P_B)^{-1}.$$

IV. Discussion

Equations (2) and (3) give us four results applicable equally to either of the two classes (proofs in the online Appendix). First, "culture- or institution-biased" technical change may accelerate transitions by making an alternative convention more productive relative to the status quo. We find that for sufficiently rational agents, because both of the critical fractions required for a transition from $\{0, 0\}$ to $\{z, z\}$ — ϕ_A^* and ϕ_B^* —are decreasing in the productivity advantage of the superior convention (Δ_1^i) , the expected waiting time for a transition (E[W]given by (3)) is decreasing in the superiority of the Pareto-dominant convention. Our evolutionary dynamic thus favors superior cultural-institutional configurations.

But, second, because deviations from the status quo are less likely the greater is the degree of individual rationality, the expected waiting time for a transition is increasing in β . Then, for sufficiently rational agents, a cultural-institutional convention can last virtually forever even if there exists an alternative Pareto-superior convention. There is no invisible hand for cultural-institutional configurations, at least not on historically relevant time scales.

Third, the greater is the cost of deviating from the inferior culture or institution (Δ_0^i) , the longer will be the expected waiting time for a transition to the superior convention. This unsurprising result has a somewhat unexpected implication (Belloc and Bowles 2013): because the gains from trade increase the payoffs for the appropriate contract-norm match at both cultural-institutional nexuses, a shift from autarchy to free trade will increase the costs of deviating and, hence, will delay a transition away from the Pareto-inferior convention. Trade liberalization, thus, does not favor cultural-institutional convergence to superior configurations.

Fourth, because transitions require extreme realizations of the sum of deviations relative to population size, for sufficiently rational individuals, the expected waiting time for a transition is increasing in the group size (z). Extending the model to allow the "upper" B class to be less numerous $(z_A > z_B)$, most of the transitions will be induced by the innovations by members of the elite. But this unsurprising result-history tends to be driven by the elite-is unrelated to the fact that smaller groups may more readily coordinate their actions in producing the public good represented by a transition in which their members do better. The result occurs because the extreme realization of the number of innovators required to induce a transition is more likely the smaller is the population size.

From the above result it follows that, by relaxing the ultra-individualism of the model and allowing for collective action, the expected waiting time for a transition will vary with the degree to which a society is "individualist" or "collectivist"-in the terms of Greif (1994). We use these terms to mean that in an individualist societv the action of one person does not affect the other individuals' actions unless the action alters the incentives facing the others. For example, if one member of a family deviates from the status quo, this has no effect on other family members' actions unless it changes their expected payoffs. By contrast, in a collectivist society individuals sometimes act in groups, such that if one brother deviates all of the siblings will also deviate. In a collectivist society the effective population size is less than the census size, and the expected waiting time for a transition is correspondingly reduced. To provide a simple illustration, suppose in our model that employees (As) work in firms of size n_A and that all employees in a given firm either conform to the status quo (best respond), or they jointly deviate. Effective population size in this case is not z_A but instead z_A/n_A . Worker-induced transitions will be correspondingly accelerated.

As the example suggests, the deviations from best response play that induce real world institutional and cultural transitions are both collective and intentional. For these two reasons, they cannot be fully understood simply as mutations as is standard practice in evolutionary game theory, or even as errors modified by costs, as we have done here. The collective nature of deviations is suggested by the fact that strikes, protests, and other actions challenging the status quo tend to be spatially and temporally correlated. Understanding the mechanisms accounting for these correlations will require attention to political relationships and other aspects of network structure among class members, perhaps along the lines suggested in Kets et al. (2011) and Young (2003).

One can extend the model presented here to represent deviant action as intentional (as in Naidu, Hwang, and Bowles 2010; Hwang, Naidu, and Bowles 2013; and Bowles 2004) by considering a heterogeneous population in which not all individuals maximize the material payoffs of the underlying game, but instead act on behalf of the interests of other members of their class even when it is personally costly to do so. Finally, because the dynamics of transitions depend critically on the size of classes, adequate models of cultural and institutional change will address demographic and sociological issues of cross-class mobility and equilibrium class size (as in Hwang, Naidu, and Bowles 2013).

REFERENCES

- Acemoglu, Daron. 2003. "Why Not a Political Coase Theorem? Social Conflict, Commitment, and Politics." *Journal of Comparative Economics* 31 (4): 620–52.
- Acemoglu, Daron, and James A. Robinson. 2012. Why Nations Fail: The Origins of Power, Prosperity, and Poverty. New York: Crown Business.
- Belloc, Marianna, and Samuel Bowles. 2013. "Cultural-Institutional Persistence under Autarchy, International Trade, and Factor Mobility." Santa Fe Institute Working Paper 13-01-003.
- Binmore, Ken, Larry Samuelson, and Peyton Young. 2003. "Equilibrium Selection in Bargaining Models." *Games and Economic Behavior* 45 (2): 296–328.
- Blume, Lawrence E. 2003. "How Noise Matters." Games and Economic Behavior 44 (2): 251–71.
- **Bowles, Samuel.** 2004. *Microeconomics: Behavior, Institutions, and Evolution.* Princeton: Princeton University Press.
- Clark, Gregory. 2007. A Farewell to Alms. Princeton: Princeton University Press.
- Edgerton, Robert B. 1992. *Sick Societies*. New York: The Free Press.
- **Greif, Avner.** 1994. "Cultural Beliefs and the Organization of Society: A Historical and Theoretical Reflection on Collectivist and Individualist Societies." *Journal of Political Economy* 102 (5): 912–50.
- Hwang, Sung Ha, Suresh Naidu, and Samuel Bowles. 2013. "Institutional Persistence and Change: An evolutionary approach." Unpublished.

