Journal of Economic Dynamics & Control 46 (2014) 219–236

Contents lists available at ScienceDirect

Journal of Economic Dynamics & Control

journal homepage: www.elsevier.com/locate/jedc

Investment decisions in finite-lived monopolies

Paulo J. Pereira [a,*], Artur Rodrigues [b]

[a] CEF.UP and Faculdade de Economia da Universidade do Porto, Rua Dr. Roberto Frias, 4200-464 Porto, Portugal
[b] NIPE and School of Economics and Management, University of Minho, Portugal

ARTICLE INFO

Article history:
Received 24 August 2013
Received in revised form
2 July 2014
Accepted 4 July 2014
Available online 11 July 2014

JEL classification:
C73
D43
D81
D92
G31
G38

Keywords:
Finite-lived monopolies
Real option games
Uncertainty
Real Options

ABSTRACT

This paper studies the value and optimal timing for investment in finite-lived monopolies, extending the literature on real option games by considering the cases of random and certain-lived monopolies. Under these settings, firms face the risk of demonopolization, that can occur as a random or a certain event. We show that these new settings produce significantly different results when compared to the canonical monopolistic and duopolistic models. In a certain-lived monopoly, the leader invests sooner than in a duopoly if there is a risk of being preempted, and later than in a monopoly if the leader role is pre-assigned. In a random-lived monopoly, entry occurs somewhere between the duopoly and monopoly cases. Higher uncertainty delays investment in all cases.

1. Introduction

Models of investment under uncertainty, as found in the real options literature, were initially developed under the assumption that the option to invest is proprietary (e.g., Tourinho, 1979; McDonald and Siegel, 1986; Dixit and Pindyck, 1994; Trigeorgis, 1996), with firms acting as operating in a monopolistic market. Several authors have proposed models that relax this assumption, allowing for competition, most assuming a duopolistic market structure (e.g., Smets, 1993; Grenadier, 1996; Shackleton et al., 2004; Pawlina and Kort, 2006).[1] This growing stream of literature, known as real option games, merges real options theory and game theory.[2] The main issue addressed by this literature is the optimal timing of investment when a firm operates in a competitive market.

Most of the extant models assume that the number of potential competitors is known and fixed, their behavior being endogenously determined. The market structure is also solely endogenously determined by the competitive game. For instance, in the case of a duopoly with preemption, the market can evolve from a monopoly, when the leader enters the

* Corresponding author. Tel.: +351 225 571 225; fax: +351 225 505 050.
E-mail address: pjpereira@fep.up.pt (P.J. Pereira).

[1] Models with more than two players are seldom considered, and most assume the collusive behavior of firms or an exogenously determined entry sequence. Bouis et al. (2009) are one notable exception, modeling an oligopoly with the endogenous entry sequencing of n firms.

[2] For a review of the literature on competitive option games, please refer to Chevalier-Roignant and Trigeorgis (2011), and Azevedo and Paxson (2014).

http://dx.doi.org/10.1016/j.jedc.2014.07.003
0165-1889/

market, to a duopoly, with the entrance of the follower, but the number of firms that can enter the market never exceeds two.

However there are many examples of markets the structure of which changes exogenously, for example from a monopoly to a competition market, in a process known as demonopolization. This is typical of government-granted monopolies, protected from competition by a non-perpetual barrier. Western European incumbent telecom companies, and several other utilities, were protected from competition until Governments opened their respective markets in the last decades of the 20th century. In the UK, the British Telecom monopoly was ended in 1982 when the British government granted a license to Mercury Communications, Ltd. This kind of liberalization was followed in several other countries and in different industries (e.g., transportation, gas, electricity), and is still being pushed by the European Union. The European Commission has recently proposed the end of the remaining rail monopolies in Europe and the opening to competition of those markets from 2019.[3] In 2009, the UK Competition Commission forced BAA to sell some airports under management, introducing competition in London main airports. Before this event, BAA acted as monopolist facing the threat of demonopolization.

