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THE ROLE OF INDUSTRY DYNAMICS IN THE PERSISTENCE OF FIRST MOVER ADVANTAGES

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We advance first mover advantages literature by adding novel insights into the conditions that affect the persistence of first mover profitability and market share. We investigate the role of two industry dynamics – market growth and technological discontinuity – and we argue that they will negatively affect the persistence of first mover performance. We test our hypotheses in the context of the European mobile communications industry by estimating System GMM models on a longitudinal panel of 65 companies in 19 markets over the period 1998-2008. Model estimations confirm that industry dynamics affect the persistence of first mover advantages. For instance, we find robust empirical evidence that technological discontinuity is detrimental to both first movers' market share and profitability.

INTRODUCTION

Historically, whether first mover advantages (FMA) exist or not has been a popular topic for debate in the management and economics literatures. Although existing empirical studies have offered mixed results, most of them find significant support for a positive relationship between order of market entry and performance. This was the finding, for example, of VanderWerf and Mahon's (1997) meta-analysis, which showed that 54 out of 66 empirical tests undertaken in the academic literature offered support for the notion of first mover advantages. Building on the results of the empirical studies carried out over the last 20 years, Lieberman and Montgomery (2013) conclude that "FMA often exist even though they are by no means inevitable".

Recent FMA research has moved in three main directions. First, some studies have focused on empirically testing the FMA isolating mechanisms (Lieberman and Montgomery,

1988) that should protect first movers from imitative competition such as customer switching costs (Gomez and Maicas, 2011) and experience curves and resource preemption (Boulding and Christen, 2008).

A second stream of research, the micro side of FMA research, has focused on firm-level characteristics and has studied the effect of firms' resources and capabilities on pioneering advantages. Built mainly on the resource-based view, this literature stream identifies firms' assets and capabilities as the key to taking advantage from early entry (Suarez and Lanzolla, 2008). The micro side of FMA theory (e.g. Franco, Sarkar, Agarwal and Echambadi, 2009) is, thus, revealed as an important factor in analyzing a firm's ability to materialize first mover advantages. This line of enquiry has been reinforced by the empirical results that show that firm resources and capabilities are important for understanding FMA. For example, Lieberman (2007) showed that early entrants owning patents were more likely to survive in the Internet industry. Franco, Sarkar, Agarwal and Echambadi (2009) show that only technologically strong pioneers benefit from early entry into the market. However, Markides and Sosa (2013) argue that focusing exclusively on the investigation of the stock of resources and capabilities may not be sufficient to fully capture the firm-level antecedents of FMA and that FMA research should now focus on a firm's business model as the most appropriate level of analysis for the micro side of FMA.

The third and most recent FMA research stream has dealt with the identification and analysis of the contextual environment-level conditions that may affect the effectiveness of the FMA isolating mechanisms. As Lieberman and Montgomery (2013) and Bamberger (2008) have argued, contextual factors should be included more formally in existing models if we are to advance management theories further and also make them more relevant for managerial actions. As a consequence, FMA research has identified several of such contingencies in the market, technology, complementary assets and competition (e.g., Kim

and Lee, 2011; Lieberman, 2011; Suárez and Lanzolla, 2007; Vidal and Mitchell, 2013). The underlying idea is that a firm's environment needs to be understood as composed of multiple dimensions (see also McCarthy, Lawerence, Wixted and Gordon, 2010).

However, despite some substantial progress, a recent special issue of LRP on Entry Timing Strategies edited by Fosfuri, Lanzolla and Suarez (2013) draws a mixed picture of the state of FMA research. Fosfuri et al. (2013) and Lieberman and Montgomery (2013) conclude that the persistent lack of predictive power in FMA research is due to some persistent weaknesses still present both in FMA theory and in the empirical measurements. First, for instance, contextual contingencies have mainly been understood, and measured, as static variables whose values do not change over time (Fosfuri et al, 2013 Lieberman and Montgomery, 2013). This condition is unlikely to be common in many business contexts. Second, first mover advantages have been mainly considered as a cross-sectional characteristic, which exist, or not, at a specific point of time. However, Lieberman and Montgomery (2013) challenge this approach and pose questions related to duration – how does FMA change over time? Are they persistent or intrinsically transitory? Third, what FMA materialize into is still controversial and studies have seldom performed comparative analyses of the effects of the order of market entry, for instance, on profitability and market share (Lieberman and Montgomery 2013).

In this paper, we seek to address these three shortcomings, arguing that, if we are to develop a better understanding of the conditions under which first mover advantages do (or do not) materialize, both the relevant contextual variables and the advantages themselves should be considered as continuous, longitudinal characteristics. Furthermore, we conceptualize first mover advantages both as profitability and market share to provide a nuanced and comparative understanding of the performance implications of FMA.

Building on extant FMA research (Suárez and Lanzolla, 2007), we identify two characteristics of the external context of a firm– market growth and technological discontinuity – whose dynamics are likely to affect the persistence of first mover advantages. The evolution of markets and technologies have been two classical factors used by different disciplines – such as industrial economics (Katz and Shapiro, 1992) or population ecology (Pfeffer and Salancik, 1978) – to characterize industry dynamics, so it is surprising that their relationships with the persistence of first movers' competitive performance have not yet been fully investigated. Our baseline hypothesis is that high market growth and technological discontinuities are detrimental to the persistence of first movers' profitability and market share (Suárez and Lanzolla, 2007). Market growth increases the carrying capacity of the environment and provides followers with opportunities to build customer bases, without needing to 'steal' them from the pioneer. Technological discontinuities allow new entrants to compete on new grounds, without suffering the 'structural imprinting' liabilities which might hold back pioneers.

We test our hypotheses in the context of the European mobile communications industry, using panel data on 65 companies in 19 European markets over the period 1998-2008. Our empirical setting is particularly suitable to test our hypotheses. First, it allows us to identify first movers and followers precisely. Second, the European mobile communications industry has experienced significant 'variance' in both market growth patterns and technological discontinuities: over the last decade, the industry has grown at annual rates above 30%, on average, while (on the technological side) it has undergone an important technological discontinuity with the transition from 2nd generation (GSM) to 3rd generation (UMTS) standards. Our results show that, after controlling for firm-level effects and competition, high market growth and technological discontinuities reduce the persistence of first mover advantages. They reveal robust empirical evidence that technological discontinuities

negatively affect both first movers' profitability and their market share, and that market growth is also detrimental to first movers' market shares.

