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Market leadership, technological progress and relative performance in the mobile telecommunications industry

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ABSTRACT

In network industries a large installed customer base is considered a key strategic asset that leads to a sustainable competitive advantage. This paper argues that market leaders should be able to demonstrate relative performance advantages vis-à-vis their competitors. Furthermore, we examine the moderating role of technological progress as a significant environmental factor that could alter the market leadership-relative performance relationship. The two-stage procedure proposed by Simar and Wilson (2007) is used to estimate relative performance determinants in the European mobile telecommunication industry. In the first stage, Data Envelopment Analysis (DEA) technique is used to measure performance, and in the second stage we empirically test our hypotheses by bootstrapping the DEA estimates with a truncated regression. Our results provide evidence that leaders enjoy performance advantages. The findings also reveal that the leader's relative performance is compromised in the event of technological progress.

1. Introduction

Achieving and sustaining a leading position within an industry in terms of market share is the driving force behind a firm's management decisions and strategic choices (Ferrier et al., 1999). This is especially so in network industries such as telecommunications or energy, where market leadership might emerge from exploiting network effects (Doganoglu and Grzybowski, 2007; McIntyre and Subramaniam, 2009) and first mover advantages (Lieberman and Montgomery, 1998) or through making better use of a firm's resources and capabilities (Finney et al., 2008). It has, however, been suggested that "it is entirely possible that certain institutions capture a large market share and not add value to the organization" (López and Roberts, 2002, pp. 1003).

Various studies have shown that incumbent firms gain performance advantages, more in terms of market share than in profitability (see, for example, Gomez and Maicas, 2011; Jakopin and Klein, 2012; or, van der Werf and Mahon, 1997). Despite these results, the evidence is ambiguous regarding whether leading firms, by having a greater installed customer base, are more efficient than their competitors in the sense that they can transform inputs into outputs relatively better than their competitors (Chen et al., 2015). The literature on network industries has singled out the strategic role of the installed customer base in engendering competitive advantages (McIntyre and Subramaniam,

2009; Shankar and Bayus, 2003). More specifically, a firm's network value depends directly on the number of users it has, and is positively related to its financial performance (Fuentelsaz et al., 2015b; Shankar and Bayus, 2003). Combining the strategic role of the customer installed base and accounting for the efficient transformation of this strategic asset into financial rewards for the firms by building a single performance measure is the first objective of the current paper. This is done through the use of a novel methodological approach in strategic management research, Data Envelopment Analysis (DEA), which allows for the combining of multiple inputs and outputs and building a unique performance measure for each firm that contrasts with studies where a single market share or profitability indexes are used to estimate the competitive advantage of industry players. Moreover, the DEA methodological approach is especially relevant for network industries, where performance is measured through a plethora of indexes and where the success of a firm depends on its ability to more efficiently transform its inputs into outputs while at the same time inefficient firms are able to identify those factors that contribute to their lack of efficiency and adjust them. Accordingly, in this paper we test whether market leadership is associated with better performance, as defined above, vis-à-vis their competitors.

The competitive landscape in which most firms operate has become highly complex and uncertain, a development that may affect their

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competitive advantages (Sirmon et al., 2011). In most network industries, such as telecommunications and video game consoles, technological progress is an important environmental factor that can alter the relationship between market share leadership and performance (Asmussen, 2015; Arregle et al., 2013; Delmas and Tokat, 2005; Fuentelsaz et al., 2015a; Kwoka, 2002; McIntyre and Chintakananda, 2014). Technological progress can alter the position of leading companies and destroy revenues that leading firms enjoy in the face of rapid technological change (Giachetti and Dagnino, 2014; Gomez et al., 2016; Hill and Rothaermel, 2003; Klingebiel and Joseph, 2016; Suárez and Lanzolla, 2007). Furthermore, technological changes provide an opening for new entries into the market only a few years after the introduction of the initial product (Fuentelsaz et al., 2015a; Schnaars, 1994). Those technological changes that occur provide an opportunity for new firms and products to enter the market, thereby challenging, and perhaps even overturning, the first mover advantages enjoyed by the incumbent. Gomez et al. (2016) found that technological discontinuities, such as the introduction of 3G mobile technologies, reduce the profitability and market share of the first-movers in the mobile industry. As the introduction and subsequent growth of 3G took place over several years (Curwen and Whalley, 2006, 2012), its impact on leading firms, either negatively or positively, may not become apparent until, for example, a critical mass of users emerges. With this in mind, our second objective is to explore the impact of technological progression, accounting for the number of subscribers in the new technology, on the degree of relative performance of market leaders, as defined in our first objective.

