EXTENDED ABSTRACT

Title: History versus expectations in economic geography: An experimental analysis

Authors and e-mails: Iván Barreda Tarrazona (ivan.barreda@eco.uji.es)[1], Tapas Kundu (tapas.kundu@oslomet.no)[2] and Stein Ostbye (stein.ostbye@uit.no)[3]

Department: Economics

University: (1) Universitat Jaume I, (2) Oslo School of Business and (3) The Artic University of Norway.

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Abstract:
In this paper, we study migration dynamics in the Core-Periphery (CP) model of New Economic Geography (NEG). More specifically, we look at history-driven behavior (HDB) versus expectation-driven behavior (EDB). By implication, we also shed light on myopic behavior (MB) and Markov-perfect equilibrium forward-looking behavior (MPE FB), since EDB is inconsistent with MB and HDB is inconsistent with MPE FB. We use the much used elaboration by Forslid and Ottaviano (2003) of the original CP model (Krugman, 1991a) as basis for developing a game theoretical framework adapted to experimental analysis.

The paper contributes to the literature in several important ways: The first contribution lies in adapting the CP model to experimental testing (Section 2 and Appendix A). To do so, we introduce a group-based migration process in the standard NEG framework and proceed by operating with a finite number of agents reflecting that the number of subjects in the lab is always finite.

We also introduce sufficient asymmetry to make locations different with complete agglomeration in order to make places clearly distinctive for potential migrants. Our theoretical findings show that the outcome of the migration game can be different based on whether agents follow HDB or EDB. We also show that EDB is inconsistent with MB and that HDB is inconsistent with MPE FB within the theoretical model.

The second contribution lies in testing the model predictions by designing and running a framed experiment that closely captures the migration incentives considered in our theoretical study.

The experiment was conducted at the Laboratorio de Economía Experimental (LEE) at Universitat Jaume I in Castellón (Spain). The experiment is implemented as a computerized laboratory experiment programmed using the standard software z-Tree (Fischbacher, 2007). Subjects were recruited from a voluntary pool of students at

Universitat Jaume I. The subjects were incentivized by earning real money depending on performance (paid in cash when leaving the lab): on average 24.40 euros, ranging from 13.60 to 42.70. The time spent in the lab was on average a little less than 2 hours. The experiment contains 3 different treatments, with controls for reasoning ability, risk aversion, and inequity aversion. We will first give a general outline of the design and then turn to more details on the different treatments. To keep the design clean, the treatments vary in one dimension only: the number of players (2, 3 or 4). Recall that, we denote treatments accordingly as T2, T3 and T4. T2 and T3 were run in November 2016 and T4 in March 2017.

The baseline (T2) is described by high transport costs and 2 players, both initially in region 0 (none in region 1).
The theoretical prediction for all treatments is complete agglomeration in region 0 when behavior is strongly history dependent (HDB), more precisely when (MB0) or (NPE0) holds. The prediction is complete agglomeration in region 1 when behavior is strongly expectation dependent (EDB), more precisely when (FB1) or (NPE1) holds. Hence, the first outcome is inconsistent with MPE FB, whereas the second outcome is inconsistent with MB. In order to make the payo
s in the tables easy to compare for the subjects, we made a transformation with payoff equal to 200 x utility from the parametrized theoretical model minus 12.5.

We consider 20 independent observations per treatment variation a minimum for meaningful statistical inference. In the baseline treatment (T2), both players are initially in region 0. This calls for 40 subjects that play in either first or second position. T3 calls for 20 (independent observations) times 3 players per observation = 60 subjects. T4 requires another 80 subjects. With a pure between subject design, this implies 180 subjects in total playing a one-shot game.

In T2, the baseline treatment, the 40 subjects were randomly matched into 20 fixed pairs. In each pair, one subject was randomly designated as decision maker in the first period and the second subject left to make the decision in the second period.

In T3, the 60 subjects were randomly matched into 20 fixed triplets. To allow each subject to act as the single decision maker in each group in any period, the number of periods compared to the baseline treatment increased from 2 to 3.