Our contribution to the FMA literature is threefold. First, we bring a much needed longitudinal component to the literature by elaborating on the role of two key industry dynamics in the persistence of FMA – market share and profitability. Rather than contextualizing (Bamberger, 2008), we follow Suarez and Lanzolla's (2007) lead in considering the influence of market growth and technological discontinuity in context theorizing. Second, it has been argued that FMAs are more likely to materialize when market share is used (VanderWerf and Mahon, 1997) and there have been recurrent calls to use a variable more closely linked to value creation to measure FMA (Lieberman and Montgomery, 2013). This research responds to this suggestion by jointly considering profitability and market share and by providing a comparative, longitudinal analysis of their persistence. Third, with few – see, for example, Mascarenhas (1992) and Song, Di Benedetto and Zhao (1999) – extant empirical FMA findings are based on single-country samples and on manufacturing industries. By testing our hypotheses across several countries and in the service sector, our paper goes beyond the extant empirical limitations and offers novel insights into the under-researched service context at the same time as allowing us high levels of international generalizability.

The paper is organized as follows. The next section presents the development of the theory concerning first-mover – and order-of-entry – advantages, as well as providing a theoretical explanation of the relationship between the two industry dimensions (market growth and technological discontinuity) and FMA persistence. Our sample, variables and methods are presented in the third section, after which we provide evidence of our main results. We close the paper by discussing its main findings and its managerial and policy implications.

THEORY AND HYPOTHESES

Over time, FMA theory has developed around three broad areas of investigation (Suárez and Lanzolla, 2007): (1) the identification of the 'isolating mechanisms' which allow first movers to protect themselves from imitative competition; (2) the firm-level resources and capabilities that allow organizations to exploit FMA; and, more recently, (3) the investigation of the relationship between environment and competitive advantage based on order of market entry.

Several classifications of the FMA 'isolating mechanisms' have been presented. Golder and Tellis (1993) proposed that FMA drivers were producer- or consumer-based; Day and Freeman (1990) identified them as resource preemptions, proprietary experience effects and leadership reputation; Kerin, Varadarajan and Peterson (1992) grouped them into economic, preemption, technological and behavioral factors, while Lieberman and Montgomery (1988) proposed three categories: technology leadership, preemption of scarce assets, and switching costs/buyer choice under uncertainty. Some recent research has tested the effectiveness of these isolating mechanisms. For instance, Boulding and Christen (2008) empirically tested three different sources of long-term pioneering cost advantage – experience curve effects, preemption of input factors and preemption of ideal market space – and three different sources of pioneering cost disadvantage – imitation, vintage effects and demand orientation, while Gomez and Maicas (2011) provided empirical evidence that switching costs mediate the relationship between market entry order and performance.

At the firm level, an important group of research studies has investigated the effect of firms' resources and capabilities on competitive advantages based on the order of their entry into markets. This literature stream argues that a firm's assets and strategies are key to its ability to capture the possible benefits (e.g. Markides and Geroski, 2005). It states that a firm's ability to derive order-of-entry advantages should be assessed with reference to the

competence and capabilities of new entrants with respect to their competitors (Teece, Pisano and Shuen, 1997: 529; Robinson and Chiang, 2002; Fuentelsaz, Gomez and Polo, 2002). Franco, Sarkar, Agarwal and Echambadi (2009) have addressed how technological capabilities complement the relationship between a firm's entry timing and its competitive performance, while Dobrev and Gotsopoulos (2010) elaborated on a specific form of imprinting – institutional imprinting – which, they argue, may hinder first movers' performance. More recently, Markides and Sosa (2013) argue that resources and capabilities *per se* are not sufficient to understand the firm-level antecedents of FMA and identify a firm's business model as a more holistic level of analysis to increase the predictive power of FMA theory.

The environment (or context) level is the most recent and the least developed FMA research stream (Fosfuri et al, 2013; Lieberman and Montgomery, 1998; Suárez and Lanzolla, 2007). Several contextual dimensions have been considered (Lieberman, 2011), but we can identify at least two specific shortcomings in this research perspective. First, the interplay between contextual variables and the FMA isolating mechanisms is not fully investigated (Suárez and Lanzolla, 2007: 378). Second (as we also noted earlier) extant FMA literature has mainly conceptualized, and measured, environmental conditions as 'cross-sectional', or static, characteristics, which is surprising, given the increasing importance of *"high velocity industries"* (D'aveni, 1994; Wirtz, Mathieu and Schilke, 2007) characterized by high, and continuous, evolution.

This paper seeks to tackle this gap in the macro, contextual side of the FMA literature. Following Bamberger's (2008) lead, by context, we understand *"a sensitizing device that makes us more aware of the potential situational and temporal boundary conditions to our theories"* (Bamberger, 2008: 840). Bamberger (2008) also highlights the difference between two ways of incorporating the context in which management phenomena take place – first, as

an ad hoc (and largely speculative) exercise in which theoretical relevance may have a low importance; and second (in what he labels 'context theorizing') via an ex ante study of the boundary conditions that delineate management research theories. Although both approaches to context are useful, the second seems more powerful for explaining different phenomena consistently and to build links between the different levels of a given theory (Bamberger, 2008).

In this paper, we use a context theorizing approach to delineate the situational and temporal limits of FMA theory. We build on extant FMA research (Suárez and Lanzolla, 2007) to conceptualize industry dynamics in terms of market growth and technological discontinuities and elaborate on their interplay with the isolating mechanisms that explain FMA. Market and technology evolution have been two classical factors – used by different disciplines, such as industrial economics (Katz and Shapiro, 1992) and population ecology (Pfeffer and Salancik, 1978) – to characterize the evolution of industries, and it is surprising that their relationship with first movers' competitive performance has not yet been formally investigated.

This paper seeks to shed light on two other weaknesses in FMA literature (Lieberman and Montgomery, 2013): FMA duration – how do FMA change over time? Are they persistent or intrinsically short-lived? – and the exact scope of FMA –what do FMA really materialize into? Market share, profitability or survival? To address these gaps, we conceptualize FMA as mirrored both in profitability and market share, and we explore their dynamics over time.

Industry Dynamics and the Persistence of First Mover Advantages

Market growth and FMA persistence. We interpret market growth in terms of the increase over time in the numbers of buyers or of total sales. Prior theoretical and empirical works have analyzed the influence of market growth on the relationship between entry timing strategies and performance. From a resource dependence theory perspective, the availability

of the key resources organizations need to compete in a particular environment strongly influences the pace at which new firms can be successfully added to the population (Pfeffer and Salancik, 1978). Greater market growth also makes it easier for later entrants to find gaps or niches in the market – as yet unexploited by incumbents - where they can grow and survive (Christensen, 1997). Agarwal, Sarkar and Echambadi (2002) found that the pattern of market growth, analyzed across the industry life cycle, may determine both entry timing and firm survival, while Bohlmann, Golder and Mitra (2002) suggested that market entry order advantages are more sustainable in markets where horizontal differentiation predominates, as is more common in mature, slow-growing markets (Utterback, 1994).

