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## The Surprising Success of a Replication That Failed

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### Abstract

In a recent paper, Oliver Will (2009) contends that the effect of mobility on trust that we originally reported (Macy and Sato 2002) depends on 'an assumption that is most probably an unwilling, unintended, and unwanted implication of the code.' When we experimented with Will's revised model, we came to the opposite conclusion: his version provides stronger support for our theory than does our original. The explanation is that Will left the learning rate at the upper limit of 1.0, the level we assumed in our original paper. When we lowered the learning rate to compensate for the removal of the contested assumption, the results showed how mobility can lead to an increase in trust, which is consistent with our explanation for higher trust in the US compared to Japan. Moreover, the model also shows that it is possible for there to be too much mobility.

Keywords: Trust, Mobility, Replication

- 1.1 We appreciate the considerable effort that Will (2009) has invested in replicating our model for a second time. As much or more can often be learned from the replications as from the original results, as can be seen in the series of papers based on Schelling's model of neighborhood segregation and Axelrod's model of the evolution of cooperation. Will's study offers the opportunity for us to revisit our 2002 model and deepen our understanding of the causal mechanisms through which mobility affects the levels of trust and cooperation in social and economic exchanges.
- 1.2 Our original paper (Macy and Sato 2002) addressed an empirical puzzle discovered by Toshio Yamagishi: Why is trust higher in the individualist US than in collectivist Japan? Yamagishi (2001; Yamagishi and Yamagishi 1994) hypothesizes that Americans developed the "social intelligence" needed to take advantage of the greater opportunities in a global market—the willingness and ability to judge who can and cannot be trusted. We wondered why Japanese do not also acquire this same ability and we used an agent-based stochastic learning model to explore a possible explanation: the higher rate of social and geographic mobility in the U.S. In our extension of Yamagishi's theory, the local neighborhood is the "school" in which the skills for trusting strangers are acquired, but only if there is sufficient mobility that agents occasionally encounter an outsider. However, this explanation turns out to require a caveat: We found that too much mobility can also undermine trust.
- 1.3 Will contends that the effect of mobility on trust that we originally reported depends on "an assumption that is most probably an unwilling, unintended, and unwanted implication of the code." That contested assumption is that newcomers do not update their propensity to enter the market until they remain in their new neighborhood for at least one complete iteration. The alternative that Will proposes is to allow newcomers to update their propensity immediately, as soon as they learn the outcome of the current iteration. Although he did not initially expect this "seemingly small issue" to have "any substantial effect on the results of the model," he reports results showing that mobility has no effect on trust in strangers when the assumption is removed.
- 1.4 When we experimented with Will's (2009) revised model, we came to the opposite conclusion: his version of the

model provides stronger support for our theory than does our original (Macy and Sato 2002) model. His version is also simpler and more elegant. Thus, were we to publish our 2002 paper today, we would use his version of the model rather than our original. The revised model shows how mobility can lead to an increase in trust, which is consistent with our explanation for higher trust in the US compared to Japan. Moreover, the model also shows that it is possible for there to be too much mobility.

1.5 Will did not observe these effects because he left the learning rate at the upper limit of 1.0, the level we assumed in our original paper. When we lowered the learning rate to compensate for the removal of the one-iteration delay in updating newcomer's propensities to enter the market, the non-monotonic effects of mobility were again apparent. Figure 1 illustrates the effects of mobility on trust when we reduced the learning rate to the midpoint, at 0.5. This means that a given outcome has half the effect on the associated propensity. Other parameters are identical to those in our 2002 paper and in Will's replication (1000 agents, 2000 iterations, and neighborhoods that vary in size from 10 to 100 by 10; we also increased the number of realizations from 20 to 100 to improve the statistical reliability of the results). Figure 1 shows the level of trust in strangers nearly doubles as mobility increases from 0 to 0.2. However, above 0.2, the effect of mobility reverses. This reversal occurs at a mobility rate that is much more empirically plausible than the reversal at 0.9 in our original results, given that observed mobility rates are below 0.3 among all the OECD countries, including the US and Japan. Indeed, at low levels of mobility, the results of our 2002 model were the opposite, with trust initially declining slightly, and then increasing above 0.1. In short, the results using Will's revised model fit more closely with the hypothesized effects of mobility than do those we originally reported.