In T4 we had 80 subjects randomly matched into 20 fixed quadruples. Each group played for 4 periods to let all subjects make decisions as they did in the previous treatments.

In T2, only the first period decision matters for testing the EDB versus HDB hypotheses. 17 out of 20 subjects (85 percent) decided in the first period to move to region 1, consistent with EDB (inconsistent with HDB). In the second period, in 2 out of the 3 pairs where the first period decision maker did choose to stay, the second period decision maker also made the decision to stay which is perfectly rational since payoff is 7.7 instead of 7.5 by moving. In one case, however, the second period decision maker made the decision to move.

In T3, as in the baseline treatment, the first period decision discriminates between EDB and HDB. But now, also the second period decision may discriminate between the two, provided the first-period decision in the group was consistent with HDB. Just as in the baseline treatment, the last period decision is irrelevant for testing apart from discriminating between rational and irrational behavior. In the first period, 4 out of 20 subjects (20 percent) made the decision to stay in region 0, consistent with HDB. Comparing first round behavior to the baseline treatment, the increase from 15 to 20 percent is clearly not enough to be statistically significant (see Table 5). In the second period, conditional on first period decision to stay, a decision to stay is consistent with HDB and a decision to move consistent with EDB. The difference in payoff is small, but the decision context very simple. In all the 4 groups where the first period decision was to stay, the second period decision maker decided to move consistent with EDB. In the third period, rational behavior calls for a decision to move since at the beginning of this period there is at least already one subject in Region 1 (giving at least 8.0 by moving as opposed to maximum 3.9 by staying, according to Table 2). Again, there is one subject who fails to make the payoff maximizing decision.

In T4, unconditional discrimination between the two behavioral hypotheses is feasible in the first period as for all treatments. We may also compare second period decisions conditional on first period decisions consistent with HDB to T3. In T4, it may even be feasible to discriminate between HDB and EDB in the third period. Starting with the first period, now only 9 out of 20 decision makers chose to move. Hence, 11 out of 20 chose to stay consistent with HDB. This is up 30 percentage points compared to baseline and clearly significant. Is there any evidence for HDB also in the second period? In 2 out of the 11 groups with HDB in first period, the second period decision was also to stay consistent with HDB. In T3, none of the 4 groups with HDB in the first period exhibited second period HDB. Finally, in the third period, for 1 out of the 2 groups that were still agglomerated in region 0, the third period decision was to stay consistent with HDB.

Our experimental findings show that EDB is less likely to prevail with a large number of participants in the migration game. More specifically, we find behavior consistent with EDB (by implication inconsistent with MB) in treatments with 2 and 3 players. However with 4 players a majority retreat to behavior consistent with HDB (by implication inconsistent with MPE FB). It therefore seems that it does not take much complexity to reach a threshold where history becomes more important than expectations from a behavioural perspective.

Is HDB in our experiment likely due to MB or some other factors? At least two arguments could be suggested against MB. First, agents' behavior can be consistent with some non-perfect equilibrium in FB. Specifically, in one of the non-MPE FB, staying is an equilibrium on the belief that all are staying and in such a case, staying may therefore have nothing to do with MB. This is true, but then we may ask why subjects in the last treatment (T4) should have this belief and not the subjects in the other two treatments (T2 and T3)? The second argument could be that subjects have preferences not reflected in the theoretical model where only real wage differences are assumed to matter. But this also raises questions. We have tested for several incentivized controls (e.g., inequity aversion and risk aversion) without finding notable differences between subjects. We have therefore no indication that the subjects in the last treatment should have different preferences than the subjects in the first two treatments.

Number effects are also found in other game theory experiments. Huck et al. (2004), find collusion in oligopoly games with 2 and 3 agents, but market outcomes at Cournot or above in games with 4 and more. Dufwemberg and Van Essen (2018) also find a significant drop in players following the backward induction prediction when moving from 2 to 4 sequential players in their line game. We may therefore ask if the number effect found in these very different settings could be the result of a more general phenomenon that could be revealed through additional experimental work.

Keywords: New Economic Geography; Migration; Experiments; Myopic vs. Forward-looking Behavior.

JEL codes: R1; C91; C73