Overall, market growth has the potential to undermine the persistence of FMA – market share and profitability – through its negative impact on the effectiveness of the FMA isolating mechanisms. First, FMA have been linked to a firm's ability to preempt scarce market resources. When growth is fast, at any point in time, there will always be sufficient market resources to allow new firms to successfully enter the market (Suárez and Lanzolla, 2007), and it can be expected that new entrants will have more opportunities to invest in specific assets to enhance production, meet increasing demand, and exploit new resources and opportunities (Kogut, 1988).

Second, market growth can also be detrimental to the predominance of technological leadership as a growing market increases the possibilities of new entrants achieving economies of scale and scope. In contrast, when market growth is slow, a firm entering the market first could easily build a strong position based on the experience curve – but, as the pace of market growth increases, followers can travel along the experience curve more quickly, limiting the potential of this isolating mechanism to support the existence of FMA.

Finally, as the third FMA isolating mechanism, switching costs may also be negatively affected by high market growth rates. These costs are important because they can contribute

to customers being 'locked-in' and so more easily exploited by the company in the future (Shapiro and Varian, 1998). More rapid growth reduces the proportion of older 'locked-in' users (Beggs and Klemperer, 1992) and increases the importance of newer users. These circumstances lead companies to the well-known 'harvest vs. invest' dilemma (Farrell and Klemperer, 2007). When market growth rates are high, switching costs have less potential to generate competitive advantage, as 'locked-in' customers constitute a lower proportion of consumers. The disabling effect of market growth will be particularly strong in markets where demand is homogeneous, and weaker where demand is fragmented (Capone, Orsenigo and Malerba, 2013).

It follows from these considerations that high market growth has the potential to allow followers to successfully enter the market and take market share away from the pioneers while also putting great pressure on their pricing power. While we do not expect FMA to disappear, we do expect that they will be put under significant pressure. We therefore posit:

> *Hypothesis 1: A high market growth is detrimental to the persistence of first mover advantages.*

Technological discontinuity and FMA persistence. Building upon Tushman and Anderson (1986), we understand technological discontinuity as *"an order-of-magnitude improvement in the maximum achievable price vs. performance frontier of an industry"* (Anderson and Tushman, 1990: 607). The strategic management literature has paid attention to the numerous disadvantages affecting pioneers in times of technological discontinuities, including the lack of incentives and capabilities to develop a new technology (Arend, 1999; Laive, 2006), uncertainty surrounding their future, organizational inertia, and prior commitments with stakeholders, all of which can serve to decrease first-movers' incentives and abilities to make efficient investments in the new technological field (Hill and Rothaermel, 2003).

Specifically, a technological discontinuity can directly affect the possibility of a company deriving FMA by undermining the effectiveness of the relevant FMA isolating mechanisms. First, it can reduce the likelihood of technological leadership being sustained. For instance, management cognition literature shows that, for a company, learning and search mechanisms are mainly 'local' (Tripsas and Benner, 2012; Tripsas and Gavetti, 2000). Therefore, early entrants may find it difficult to search outside their current technological trajectory, potentially delaying the adoption of the new technology or even missing out on it. The case of British Telecom, who stayed focused on fixed telephony and took insufficient notice of the emergence of mobile communication technologies, is a textbook example of this. Strategy and organization theory focus on the effect of discontinuities on resources and capabilities and show that they may render pioneers' knowledge obsolete and destroy their existing competences (Leonard-Barton, 1992; Henderson and Clark, 1990; Tushman and Anderson, 1986; Schilling, 2002; Suárez and Lanzolla, 2007); reduce pioneers' experience curve advantages (Lieberman, 1989) or make it difficult for them to lead quality improvements (Bohlmann, Golder and Mitra 2002).

Technological discontinuities may also affect a second isolating mechanism, reducing the effectiveness of resource preemption. Even large and vertically-integrated firms are unlikely to possess all the resources necessary to exploit an innovation – rather, they frequently have to access the market in order to obtain complementary resources (Teece, 1986), sometimes via contracts with the suppliers of these assets in sectors such as marketing, distribution and competitive manufacturing. As noted above, a technological discontinuity is likely to change a firm's relationships with its existing suppliers, modifying the value of the complementary resources they provide and causing firms to have to look for new complementary resources and, thus, new suppliers. So, as a technological discontinuity creates a need to find new

resources to exploit new products or services, followers have a chance to level the pitch and the persistence of a pioneer's advantages is reduced.

Finally, a technological discontinuity may also affect the effectiveness of buyers' switching costs as an isolating mechanism. Suárez and Lanzolla (2007) emphasize that a technological discontinuity may affect domain expertise (Wernerfelt, 1985) or the formation of consumer preferences (Carpenter and Nakamoto, 1989), two antecedents of buyers' switching costs. These discontinuities also create new generations of products or services, making existing ones obsolete and, importantly, can create a new setting for the appearance of incremental innovations (Anderson and Tushman, 1990) where followers are no longer at a disadvantage in relation to pioneers in terms of the value that they can offer to consumers.

It follows from the arguments above that technological discontinuities not only offer a great window of opportunity for followers to enter the market (Tripsas, 1997) but also put pioneers' cost base and pricing power under significant strain. Integrating these arguments produces our second hypothesis[1]:

> *Hypothesis 2: Technological discontinuity is detrimental to the persistence of first mover advantages.*

SAMPLE, VARIABLES AND METHODS

Research Setting: The European Mobile Communications Industry

To test our hypotheses, we focus on the mobile communications industry, which has experienced impressive growth over the last two decades and has received the attention of an increasing number of researchers (Kim and Kwon, 2003; Birke and Swann, 2006; Lee, Kim, Lee and Park, 2006; Gomez and Maicas, 2011). The industry constitutes an appealing

[1] It is important to note that, in both hypotheses, we do not maintain that market growth or technological discontinuities will eliminate the advantage of the pioneer, only that it will affect its persistence.

laboratory for testing and analyzing FMA for several reasons. Entry into the market has taken place in a number of waves, and this pattern allows us to identify first movers and followers very precisely. Another important characteristic of our sample is the significant 'variance' in the industry dynamics which can be considered. For instance, the European mobile communications industry in recent years has experienced robust market growth, from an average market penetration of around 30% at the end of 1998 to slightly over 100% by the end of 2008. Analyzing this process in a world-wide setting, Gruber and Verboven (2001a, 2001b) suggest that this rapid diffusion can be attributed to the setting of a single digital standard (which leads to substantial reductions in costs and, thus, subsequently, in prices) and to the levels of competition in second generation mobile technology (GSM). Table 1 shows the evolution of annual market growth for all the countries included in the sample. While annual growth has exceeded 50% in some countries, it has also varied substantially between countries, so that the variable displays enough variability to test our hypotheses.

