Games and Economic Behavior 86 (2014) 264–281

Contents lists available at ScienceDirect

Games and Economic Behavior

www.elsevier.com/locate/geb

The effect of endogenous timing on coordination under asymmetric information: An experimental study ☆

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ARTICLE INFO

Article history:
Received 10 August 2011
Available online 13 April 2014

JEL classification:
C72
C91
D62
D82
D83

Keywords:
Coordination
Delay
Information
Global games
Experiment

ABSTRACT

This paper investigates the role of endogenous timing of decisions on coordination under asymmetric information. In the equilibrium of a global coordination game, where players choose the timing of their decision, a player who has sufficiently high beliefs about the state of the economy undertakes an investment without delay. This decision (potentially) triggers an investment by the other player whose beliefs would have led to inaction otherwise. Endogenous timing has two distinct effects on coordination: a learning effect (early decisions reveal information) and a complementarity effect (early decisions eliminate strategic uncertainty for late movers). The experiments that we conduct to test these theoretical results show that the learning effect of timing has more impact on the subjects' behavior than the complementarity effect. We also observe that subjects' welfare improves significantly under endogenous timing.

1. Introduction

Many economic activities are characterized by strategic complementarities where individuals achieve desirable outcomes if they can coordinate their actions. Such activities include the agglomeration of businesses (Caplin and Leahy, 1998), technology adoption (Katz and Shapiro, 1985, 1986), crop choice by subsistence farmers (Conley and Udry, 2001), bank runs and currency attacks (Diamond and Dybvig, 1983; Morris and Shin, 1998 and Goldstein and Pauzner, 2005), and foreign direct investment (FDI) (Jordaan, 2009), among others.

☆ We would like to thank the editor, Thomas Palfrey, an advisory editor and two anonymous referees for their valuable comments, which have substantially improved the paper. We gratefully acknowledge helpful discussions with Alessandro Citanna, John Duffy, Stephen Morris, Hyun Song Shin, and Paolo Siconolfi, as well as seminar participants at New York University, University of Maryland, Rutgers University, Columbia University, Fordham University, University of Texas at Austin, Boston College, Carnegie Mellon University, University of British Columbia, McGill University, Yeshiva University and Georgetown University. This paper has also benefited from suggestions by the participants of the AEA 2009 Annual Meeting, and the 2009 ESA North American Conference. The views expressed in this paper are the personal views of the authors and are not necessarily reflective of views of the City of New York or its Office of Management and Budget.

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http://dx.doi.org/10.1016/j.geb.2014.03.018
0899-8256/

Another common characteristic of the examples mentioned above is the existence of asymmetric information. For instance, potential investors in foreign markets have myriad sources of information regarding the uncertainty that their decision involves. Uncertainty in FDI decisions can include political uncertainty (Rodrik, 1991), demand uncertainty (Goldberg and Kolstad, 1995), and cost uncertainty (Creane and Miyagiwa, 2007). In many cases, individuals acquire private information from various sources regarding these uncertain events. For example, as Markusen (2004) argues, "[... a] multinational firm may adopt some contractual agreement with a local agent as a means of exploiting any superior information the agent may possess regarding market characteristics." As a result, each firm's information is determined by its relationship with a local agent, which can create asymmetry because different investors pair with different local agents leading to different sources of information.

The effect of strategic timing has been subject to analysis both under pure information externalities (Chamley and Gale, 1994; Gul and Lundholm, 1995) and under strategic complementarities (Bolton and Farrell, 1990; Farrell, 1987; Farrell and Saloner, 1985, 1988). Under pure information externalities, time serves as a medium for disseminating information between individuals who make their decisions at different moments. We will refer to this effect of time as the *learning effect*. In the presence of strategic complementarities, time serves as a coordination device, because early movers eliminate strategic uncertainty by late movers, thus facilitating coordination. In the sequel, we will refer to this effect as the *complementarity effect* of strategic timing. As will be seen, the two effects can be distinguished by comparing decisions in games with and without uncertainty. Given no uncertainty there is nothing to be learned, so all differences between the simultaneous and sequential treatments are attributable to complementarity effects. With uncertainty, treatment effects are a combination of complementarity and learning effects.

The outcome of economic activities can also be affected by the timing of decisions. A firm's investment decision reveals valuable information about the profitability of the project. Early investors therefore trigger a process through which information aggregates. At the same time, the option of having access to this information in later periods (i.e., the learning effect) creates an incentive for the investors to wait and observe others' decisions. In fact, as Chamley and Gale (1994) show, if the incentive to delay the investment is sufficiently strong, no investment is undertaken even though it is beneficial for all investors.

Despite the substantial amount of research analyzing the complementarity and learning effects separately, there is little theoretical work (viz. Brindisi et al., 2013; Dasgupta, 2007; Xue, 2003) that studies the two effects together. Furthermore, to the best of our knowledge, there is no experimental research that does this. Little is known about the interaction of these two effects. We aim to fill this gap by using a series of laboratory experiments to investigate the effects of strategic timing decisions on coordination under asymmetric information—i.e., when strategic complementarities and information externalities coexist.

Since the main focus of our paper is on strategic complementarities and asymmetric information about the fundamentals of the economy, we base the design of our experiment on the global coordination game introduced by Carlsson and van Damme (1993).[1] Incorporating endogenous timing into this model allows us to analyze the two effects of timing, which we discussed above. The theoretical framework analyzed by Brindisi et al. (2013) provides us with insights and hypotheses that we test in our experimental treatment. They characterize the equilibrium of a simple two-player global coordination game that allows endogenous timing. They demonstrate that the complementarity and the learning effects of timing allow players to internalize the returns from coordination, and strategic delay serves as a coordination device. In particular, they find that an optimistic player invests earlier, and a pessimistic player invests later, if at all.

The intuition for this is as follows. An optimistic investor, already expects a high return, making investment an attractive option. Beyond this, the optimistic investor also understands that his investment will make the other player more optimistic about the economic fundamentals, increasing the likelihood that the other player will invest in subsequent periods, if he has not already done so. Because of strategic complementarities, this further increases the optimistic investor's expectation of higher returns. The equilibrium behavior of the pessimistic investor is as follows: Because of his pessimistic beliefs, he not only expects a low return, but he also believes that the other investor holds pessimistic beliefs as well. Therefore, he finds it optimal to wait. If he observes investment, then in the next period he becomes less pessimistic, and adjusts his decision accordingly.

This characterization determines the effect of endogenous timing on welfare. It is well-known that the risk-dominant equilibrium is the limit equilibrium of the simultaneous game as the player's signal becomes fully informative. However, this equilibrium is inefficient. In contrast, Brindisi et al. (2013) show that the equilibrium of the sequential game is fully efficient in the limit as signals become fully informative. For the parameters used in our experiment, the ex ante average payoffs are higher in the sequential game than in the simultaneous game for all levels of informativeness of signals. However, the difference between the two treatments is actually decreasing for all levels of signal informativeness. Thus, endogenous timing is especially beneficial in relatively noisy environments.

[1] For a thorough review of global games literature, see Morris (2008) and Morris and Shin (2003).