Available online at www.sciencedirect.com

ScienceDirect

Journal of Economic Theory 154 (2014) 173–186

JOURNAL OF Economic Theory

www.elsevier.com/locate/jet

Notes

Community enforcement with observation costs

Yu Awaya

Department of Economics, Penn State University, University Park, PA 16802, United States

Received 23 April 2013; final version received 1 September 2014; accepted 20 September 2014

Available online 3 October 2014

Abstract

Takahashi (2010) [12] proves a folk theorem in an environment where a continuum of players are randomly matched in each period to play the prisoner's dilemma with a different partner. A key assumption there is that a player can observe her partner's past play *without any cost*, while she cannot observe the past play of her partner's past partners, the partners of her partner's past partners, and so on. However, Takahashi's [12] result is not robust to the introduction of an *infinitesimal cost* to acquire information about partners' past play. In this note, with the help of cheap-talk communication, I prove a folk theorem by constructing an equilibrium strategy that is robust to an infinitesimal cost.

JEL classification: C72; C73

Keywords: Repeated game; Random matching; Community enforcement; Observation cost

1. Introduction

Prior to giving a loan, a bank has the option of checking an applicant's credit history. This history is usually summarized by a statistic—the applicant's credit score. A bank is unlikely to approve a loan application if the applicant has a low credit score due to defaulting on a past loan, or missing a credit card payment. In effect, a bank can punish an applicant for past transgressions by denying the loan. Most credit scores are made available to lenders for a small fee.

E-mail address: yxa120@psu.edu.

http://dx.doi.org/10.1016/j.jet.2014.09.007

In a recent paper, Takahashi [12] establishes a folk theorem in an environment where a continuum of players are randomly matched in each period to play the prisoner's dilemma with a different partner. Motivated by credit scores and online feedback, he assumes that only first-order information (a record of the current partner's past play) is available *without any cost*, while second or higher-order information (a record of the current partner's past partner's past play, a record of the current partner's past partner's past partner's past play, and so on) is not available.

To show the result, Takahashi [12] constructs two classes of equilibria. One class consists of grim-trigger equilibria (and its modification by Ellison [4]). The other consists of what are called *independent and indifferent* equilibria. As the name suggests, independent and indifferent equilibria have properties that players' actions are independent of their own histories and players are indifferent between the two actions available to them. However, as I argue below, neither class of equilibria is robust to costly information acquisition.[1] This is so even if the costs are infinitesimal. Grim-trigger equilibria are not robust because if every player cooperates on the equilibrium path, then no player has an incentive to observe his partner's past record. Thus, a defection is never detected. Independent and indifferent equilibria are not robust because if the actions of a player are independent of her own record, knowing past plays does not help to predict future plays. Thus, there is no reason to observe past plays.

In this note, with a help of cheap-talk communication, I construct equilibria that are robust to infinitesimal observation costs. Players incur a small cost to observe first-order information. This observation cost is small enough that it only affects a player's choice between strategies with otherwise equivalent payoffs.[2] The observational decision (whether or not to pay for information) cannot be observed by other players at any cost. I keep the assumption that second or higher-order information is not available at any cost. Given this setting, I show that a folk theorem holds generally.

The construction of the equilibria is as follows. First, I show that the infinite horizon random matching game of Takahashi [12] can be reduced to a payoff-equivalent one-shot game. The one-shot game has at least three equilibria, and one of them corresponds to an independent and indifferent equilibrium. It is key that for each player in any match, there always exists an equilibrium in which the player is strictly worse off relative to the independent and indifferent equilibrium. The equilibrium is referred to as a *punishment equilibrium*. The independent and indifferent equilibrium is used as a reward for observing while a punishment equilibrium is used as a punishment for not observing. To find out whether a player has observed the history of her matched player, cheap talk is used. After the observational decisions are done, a randomly picked player (the "examiner") asks other player (the "examinee") about the examiner's past actions. The examinee can answer correctly if he prepares, while he fails with positive probability if he does not. This class of strategies is referred as *testing strategies*.

Next I consider the case where observation costs are strictly positive. It will be shown that when the observation cost is small (but strictly positive), the testing strategies no longer constitute an equilibrium. Moreover if the cost is big enough, then the trivial equilibrium—the repetition of the stage-game equilibrium—is the only equilibrium.

[1] Gong and Yang [6] work on an experiment where either first- or second-order information is available. There, to observe information, subjects have to click a button which is slightly troublesome.

[2] Thus, players effectively have lexicographic preferences over payoff-cost pairs. See Section 4 for a precise specification.