Insert Table 1 here

Finally, we can clearly identify the effects of a technological discontinuity – the introduction of UMTS technology – which acts as a common technological shift affecting all the mobile operators in our sample. Table 2 illustrates the evolution of operators that have implemented UMTS. It can be observed that the number of both first movers and followers adopting UMTS technology substantially increased from 2003 onwards. It is also worth noticing that the patterns of UMTS adoption across European countries show some interesting differences. For instance, both pioneers and followers in countries such as Austria, Germany, Greece or Spain, adopted UMTS earlier vis-à-vis their counterparts in countries such as the Czech Republic, Denmark or Poland. It is important to note that this is not a firm-specific technological change that can be understood as a strategic weapon through which

firms can either innovate or differentiate themselves. As the technology is standardized, it is a common shift affecting all the operators. In other words, as with market growth, technological discontinuity is market- and not firm-specific.

Insert Table 2 here

Sample Characteristics

Our data is taken from the complete records of all mobile telecommunications companies who operated in 19 European markets across the whole period 1998-2008,[2] so our sample does not suffer from survival bias during the analysis period. Data was gathered from multiple sources but principally from the Merrill Lynch Global Wireless Matrix, a database which contains quarterly information on several significant variables – operators names, subscriber numbers, number of operators in each market and their performance (in both market share and profitability). We also collected information about operators' market entry dates (mainly from their websites and other industry reports) together with information from other sources such as the International Telecommunications Union (ITU).

The analysis of the evolution of the number of operators by period from the last quarter of 1998 (the first period for which data is available) to the second quarter of 2008[3] shows that their number grew from 54 to 64. The number of operators per country ranged from 2 to 5, but remained relatively stable, with few entries and exits during the period: some entries, however, coincided with the licensing of the UMTS technology.

[2] The European countries considered in our research are Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, the Netherlands, Norway, Poland, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

[3] It should be noted that this analysis does not take into account the firms for which we do not have information about one of the dependent variables (EBITDA). Overall, the number of operators in the market is slightly higher.

Dependent Variables

The two first mover performance measures proposed here are defined as follows: (1) *market share* is the number of users subscribing to the services of operator *i* in country *j* divided by the total number of users in country *j*; (2) the *firm profitability* of firm *i* is measured by the ratio of the firm's EBITDA to its sales. Our data gives us quarterly information on both variables, thus enabling us to capture the longitudinal dimension – or persistence – of FMA.

Independent Variables

First mover. Different methodologies have been used to try to identify first movers –often referred to also as 'pioneers' – which are mirrored in the different 'labels' used to describe them. Brown and Lattin (1994) state that there has been some disagreement about what exactly the term means: whereas some researchers use only market entry order as their main variable, other authors combine it with complementary variables. For instance, Urban, Carter, Gaskin and Mucha (1986)'s model of relative market share uses what they call a 'lag between entries', measured as the number of years elapsed between the entries of two successive brands; in a similar vein, Brown and Lattin (1994) employ a market share attraction model that measures the ratio of a late entrant's time in the market to that of a first mover. Our identification of first movers treats each of our 19 markets as independent, considering that FMA should be related to operators' order of entry into each. We, therefore, define a dummy variable that takes the value of 1 when the firm is the first mover/pioneer – i.e., the first to enter a particular market (or the first two firms, if they enter within 6 months).[4]

Market growth. Market evolution is usually characterized by an initial period of slow growth, followed by a rapid increase or 'sales takeoff' and a later phase of market maturity and decline, a model that has been previously analyzed in the mobile communications

[4] There is no case with three or more operators entering the market at the same time.

industry context although generally for the purpose of studying diffusion patterns (Gruber and Verboven, 2001a, 2001b; Doganoglu and Grzybowski, 2007). Our *market growth* variable for each country is calculated as the number of new mobile phone users in a specific period in that country divided by the total number of users at the beginning of that period.

Technological discontinuity. We focus on the introduction of UMTS technology, a key technological discontinuity in the European mobile communication industry, capturing it by introducing a dummy variable which takes value 1 from the time the first company adopts the new UMTS technology in a given country and 0 previously, making the assumption that the technology is available in that market from that 'first adoption' moment. Therefore, it is a market level variable.

Control Variables

We introduce several control variables. First, we control for the level of operators' *internationalization*. Most firms in our sample are diversified across geographical markets so we may expect a relationship between internationalization and the persistence of FMA. We measure internationalization by counting, at any given time, the number of countries in which the firm owns at least 50% of the capital of a national telecommunication operator - in other words, our variable measures the number of countries the operator has entered. Second, we calculate a measure of competition by counting the *number of operators* present in each market at any given time. Finally, we also define year dummies to control for any time-specific influences and include firm-specific dummies to control for unobservable effects.

Descriptive Statistics

Descriptive statistics and correlations, referring to 1,934 observations, are shown in Table 3. As can be seen in Table 3, the average operator has an average EBITDA of 0.29 and an average market share of 0.31. The average number of countries in which the operator is

present is about 11 and the average number of firms per market is almost 3.5. Market growth and technological discontinuity have been previously analyzed in Tables 1 and 2.

Insert Table 3 here

Tables 4 and 5 provide a more granular analysis of the evolution of the two performance measures used in this study, EBITDA and market share. In Table 4, we observe how the EBITDA evolves for both pioneers and followers during our research window. Profitability for first movers is quite stable, ranging on average from 0.37 at the beginning of the period to 0.39 at the end. On the contrary, followers begin with more modest figures (0.04) and obtain an average value of 0.28 in 2008. Interestingly, we observe how the gap between pioneers and followers is constantly reduced from a difference of 0.33 in 1999 to 0.11 in 2008, meaning that pioneers perform better than followers in the period analyzed but that the latter are catching up.

Insert Table 4 here

Table 5 replicates the analysis for market share and the conclusions are qualitatively but not quantitatively the same as for EBITDA. Pioneers have a higher market share than followers for the whole period, but the gap between them is more slowly reduced than for EBITDA. This evidence is consistent with the idea that market share is very inertial and may overestimate FMA (VanderWerf and Mahon, 1997) and gives robustness to our strategy of using two alternative performance measures.