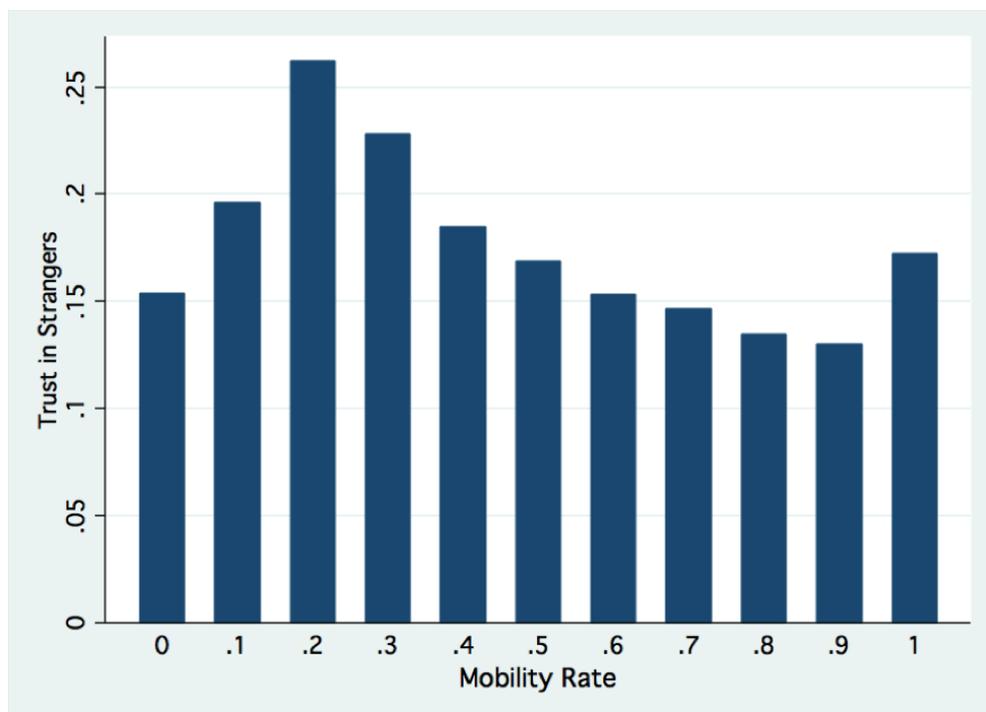


Figure 1. The effect of mobility on trust in strangers with a reduced learning rate (0.5). 1000 agents in 10 to 100 neighborhoods by 10, 2000 iterations per trial, and 100 trials in each condition.

1.6 The sensitivity of the results to the learning rate is instructive. The learning rate determines the number of steps in a random walk into a cooperative equilibrium.<sup>[1]</sup> The fewer the steps, the lower the coordination complexity for reaching this equilibrium. A high learning rate allows agents to coordinate on a strategy of high trust and high trustworthiness before they learn an effective rule for trusting strangers, or in Yamagishi's terms, before they acquire the "social intelligence" needed to sustain an effective global market. As a consequence, agents end up abandoning the market for the higher payoffs they can earn in local exchange. This effect of the learning rate supports Yamagishi's theory of trust. Yamagishi argues that populations tend toward either a parochial equilibrium that minimizes the transaction costs of being cheated, or toward a global-market equilibrium that minimizes the opportunity costs of a small pool of possible exchange partners. The outcome depends decisively on whether agents acquire the "social intelligence" needed to effectively navigate a global market. The argument has the counter-intuitive implication that trust in strangers will be lower in collectivist societies like Japan. Yamagishi's empirical findings are consistent with this hypothesis, but because the argument is highly counter-intuitive, many scholars have remained skeptical. Demonstrating this dynamic with a formal model is therefore

important in showing that the theory is logical even though it violates intuition.

- 1.7 To sum up, Will correctly identified an unnecessary assumption in our model that, when removed, strengthens our original result, both theoretically and empirically. His careful examination of our study has contributed not only to better understanding of the effects of mobility on trust but also to the appreciation of the methodological value of model replication. We believe both of his comments on our paper are valuable contributions, on both substantive and methodological grounds, and we look forward to the next one.<sup>[2]</sup>
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## Notes

<sup>1</sup> The dynamics of random walk are explained in Macy and Flache ( 2002).

<sup>2</sup> "The model's high sensitivity to small modifications of the learning algorithm will be addressed in future work" (fn 12).

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