In these cases, the date of demonopolization was not known *ex ante* by the incumbent firms, and as such they benefited from a random-lived monopoly. In some other cases the end of the monopoly period is defined in advance, having a certain duration. This is typically the case of firms that grant a monopoly to other firms through special rights, such as the exclusiveness to produce or sell a product in a market. For example, in 2007, Apple Inc. gave AT&T the exclusive right to sell the iPhone in the US, supposedly for five years.[4] In this case AT&T could not be preempted by other competitors. However, firms that may benefit from a certain-lived monopoly can be preempted by other firms. This happens, for example, in R&D or pharmaceutical companies, that vie for patents that protects them from competition for a certain period, according to the patent duration.

Governments can also grant certain-lived protection periods to ensure that a private concessionaire is economically viable. In Thailand, in 1991, Shinawatra Satellite Co. was granted a 30 year concession to operate Thailand's first commercial satellites, with 8 years of exclusivity. In Portugal, in 1995, Lusoponte won a concession to manage two bridges over the river Tagus, with an exclusivity clause on any other crossing built during the 33 years concession period.

Under these settings, besides the usual sources of uncertainty, firms face the possibility of a change in the market structure. They operate in a finite-lived monopoly, but face a process of demonopolization, that can occur as a random or a certain event. The incumbent firm must adapt its behavior to take into account the risk of losing the monopoly rents which significantly impacts its value.

Demonopolization is often part of liberalization processes or other significant modifications of Government or regulator policies. Liberalization processes are extensively studied in the economics literature. For instance, Armstrong and Sappington (2006) discuss different liberalization policies and the role of regulation. A common form of liberalization, discussed in the paper, is the announcement of a date in the future when new competitors will be allowed to enter, precluding competition before that date. The authors argue that a temporary monopoly (or oligopoly) can increase the incumbent firm investment, benefiting consumers. However it also delays investment from new firms, reducing aggregate investment. Regulator policies in an uncertain environment have been studied using a real options approach by Brennan and Schwartz (1982), Dixit and Pindyck (1994), and Teisberg (1993, 1994). None of these papers considers the possibility of a regulator controlling the number of players in the market. Our paper introduces this possibility, analyzing the impact of changing a monopoly to a duopoly, and shows how this change affects the behavior and value of firms in an uncertain environment.

This paper extends the previous literature on real options games by considering that the market structure is not immutable, but is, instead, allowed to change. Here, a monopolistic firm faces a process of demonopolization, that changes the market structure to a duopoly. This process can be triggered by a random or a certain event, and impacts the monopolistic firm even when it is idle, waiting to enter the market.

Note that in the existing duopolistic leader–follower models, the market structure remains unchanged as a two players game. As the investment opportunity value increases, the number of active players in the market changes from zero to two. For certain values, it is only optimal for a single firm to be active in the market (the leader), benefiting from monopolistic rents, while waiting for the second player (the follower) to enter the market. From the beginning, the market has only two slots available, that are taken sequentially by the firms. Typically these models assume that the equilibrium, translated into the entry timing, is endogenously determined.

The competitive setting studied in this paper, where a monopolistic firm faces a market structure change, does not fit in the existing duopolistic models. In this paper, the number of places in the market may change as a result of an exogenous event. Before that event, the firm acts in a monopolistic single player market, and a second player can only enter the market afterwards.

Some early real options literature modeled firm entry in the market as an exogenous event. In Trigeorgis (1991), as more firms randomly enter the market, arriving according to a Poisson process, the project value drops by a certain amount. Accordingly, the project value is modeled as a mixed jump diffusion process. Similarly, but for perpetual investment options,

[3] European Rail: Challenges Ahead European Commission – MEMO/13/45 30/01/2013, accessed on 26/11/2013 at http://europa.eu/rapid/press-release_MEMO-13-45_en.htm.

[4] "Does AT&T have iPhone exclusivity until 2012?", accessed on 26/11/2013 at http://news.cnet.com/8301-31021_3-20004713-260.html.