Insert Table 5 here

Methods

We use dynamic panel System GMM estimators to estimate the relationship between industry dynamics and first mover performance (Arellano and Bond, 1991, Arellano and Bover, 1995, Blundell and Bond, 1998). In our context, this type of model has (at least) two advantages. First, System GMM allows the introduction of regressors that may be predetermined but not strictly exogenous, enabling us to introduce past realizations – lags – of the dependent variable, which can reduce specification problems. For example, Baum, Calabrese and Silverman (2000) argue that the introduction of the lagged dependent variable reduces the specification bias that may be caused by any unobserved heterogeneity. Using past realizations of the dependent variable may also be important in analyzing the inertia of market share and profitability, studying the magnitude and significance of the coefficient accompanying its lag, which could be particularly important here, given that we are interested in the persistence of FMA. Second, using System GMM allows us to introduce firm-specific effects into all our estimations, thus further controlling for any possible unobserved firm-specific heterogeneity in our data. Again, this is important in our setting as the information on firm characteristics is limited and non-observed factors could affect performance. Third, the method also allows the calculation of standard errors that are robust to heteroskedasticity and autocorrelation.

In our specification, both equations share the same explanatory and control variables. They are specified in the following way:

$$Performance_{it} =$$

$$\beta_1 * First\ mover_i + \beta_2 * Market\ growth_{jt} + \beta_3 * Technological\ discontinuity_{jt} +$$

$$\beta_4 * Market\ growth_{jt} * First\ mover_i + \beta_5 * Technological\ discontinuity_{jt} *$$

$$First\ mover_i + \beta_6 * Control\ variables_{ijt}$$

where $Performance_{it}$ stands for market share and firm profitability and all the other variables have been defined above. The subscripts refer to the firm (*i*), the market (*j*) and the year (*t*) to which the value of the variable refers. Apart from the control variables described above, the model also introduces lagged values of the dependent variable in order to minimize specification problems. As this creates endogeneity, we used internal instruments to avoid potential bias.

RESULTS

Table 6 shows System GMM estimates of our market share and profitability equations, with all models presenting heteroskedasticity and autocorrelation consistent (HAC) estimates.[5, 6] To test our hypotheses about the impact of industry dynamics on the persistence of first movers' performance, we ran six models. Models A.1 to A.3 consider market share as the dependent variable and models B.1 to B.3 repeat the sequence for profitability. In each sequence, the first model introduces only the variable accounting for the first mover effect and the control variables, model 2 adds the direct effects of industry dynamics, and the full model incorporates the effect of the market growth and technological discontinuity variables on the persistence of first movers' advantage effects (thus addressing Hypotheses 1 and 2).

Market Share Equation

In model A.1, we can observe that the first mover variable is positive and significant – in other words, the order of market entry of mobile telecommunication firms in each country explains the differences in their market shares, so first movers have higher market shares than their followers. The variable measuring the number of operators has a significant and

[5] We used the "xtabond2" command in Stata to estimate the model (Roodman, 2009). In order to reduce the number of instruments, the "collapse" option was included. The number of instruments is 24 in the market share equation and 26 in the profitability equation (full models). Therefore, the number of instruments is well below the number of firms in all the cases.

[6] We performed a series of robustness tests that produced statistically identical conclusions (not reported in this paper but available on request from the authors). Specifically, results did not change when adding controls for firm size (number of subscribers), a country's mobile penetration rate and a country's population. We also repeated the estimations by using 2SLS and obtained consistent results.

negative impact on market share, meaning that the more firms operating in a market the lower will be the first mover's market share. The degree of a firm's internationalization is not significant[7], but past market share has a positive and highly significant influence on market share.

Model A.2 introduces the industry dynamics of market growth and technological discontinuity. Market growth has a negative impact on the market shares of all industry players; technological discontinuity has a positive impact, although the coefficient is non-significant. The impact of the first mover, number of competitors, internationalization and past market share variables is qualitatively the same as in model A.1.

Our analysis of the effect of industry dynamics on the persistence of first mover's market shares is shown in model A.3. Analyzing the interaction between first mover and market growth, we can see that the coefficient is negative and significant, but that the direct effect becomes non-significant. Together, these observations seem to imply that the negative direct effect is due to a reduction of the first mover's advantage as the market grows, supporting Hypothesis 1. The interaction between technological discontinuity and first mover also has a negative and significant effect on market share, meaning that technological discontinuity harms the market share of first movers, supporting Hypothesis 2.

Insert Table 6 here

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[7] This finding means that operating in various international markets is not significantly related to firm performance (for either market share or profitability). We offer a threefold explanation. First, while it is true that a number of mobile service providers are competing globally, users are restricted in their choices to companies operating in their local markets. Second, the internationalization of mobile operators could have become a strategic necessity. This seems to be clear from an analysis of the recent evolution of the industry in which the international diversification of the main operators has been quite similar. Finally, the availability of roaming services in all European countries, the similarity of roaming coverage and charges within operators, and the lack of complete information for users about roaming charges within the operators of the same international group (Salsas and Koboldt, 2004) may limit the existence of international network effects. Moreover, this result is consistent with previous studies (Gerpott and Jakopin, 2005; Garrido, Fuentelsaz and Maicas, in press). We are grateful to an anonymous reviewer for pointing out this issue.

Profitability Equation

Columns B.1 to B.3 of Table 2 report the estimates of our profitability equation. The sequence followed for testing Hypotheses 1 and 2 is analogous to that of the three previous models – only the dependent variable differs. As before, model B.1 only includes the variable capturing the first mover effect and the control variables – and, again, we find that first movers perform better than followers, as shown by their positive and significant coefficient, supporting the general notion that pioneering has been important in the European mobile communications industry. Among the control variables, the number of operators has a significant and negative impact on profitability, but internationalization has no effect: their impacts are, thus, qualitatively the same as in the market share estimation – again, past performance has a positive and highly significant influence on profitability.

Model B.2 considers industry dynamics. Market growth has a positive and significant effect on the profitability of all the industry players, while the influence of technological discontinuity is negative, but non-significant. The impacts of first mover effects, competition, internationalization and the past realization of the dependent variable are qualitatively the same as in model B.1.

Finally, column B.3 presents the full model including the interaction effects between first mover status and industry dynamics. The results are again consistent with those on market share – that first moving has a positive and significant impact on profitability. In relation to the direct effects of the variables capturing industry dynamics, only market growth shows a positive and significant sign. The interaction between first mover and technological discontinuity variables shows a negative and significant effect on profitability (again fully consistent with our market share findings). This means technological discontinuity harms pioneers' profitability and its persistence, and that the influence of the other variables remains as before. In sum, the results from the profitability estimations show that Hypothesis 2 is

supported by the data, but that Hypothesis 1 is not supported when first mover advantages are operationalized as profitability.

