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QWERTY is efficient ☆

Bernardo Guimaraes *, Ana Elisa Pereira

Sao Paulo School of Economics – FGV, Brazil

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Abstract

We study a dynamic coordination problem with staggered decisions where agents choose between two competing networks. If the intrinsically worst one prevails, this is efficient. Moreover, inefficient shifts to the intrinsically best network might occur in equilibrium.

Keywords: Coordination; Networks; Timing frictions; Dynamic games

1. Introduction

Consider the problem of choosing between two industry standards or networks (PC or Mac, iOS or Android, Facebook or Google+, DVD or blu-ray, QWERTY or Dvorak keyboards). A consumer takes into account not only the intrinsic quality of each alternative but also the number of people in each one. Agents' choices are strategic complements: the larger the amount of people in a given network, the more each individual is willing to choose that option. Moreover, these choices are only occasionally made, typically when our current device is old or not working very well. Hence, our decisions are staggered and expectations about the future are crucial.

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* Corresponding author.
E-mail address: bernardo.guimaraes@fgv.br (B. Guimaraes).

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We observe that in many cases agents tend to follow the crowd and choose, say, Windows over Linux (even though many computer experts would recommend Linux), because it is useful to be in a large network of users.[1] Likewise, in the past century, we observed the mass adoption of the QWERTY keyboard over the Dvorak alternative because most people were used to the QWERTY standard, even though the Dvorak keyboard was arguably better in terms of its intrinsic quality.[2] This raises questions about efficiency in this problem. Is the equilibrium inefficient? Is there room for policy?

In order to answer these questions, we study efficiency in a dynamic coordination game with staggered decisions and show that the planner assigns an even lower weight to the intrinsic quality of each good than the agents. Hence the planner would be even more inclined towards QWERTY. One implication is that, if there is no other relevant externality, we should not subsidize a shift to an intrinsically better network – agents will move too early even without subsidies.

This paper builds on the model of Frankel and Pauzner (2000). They base their analysis on a model of sectorial choice (along the lines of Matsuyama, 1991), but their framework has been used to analyze location choices (Frankel and Pauzner, 2002), carry trades and speculation (Plantin and Shin, 2006), speculative attacks (Daniëls, 2009) and business cycles (Frankel and Burdzy, 2005; Guimaraes and Machado, 2015).[3] The model of currency attacks in Guimaraes (2006) and the model of debt runs in He and Xiong (2012) employ similar timing frictions.[4]

The paper is also related to the literature on network externalities, in which strategic complementarities arise from consumption externalities.[5] Agents' optimal choices typically depend on what they expect others will do. However, most of this literature makes ad-hoc assumptions on how agents coordinate.[6] Argenziano (2008), an important exception, considers a static coordination game played by ex ante heterogeneous agents who must choose among two networks. In her model, agents give too much importance to their own idiosyncratic tastes, so the efficient allocation would feature a larger higher-quality network. Here, in contrast, inefficiencies result from the dynamic interaction among agents: they sometimes switch to the higher-quality network when it would be socially better for them to stay in the lower-quality one.[7]

2. The model

There is a continuum of infinitely-lived agents indexed by $i \in [0, 1]$. Time is continuous and agents discount the future at rate ρ. An agent can be in two possible networks. We denote by $a_{i,t} \in$

[1] In August 2015, about 85% of desktop or laptop computers worldwide used Microsoft Windows (Statcounter).

[2] See David (1985).

[3] In Guimaraes and Pereira (2015), we extend the model of Frankel and Pauzner (2000) to the case of ex-ante heterogeneous agents.

[4] This work is also related to the literature on coordination in games with strategic complementarities and asymmetric information, such as Carlsson and Van Damme (1993) and Morris and Shin (1998). The relation between this literature and that on dynamic coordination games (e.g., Frankel and Pauzner, 2000 and Burdzy et al., 2001) is discussed in Morris (2014).

[5] This literature has started with Katz and Shapiro (1985) and Katz and Shapiro (1986). See Shy (2011) for a survey.

[6] For instance, Katz and Shapiro (1986) assume that whenever there are multiple equilibria in the model, agents manage to coordinate their decisions in order to achieve the Pareto-superior outcome.

[7] In Argenziano's (2008), the higher-quality network is always the largest one in equilibrium. Hence her model is not well suited to analyze situations in which the largest observed network is the one with lowest intrinsic quality. Here, owing to the dynamic aspect of our model, the economy may be in states where the lower-quality network is the largest one in equilibrium – which captures well situations like the Linux–Windows dispute or the QWERTY–Dvorak choice.