- Jürgens, Ulrich. 2002. Corporate Governance, Innovation and Economic Performance. Berlin: Social Science Research Center Berlin (WBZ).
- Kets, Willemien, Garud Iyengar, Rajiv Sethi, and Samuel Bowles. 2011. "Inequality and Network Structure." *Games and Economic Behavior* 73 (1): 215–26.
- Naidu, Suresh, Sung-Ha Hwang, and Samuel Bowles. 2010. "Evolutionary Bargaining with Intentional Idiosyncratic Play." *Economics Letters* 109 (1): 31–3.
- Nuti, D. Mario. 2011. "Industrial Relations at FIAT: Dr. Marchionne's Class War." Transfer: *European Review of Labour and Research* 17 (2): 251–54.
- Parsons, Talcott. 1964. "Evolutionary Universals in Society." *American Sociological Review* 29 (3): 339–57.
- Sokoloff, Kenneth L., and Stanley L. Engerman. 2000. "Institutions, Factor Endowments, and Paths of Development in the New World." *Journal of Economic Perspectives* 14 (3): 217– 32.
- Williamson, Oliver. 1985. The Economic Institutions of Capitalism: Firms, Markets, Relational Contracting. New York: Free Press.
- Wood, Elisabeth Jean. 2000. Forging Democracy from Below: Insurgent Transitions in South Africa and El Salvador. Cambridge: Cambridge University Press.
- Young, H. Peyton. 1998. Individual Strategy and Social Structure: An Evolutionary Theory of Institutions. Princeton: Princeton University Press.
- Young, H. Peyton. 2003. "The Diffusion of Innovations in Social Networks," in *The Economy as a Complex Evolving System*, edited by Lawrence Blume and Steven Durlauf. Oxford: Oxford University Press.

This article has been cited by:

- 1. Pauline Grosjean, Rose Khattar. 2019. It's Raining Men! Hallelujah? The Long-Run Consequences of Male-Biased Sex Ratios. *The Review of Economic Studies* 86:2, 723-754. [Crossref]
- 2. Jiabin Wu, Hanzhe Zhang. 2019. Intergenerational Transmission of Preferences and the Marriage Market. SSRN Electronic Journal. [Crossref]
- 3. NADIA VON JACOBI. 2018. Institutional interconnections: understanding symbiotic relationships. *Journal of Institutional Economics* 14:5, 853-876. [Crossref]
- 4. Jonathan Newton. 2018. Evolutionary Game Theory: A Renaissance. Games 9:2, 31. [Crossref]
- 5. Andrea Boltho, Wendy Carlin, Pasquale Scaramozzino. 2018. Why East Germany did not become a new Mezzogiorno. *Journal of Comparative Economics* 46:1, 308-325. [Crossref]
- 6. Marianna Belloc, Samuel Bowles. 2017. Persistence and Change in Culture and Institutions under Autarchy, Trade, and Factor Mobility. *American Economic Journal: Microeconomics* 9:4, 245-276. [Abstract] [View PDF article] [PDF with links]
- 7. Sung-Ha Hwang, Jonathan Newton. 2017. Payoff-dependent dynamics and coordination games. *Economic Theory* 64:3, 589-604. [Crossref]
- 8. Mathieu Couttenier, Pauline Grosjean, Marc Sangnier. 2017. The Wild West IS Wild: The Homicide Resource Curse. *Journal of the European Economic Association* 15:3, 558-585. [Crossref]
- 9. Carlo Beretta. 2017. Variazioni neoclassiche. *QUADERNI DI ECONOMIA DEL LAVORO* :106, 101-119. [Crossref]
- Jonathan Newton. 2017. Evolutionary Game Theory: A Renaissance. SSRN Electronic Journal . [Crossref]
- 11. Oded Galor, Ömer Özak. 2016. The Agricultural Origins of Time Preference. *American Economic Review* **106**:10, 3064-3103. [Abstract] [View PDF article] [PDF with links]
- 12. Fabio Landini. 2016. The evolution of control in the digital economy. *Journal of Evolutionary Economics* 26:2, 407-441. [Crossref]
- H. Peyton Young. 2015. The Evolution of Social Norms. Annual Review of Economics 7:1, 359-387. [Crossref]
- 14. Jonathan Newton, Simon D. Angus. 2015. Coalitions, tipping points and the speed of evolution. *Journal of Economic Theory* 157, 172-187. [Crossref]
- 15. Mathieu Couttenier, Pauline Grosjean, Marc Sangnier. 2014. The Wild West is Wild: The Homicide Resource Curse. *SSRN Electronic Journal*. [Crossref]
- Pauline Grosjean, Rose Khattar. 2014. It's Raining Men! Hallelujah?. SSRN Electronic Journal . [Crossref]
- 17. Daron Acemoglu, Matthew O. Jackson. 2011. History, Expectations, and Leadership in Evolution of Social Norms. *SSRN Electronic Journal*. [Crossref]