Figure 1 graphically shows the impact of market growth on the persistence of first movers' – and followers' – market shares, while Figures 2a and 2b show the effects of technological discontinuity on market growth and on profitability, respectively.

Insert Figure 1 here

Insert Figures 2A and 2B here

We can also assess the economic significance of our results. As just noted, the interaction between industry dynamics and entry timing strategy shows a negative and significant effect on performance (columns A.3 and B.3). In terms of market growth, the interaction effect is only significant in the market share equation - the value of the associated coefficient is β=-0.0157 ($p<0.05$), whereas the standard deviation of the variable is 0.145, so that the net effect of a standard deviation in market growth is to decrease the advantage of the pioneer by 0.0023. In other words, taking into account that the first mover enjoys a market share advantage that equals 0.0139 ($p<0.10$), we can see that the net effect of a standard deviation in market growth is to decrease the pioneer's advantage from 1.39% to 1.16%.

We can also extract conclusions on the net effect of technological discontinuity on a pioneer's performance by combining the direct and the interaction effects. The value of the interaction term in the market share equation is β=-0.00447 ($p<0.10$) and, in the profitability equation, it is β=-0.0286 ($p<0.05$). For the market share equation - taking into account that the direct effect of technological discontinuity is positive – the conclusion is that the advantage of the pioneer vis à vis follower companies is reduced from 0.0139 to 0.0127, in

other words (on average), from 1.39% to 1.27%. For the profitability equation, the pioneer's advantage is reduced from 0.0444 to 0.0158 (i.e., on average, from 4.44% to 1.58%).

Finally, comparing the coefficients of the lags of the dependent variables in the two models, our results show that the past realization of market share $\beta=0.929$ ($p<0.01$) is notably higher than the past realization of profitability $\beta=0.722$ ($p<0.01$), implying that market share is more inertial than profitability, which is important in understanding how the persistence of FMA depends on the dependent variable used.

DISCUSSION AND CONCLUSIONS

This paper has focused on market growth and technological discontinuity and has shown how these dynamics affect first mover advantages as manifested in profitability and market share. Most existing studies have dealt with FMA as a static phenomenon, merely conceptualizing them as existing, or not, at any given time. The industry conditions likely to affect first mover's performance have similarly been seen as static and not conceptualized as factors likely to change in magnitude and direction over time. The absence of a robust analysis of the dynamic conditions that favor or hinder the persistence of first mover advantages is somewhat surprising, given the emergence, for instance, of hyper-competition and high velocity industries (e.g., D'aveni, 1994; 2010; Wirtz et al., 2007) where competitive advantages are likely to rise, or fall, much more quickly.

We find strong empirical support for our hypotheses that technological discontinuity negatively affects the persistence of first mover advantages, both in the form of profitability and market share. Technological discontinuity – in our case, the introduction of the UMTS technology – is likely to open considerable differentiation opportunities for followers to gain market share, which they will inevitably take at the expense of first movers. Furthermore, keeping pace with technological discontinuity is not easy for first movers because of strong inertial forces that may 'anchor' them to the *status quo* (e.g. Tripsas and Gavetti 2000). We

should underline here that we conceptualize technological discontinuity as an exogenous shock to the firm – it is not a firm-specific technological change resulting from a firm's own innovation activity, but rather one that creates opportunities for all firms in the market to improve their offers. Overall, our research shows that technological discontinuity should be considered a key construct in building a more comprehensive understanding of the persistence of first mover advantages. Considered together with the micro (firm-level) elements of FMA theory, technological discontinuity can provide a more realistic framework of the conditions in which a particular firm can sustain its first mover advantages. In fact, ex post, several anecdotal cases can be interpreted building on our theory. Consider, for instance, the role that technological discontinuities had for Polaroid in instant cameras. The firm completely missed the transition from analog to digital imaging, despite early investment in digital imaging technologies (Tripsas and Gavetti, 2000).

Our predictions on the role of market growth are supported when first mover performance is measured as market share, but not when it is measured as profitability. Consistent with our hypothesis, we find that market growth has a negative effect on the persistence of first movers' market shares. With this prediction the interpretation of several cases where first movers lost their lead in the face of high market growth is not surprising. Consider, for instance, the pioneering efforts of Netscape in the Internet browser industry or MySpace in social media. They lost their pioneering advantages also because high market growth opened up several opportunities for later entrants (see also Suárez and Lanzolla, 2005).

Differently from what was predicted, we do not find a significant *extra* effect – beyond that common to all industry players – on the persistence of first mover profitability. This may be due to the fact that pioneers still enjoy lower costs – because of experience effects – and higher pricing power – because of their first mover status – thus partially offsetting the detrimental effect of high-market growth. The discrepancy in the performance implications

that we find here corroborates the need for empirical FMA research to clearly differentiate between market share and profitability as measures of first movers' advantages (Lieberman and Montgomery, 2013).

Finally, our paper also contributes some interesting empirical findings to the FMA literature. First, our empirical results show that first movers also consistently outperform later entrants in the service sector. In showing this, we begin to address a recurrent empirical gap – the absence of evidence about FMA in the service sector. Indeed, most existing empirical literature focuses on manufactured products (Song, Di Benedetto and Zhao 1999) where pioneers are more likely to benefit from FMA isolating mechanisms (Lieberman and Montgomery, 1998).

Implications for FMA theory and the FMA research agenda. Our paper has several implications for FMA theory. First, it suggests that the traditional emphasis on simply identifying the existence of FMAs should be complemented by the study of their persistence. Although the relevance of the FMA concept has been questioned, the majority of studies show FMAs are present in a great variety of settings (54 out of 66 in VanderWerf and Mahon's (1997) meta analysis). So, it seems sensible that, apart from just testing for their existence, we should also look at the persistence of FMA. This is not only valuable in terms of FMA theory but also for the wider Strategic Management literature, which is concerned with the sustainability of firms' competitive advantages. We echo the surprise of other authors (Makadok, 1998, Kim and Lee, 2011 and, more recently, Lieberman and Montgomery 2013) that the persistence of FMA has not attracted greater academic attention.

Second, the paper shows that context theorizing (Bamberger, 2008) is a promising way to study the conditions under which FMA persist. Following Suárez and Lanzolla (2007), we include two situational and temporal dimensions that define the focal context. The service character of the industry we study is an additional element to consider when assessing our

results. The weak appropriability of innovation in services (Howells, 2001) may imply that FMAs were unlikely to be present in the mobile communications sector. In this sense, our results have a double value from a theoretical point of view. On the one hand, if *"theoretical insights come from demonstrating how the addition of a new variable significantly alters our understanding of the phenomena by reorganizing our casual maps"* (Whetten, 1989: 493), our finding that market growth and technological discontinuity have important roles in explaining the persistence of FMAs should be interesting in terms of reinforcing FMA theory. On the other hand, the mere fact of our finding that they do exist in a service industry might sound counterintuitive to those who point out that property rights in these settings are ill defined, so our results may question the validity of this assumption and should stimulate the debate about the conditions which are said to make competitive advantage less sustainable in services, a theme of special interest in the innovation literature.

