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Platform selection in the lab

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ABSTRACT

Emerging literature explores experimental platform selection games. These games converge rapidly on the superior platform under a wide range of conditions. We replicate the remarkable results of Hossain and Morgan (2009) in which such a game tips almost perfectly to the superior platform. Next, we show that platform coordination fails when seemingly innocent increases in out-of-equilibrium payoffs are introduced. The inflated payoffs keep the best reply structure unchanged and do not influence players' security levels. Our design allows control for the explanatory force of risk dominance. We find that equilibrium selection theory is unable to account for coordination failure while observed behavior is consistent with non-rational learning. Furthermore, and contrary to the literature, we find that efficiency suffers when an inferior platform is granted initial monopoly.

1. Introduction

Arguably, the most important unresolved question in economic theory is that of equilibrium selection. Despite the indeterminacy of theory, coordination failures are held responsible for substantial social costs in a wide range of important applications.[1] We focus on coordination failures in platform selection games.[2] These games are characterized by the presence of network effects and Pareto-ranked equilibria. Protracted investigation by case historians has not produced agreement about the severity of coordination problems in platform selection games.[3]

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[1] A non exhaustive list of applications where coordination failures are held culpable include: selection of Condorcet losers in elections (Myerson and Weber, 1993; Forsythe et al., 1993); persistency of money illusions (Fehr and Tyran, 2007); bank runs (Diamond and Dybvik, 1983; Garratt and Keister, 2009); currency attacks (Obstfeld, 1996; Morris and Shin, 1998, 1999); setting of industry standards (Farrell and Saloner, 1985); emergence of fiat money (Kiotaki and Wright, 1989; Cooper and John, 1988); team production (Van Huyck and Battalio, 2008; Brandts and Cooper, 2006); and lack of economic development (Rodrik, 1996).

[2] We take "coordination" to mean play consistent with the payoff dominant equilibrium. Coordination "failure", or "breakdown", is understood as the failure to play the payoff dominant equilibrium.

[3] The prime example is the claim that the QWERTY keyboard is inferior, but still prevalent due to path dependence (David, 1985). The claim that QWERTY is inferior is strongly contested by, among others, Liebowitz and Margolis (1990, 1994). For a review of the QWERTY history and several other case histories see Farell and Klemperer (2007) and Gretz (2010).

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The emerging literature exploring experimental platform selection games (EPSGs) is, however, more conclusive (Hossain and Morgan, 2009, 2011; Hossain et al., 2011). Its main finding is that behavior converges rapidly on the superior (i.e. payoff dominant) equilibrium under a wide range of conditions.[4] In particular, granting initial monopoly to an inferior platform does not affect subsequent coordination on a superior entrant.[5] The one exception to the strong efficiency results in the literature is that conflicts between payoff- and risk dominance seem capable of pushing behavior away from the superior platform.[6]

We add to the EPSGs literature in several important ways. First, we show that systematic coordination failures can be generated in platform selection experiments, but that such failures are not caused by conflicts between payoff- and risk dominance. Second, we find strong incumbency (i.e. first-mover) effects at work. In particular, periods of inferior incumbency significantly reduce subsequent coordination on a superior entrant. Finally, we show that non-rational learning rules – not equilibrium selection theory – explain both coordination and coordination failures in platform selection. Specifically, inflated out-of-equilibrium payoffs tend to drive behavior away from the superior platform through payoff reinforcement learning. This happens regardless of the inflated out-of-equilibrium payoffs' impact on risk dominance.

Taken together our findings qualify the main message of the EPSG-literature; efficiency cannot be taken for granted in platform selection games, not even when payoff- and risk dominance are aligned. Inferior incumbency tends to generate inefficiency, and seemingly innocent payoff changes impact forcefully on coordination through behavioral rules.

In EPSGs, positive and negative network effects are at work. There are two types of players and two platforms. The more players of the opposite type and the fewer of own type that choose a platform, the more profitable that platform choice is. Platform users face a major challenge in choosing platforms since coordinating on the superior platform requires mutually consistent beliefs and actions. Such consistency cannot be taken for granted.

To fix ideas, consider an island fable (close to the EPSGs we consider). Two sellers and two buyers (two pairs of player "types") interact. Trading can take place on two different islands ("platforms"). One island is far away, the other one is close. Players decide simultaneously which island to trade on. Intuitively, if all players locate on the same island, this is an equilibrium. A deviant would be located on the other island alone and would get no trade. Since there are two islands, there are two such equilibria. Travelling to the far off island is more costly, so the equilibria are Pareto-ranked.

Despite their stylized nature, these games highlight strategic tensions that are present in real world markets. An illustration is the choice of "green" car technology, should I choose an electrical platform or a hydrogen based one? The network of complementary services (e.g., filling/charging stations, repair shops, and secondhand market) is important for consumers. Further, the extent of a network depends on the number of consumers using the technology. The flip side is that the profitability of investing in a platform depends on the expected size of the network. The risk of ending up with a small network may prevent the adoption of a technology, even if a widespread change to that technology is preferred.

An issue of particular relevance for the problems considered in this paper is that the level of both producer and consumer rents may depend on the technology of the platform. Consider a situation in which the fixed costs of a hydrogen filling station (vehicle) are higher than those of the electrical alternative. Now, holding all else equal, monopoly (monopsony) rents will be higher on the electric platform. Importantly, however, high rents are an out-of-equilibrium phenomenon in platform selection games.

In the remainder of the paper, we explore the robustness of EPSG efficiency. First, we present a design that permits replication, facilitates a controlled test of equilibrium selection theory, and allows for the exploration of incumbency advantages. Second, in the results section, we replicate the remarkable coordination result of Hossain and Morgan (2009) (hereafter HM). We then show that coordination is wiped out when out-of-equilibrium payoffs are manipulated in seemingly innocent ways. Subsequently, we demonstrate that incumbency effects are present and that non-rational learning rules, not the theory of equilibrium selection, explains our data. The paper ends with a brief conclusion.

2. Design

The centre piece of our design is a controlled inflation of out-of-equilibrium payoffs (i.e. provision of high rents) in each of the two original payoff matrices used by HM. This leaves us with two pairs of matrices, each pair consisting of an original and an inflated matrix. In each pair we inflate in a way that preserves the best reply structure and security levels of the original matrix. Thus, the inflated out-of-equilibrium payoffs should not lead to coordination breakdown according to standard theory.[7] In the first pair of matrices (1/1*) the superior platform remains risk dominant after inflation. In the second pair of matrices (2/2*) the superior platform becomes risk dominated after inflation. According to the theory of equilibrium selection, coordination should not fail in the inflated matrix of the first pair, while it may fail in the second.

[4] These include coexistence of tipping and non-tipping equilibria; as well as vertically and horizontally differentiated platforms.

[5] The main finding from EPSGs contrast with the frequent coordination failures commonly observed in the lab for other games in which equilibria are Pareto-ranked, notably order statistic games and stag hunt games (see Van Huyck and Battalio, 2008; Devetag and Ortmann, 2007 for reviews).

[6] When criteria conflict, market shares of the superior platform hoovers around 50–60% in Hossain et al. (2011, Figure 6, N-treatments), compared to rapid convergence to close to 100% in all other treatments of their study.

[7] By standard theory we understand maximizing behavior from pure self-regard and common knowledge rationality. We make a distinction between standard theory and (the more general) theory of equilibrium selection.