DEA is used to calculate relative performance. DEA has been extensively applied a variety of industries (Anderson et al., 2007; Anderson et al., 2008; Guan and Chen, 2010). According to Liu et al. (2013) the top-five industries with the majority of applications using the DEA methodological approach are banking, health care, agriculture and farm, transportation and education, and has recently emerged as a robust tool to measure performance within the field of strategic management research (Chen et al., 2015). However, while a variety of methodological approaches have been used to investigate the mobile telecommunications industry, such as, for example, diffusion modelling (Islam and Meade, 2012; Michalakelis et al., 2010), system dynamics, (Mir and Dangerfield, 2013) and surveys (Brouwer and Brito, 2012), the use of DEA is not common. Having said this, DEA has been used to investigate the efficiency of telecommunications in the United States (Moreno et al., 2013), Europe (Usero and Asimakopoulos, 2013), Taiwan (Kang, 2009; Yang and Chang, 2009) and, more broadly, Asia (Liao and Lien, 2012).

This paper's two research objectives are tested in the European mobile telecommunications industry using a sample of 141 mobile operators from 37 countries over a ten-year period (2003 to 2012). The mobile telecommunications industry lends itself to this type of empirical analysis due to the strong persistence of market share leadership and first-mover advantages that firms enjoy (Curwen and Whalley, 2014; Giachetti and Dagnino, 2014; Fuentelsaz et al., 2015b). Furthermore, the industry's competitive environment has changed due to widespread and sustained technological advances – see, for example, Henten (2013) and the accompanying papers in the special issue for illustrations of the transformational role that technological change has played in the telecommunications industry. In the last two decades, the mobile telecommunications industry has undergone seemingly constant technological change, moving from analogue telephony to digital technology through a series of different generations that have widened and improved the services that are available (Jho, 2007; Curwen and Whalley, 2013). To date, the research has largely focused on the diffusion of mobile handsets (see, for example, Gruber and Verboven, 2001; Michalakelis et al., 2010; Mir and Dangerfield, 2013), or the strategies and policies that emanate from technological change (see, for example, Ghezzi et al., 2015; Shin, 2008) and has not sought to address whether market leaders are able to sustain their competitive position

and increase their performance over and above their competitors in this dynamic environment.

This study, therefore, aims to contribute to the literature in several ways. Firstly, it advances our theoretical understanding of competitive advantage in network industries by studying the relationship of market leadership – relative performance relationship. Secondly, it explores the impact of an important environmental variable that of technological progress on the market leadership – relative performance relationship. Thirdly, from an empirical point of view, using data from the mobile telecommunications industries of 37 European countries, we adopt a novel methodological approach to measure performance. In the first stage, the relative performance of the mobile operator is estimated by using a non-parametric approach (DEA) to construct the dependent variable used in the second stage. In the second stage, the Simar and Wilson (2007) algorithm is used to bootstrap the DEA scores combined with a truncated regression to explore the impact of environmental variables on firms' performance.

The rest of the paper is structured as follows. Section 2 develops the hypotheses regarding the relationship between market leadership and performance. This section also provides theoretical explanations of the moderating role of the impact of technological progress. Section 3 describes the data and methodology adopted in the empirical part. Section 4 sets out the results and, Section 5 discusses the main findings and their managerial and policy implications. Conclusions are drawn in Section 6, the final section of this paper.

2. Theory and hypotheses

2.1. Market leadership and performance

We define 'leading market firms' as those with the highest market share in a particular industry. Through the possession of large market shares, such firms are able to create competitive advantages that can be translated into performance advantages over their competitors (Growitsch et al., 2009; Shankar and Bayus, 2003). The competitive advantages associated with market leadership could be explained theoretically as emerging from positive network externalities (Katz and Shapiro, 1986), first-mover advantages (Lieberman and Montgomery, 1988, 1998) and superior resources and capabilities (Shankar and Bayus, 2003).

In the presence of network effects, building an initial customer base is crucially important and could give a market leading firm a sustainable competitive advantage with positive ramifications for its ability to generate earnings greater than its competitors. Direct network externalities arise when the utility from the consumption of one product grows with the increase in the number of consumers who use the same product (Katz and Shapiro, 1986; Economides, 1996), while the indirect ones refer to the development of complementary products critical to the use of a given product as a consequence of its market success (McIntyre and Subramaniam, 2009).

Both types of network effects positively affect the value of consuming a certain product. Once the initial customer base has been created, more users will buy the product because the value of consuming the good is higher due to the number of actual or expected users and, additionally, more developers of complementary products will join the network, thereby accelerating the adoption of the product. An example would be that of different operating systems in the mobile telecommunications industry, which attracts applications developers because of their large installed base of users (Rohlf, 2003; Shapiro and Varian, 1999). Direct and indirect network externalities then increase the product's value for end customers and their willingness to pay. Doganoglu and Grzybowski (2007) found that within Germany, network effects significantly influenced the decisions of consumers to adopt mobile services, while within the context of network effects club effects have been found to influence customer preferences such that consumers are more prone to subscribe to a network with a larger

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