Furthermore, context theorizing has not only allowed us to address the relevance of market growth and technological discontinuity (as Suárez and Lanzolla (2007) argue) but also suggests a way of advancing both theoretical and empirical research within FMA literature. In particular, our study has analyzed FMA in different countries whereas – in spite of some exceptions (for example, Mascarenhas, 1998 and Song, Di Benedetto and Zhao, 1999) – most empirical research on FMA refers to just one country. Not only does this respond to Bamberger's (2008) suggestion that strategic management theories should be tested formally across a wider range of different contexts, but it also points to the need to incorporate the role of national institutions when studying FMAs. Elaborating on the interplay between the institutional elements (e.g. Peng, Sun, Pinkham and Chen, 2009) that configure a specific environment and the isolating mechanisms that sustain a pioneer's advantage looks a promising line of enquiry for developing new FMA theory.

Managerial implications. Our theory also has several implications for market entry strategies. First, managers should look at technology dynamics. Overall, industries that undergo frequent technological shifts are not 'cozy' places for early movers or, more generally, for incumbents. To overcome the pitfalls that technological discontinuities create, these companies should seek to equip themselves with both strong technology scouting capabilities and clear incentives for technology adoption. Conversely, technological discontinuities offer a window for successful market entry for later movers. Indeed, this has historically been Apple's market entry strategy: every time Apple missed a technological shift, they just waited to (re)enter the market until they could leverage a new discontinuity.

Second, managers should look at market dynamics. Low levels of market growth tend to favor first mover's performance, making early entry preferable. Conversely, high market growth also opens opportunities for later entries. However, first movers' profitability seems to be resilient in conditions of high market growth. Managers should fine tune their market entry timing depending on the expected market dynamics.

Limitations. As is often the case with empirical research, this paper has some limitations which, in turn, represent potential avenues for future research. First, we have started unpacking the environment-level conditions that affect FMA but the treatment of the environment could be expanded further by considering, for instance, market regulation and the informal environment (North, 1990; McCarthy et al., 2010). Second, firms' strategies and level of resources could be operationalized at a more granular level of analysis to account for firms' specific business models (Markides and Sosa, 2013). Furthermore, advertising and R&D expenditures could also be incorporated into future models to analyze their role in FMA (Lieberman and Montgomery, 1998). Finally, we acknowledge that care should be taken in generalizing our results. For instance, we must not forget that our research setting refers to a single industry, mobile telecommunications, which possesses some peculiarities such as the

existence of network effects. However, our research has shown quite consistent findings for a wide sample of countries and this allows us to claim some degree. Future studies may want to replicate ours in other industries that present different structural characteristics.

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TABLES AND FIGURES

TABLE 1
Market Growth (%) by Year and Country

Country	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Austria	0.87	0.60	0.22	0.02	0.06	0.09	0.08	0.09	0.08	0.09
Belgium	0.81	0.75	0.56	0.11	0.02	0.09	0.06	0.05	0.08	0.09
Czech Republic	1.01	1.22	0.61	0.39	0.15	0.12	0.09	0.06	0.07	0.06
Denmark	0.46	0.33	0.33	0.08	0.18	0.11	0.00	0.06	0.14	0.10
Finland	0.14	0.11	0.14	0.09	0.04	0.05	0.11	0.08	0.06	0.11
France	0.83	0.64	0.33	0.12	0.06	0.07	0.07	0.06	0.06	0.07
Germany	0.87	0.97	0.51	0.04	0.09	0.10	0.10	0.10	0.11	0.13
Greece	0.89	0.64	0.41	0.22	0.19	0.04	0.10	0.13	0.16	0.13
Hungary	1.02	0.47	0.39	0.54	0.23	0.12	0.05	0.08	0.10	0.14
Ireland	0.71	0.61	0.36	0.11	0.07	0.11	0.12	0.10	0.09	0.09
Italy	0.50	0.44	0.29	0.10	0.05	0.09	0.12	0.14	0.12	0.07
Netherlands	1.03	0.71	0.29	0.03	0.06	0.17	0.11	0.01	0.06	0.08
Norway	0.26	0.18	0.16	0.10	0.07	0.10	0.08	0.06	0.02	0.02
Poland	0.92	0.71	0.59	0.40	0.31	0.29	0.30	0.26	0.18	0.08
Portugal	0.60	0.41	0.40	0.17	0.10	0.04	0.07	0.10	0.10	0.11
Spain	0.99	0.89	0.31	0.17	0.12	0.06	0.09	0.10	0.07	0.06
Sweden	0.23	0.23	0.16	0.12	0.09	0.10	0.06	0.04	0.02	0.09
Switzerland	0.89	0.75	0.20	0.14	0.04	0.07	0.06	0.09	0.09	0.08
United Kingdom	0.84	0.77	0.39	0.09	0.07	0.12	0.11	0.06	0.05	0.04
Average	0.74	0.59	0.33	0.14	0.10	0.10	0.10	0.09	0.09	0.09

TABLE 2
Number of Firms Operating in UMTS by Country and Year

Year	1999-2002		2003		2004		2005		2006		2007		2008	
Country	**Pioneers**	**Followers**	**Pioneers**	**Followers**	**Pioneers**	**Followers**	**Pioneers**	**Followers**	**Pioneers**	**Followers**	**Pioneers**	**Followers**	**Pioneers**	**Followers**
Austria	0	0	1	0	1	3	1	3	1	2	1	2	1	2
Belgium	0	0	0	0	0	0	1	0	1	1	1	2	1	2
Czech Republic	0	0	0	0	0	0	0	0	1	0	1	1	1	1
Denmark	0	0	0	0	0	0	0	0	2	1	2	1	2	1
Finland	0	0	0	0	1	1	1	1	1	2	1	2	1	2
France	0	0	0	0	0	0	1	1	1	1	1	1	1	1
Germany	0	0	0	0	2	2	2	2	2	2	2	2	2	2
Greece	0	0	0	0	2	1	2	1	2	1	2	1	2	1
Hungary	0	0	0	0	0	0	2	0	2	0	2	0	2	0
Ireland	0	0	0	0	1	0	1	1	1	1	1	1	1	1
Italy	0	0	0	0	1	2	1	2	1	2	1	2	1	2
Netherlands	0	0	0	0	1	1	1	1	1	2	1	2	1	2
Norway	0	0	0	0	0	0	1	1	1	1	1	1	1	1
Poland	0	0	0	0	0	1	0	2	1	2	1	3	1	3
Portugal	0	0	0	0	2	1	2	1	2	1	2	1	2	1
Spain	0	0	0	0	1	2	1	2	1	2	1	2	1	2
Sweden	0	0	0	0	2	1	2	1	2	2	2	1	2	1
Switzerland	0	0	0	0	0	0	1	1	1	1	1	1	1	1
United Kingdom	0	0	0	0	0	0	1	3	1	3	1	3	1	3
Total	**0**	**0**	**1**	**0**	**14**	**15**	**21**	**23**	**25**	**27**	**25**	**29**	**25**	**29**

TABLE 3
Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max	1	2	3	4	5	6	7
EBITDA (1)	1,934	0.289	0.257	-3.571	0.580	1						
Market share (2)	1,931	0.318	0.145	0.001	0.731	0.549	1					
First mover (3)	1,934	0.509	0.500	0	1	0.383	0.677	1				
Internationalization (4)	1,934	11.226	9.285	1	30	0.069	0.019	0.014	1			
Number of operators (5)	1,934	3.542	0.762	2	5	-0.168	-0.363	-0.213	0.089	1		
Market growth (6)	1,934	0.178	0.204	-0.131	1.216	-0.231	0.018	-0.017	-0.108	-0.060	1	
Technological discontinuity (7)	1,934	0.507	0.500	0	1	0.167	-0.058	-0.018	0.063	0.215	-0.436	1

TABLE 4
Evolution of EBITDA (%) by Year and Country

Country	1999		2000		2001		2002		2003		2004		2005		2006		2007		2008	
	Pioneers	*Followers*	*Pioneers*	*Followers*	*Pioneers*	*Followers*	*Pioneers*	*Followers*	*Pioneers*	*Followers*	*Pioneers*	*Followers*	*Pioneers*	*Followers*	*Pioneers*	*Followers*	*Pioneers*	*Followers*	*Pioneers*	*Followers*
Austria	0.29	-0.20	0.29	-0.19	0.36	0.02	0.36	0.14	0.35	0.19	0.35	0.22	0.36	0.23	0.35	0.26	0.35	0.26	0.38	0.29
Belgium	0.35	0.10	0.36	-0.94	0.46	-0.06	0.50	0.19	0.50	0.27	0.50	0.37	0.48	0.42	0.47	0.45	0.44	0.41	0.46	0.42
Czech Republic	--	--	0.35	--	0.42	-0.33	0.48	0.08	0.47	0.28	0.46	0.32	0.45	0.35	0.46	0.36	0.46	0.40	0.47	0.39
Denmark	--	--	0.29	-0.92	0.27	-0.87	0.30	-0.28	0.28	0.06	0.24	0.07	0.27	0.08	0.27	0.19	0.25	0.14	0.23	0.18
Finland	0.46	--	0.38	-1.54	0.41	-0.61	0.39	-0.25	0.37	--	0.37	--	0.25	0.08	0.27	0.13	0.31	0.19	0.29	0.20
France			0.27	0.12	0.32	0.28	0.37	0.34	0.41	0.32	0.42	0.32	0.40	0.33	0.39	0.34	0.39	0.34	0.39	0.35
Germany	0.37	-0.20	0.27	-0.19	0.40	0.02	0.43	0.14	0.43	0.19	0.44	0.22	0.44	0.23	0.43	0.26	0.40	0.26	0.40	0.29
Greece		0.13	0.34	0.37	0.38	0.41	0.37	-0.31	0.38	0.01	0.35	0.27	0.33	0.31	0.34	0.36	0.35	0.37	0.36	0.42
Hungary	--	--	0.40	--	0.38	--	0.38	--	0.37	--	0.38	--	0.39	--	0.38	--	0.41	--	0.43	--
Ireland	--	--	--	--	0.39	0.31	0.44	0.34	0.43	0.39	0.45	0.38	0.45	0.38	0.45	0.24	0.44	0.24	0.43	0.24
Italy	0.47	0.42	0.49	0.45	0.50	0.19	0.50	0.34	0.53	0.39	0.52	0.40	0.51	0.39	0.49	0.46	0.46	0.46	0.48	0.46
Netherlands	0.29	0.27	0.34	-0.13	0.43	-0.28	0.44	0.04	0.45	0.16	0.40	0.21	0.37	0.23	0.37	0.24	0.40	0.26	0.40	0.26
Norway	--	--	0.31	--	0.34	--	0.39	--	0.40	--	0.35	--	0.36	--	0.40	--	0.35	--	0.36	--
Poland	--	--	--	--	--	--	0.40	0.21	0.38	0.30	0.39	0.34	0.41	0.38	0.35	0.35	0.35	0.02	0.38	-0.01
Portugal	0.35	0.13	0.36	0.11	0.34	0.13	0.36	0.18	0.36	0.23	0.40	0.29	0.40	0.27	0.39	0.28	0.40	0.25	0.38	0.20
Spain	0.33	-0.42	0.36	-0.09	0.49	0.24	0.52	0.32	0.53	0.33	0.50	0.33	0.47	0.33	0.45	0.31	0.44	0.30	0.45	0.29
Sweden	0.43	--	0.42	--	0.47	--	0.47	--	0.43	--	0.38	--	0.31	--	0.33	--	0.32	--	0.31	--
Switzerland	--	--	0.43	--	0.47	-0.01	0.48	0.09	0.49	0.24	0.49	0.28	0.49	0.30	0.49	0.30	0.48	0.26	0.49	0.24
United Kingdom	0.32	0.11	0.31	0.15	0.33	0.21	0.37	0.26	0.36	0.29	0.33	0.32	0.32	0.30	0.31	0.25	0.26	0.25	0.25	0.24
Average	0.37	0.04	0.35	-0.23	0.40	-0.02	0.42	0.11	0.42	0.24	0.41	0.29	0.39	0.29	0.39	0.30	0.38	0.27	0.39	0.28
Pionners-Followers	0.33		0.59		0.42		0.30		0.17		0.12		0.10		0.09		0.11		0.11	

TABLE 5
Evolution of Market Share (%) by Year and Country

Country	1999		2000		2001		2002		2003		2004		2005		2006		2007		2008	
	Pioneers	*Followers*	*Pioneers*	*Followers*	*Pioneers*	*Followers*	*Pioneers*	*Followers*	*Pioneers*	*Followers*	*Pioneers*	*Followers*	*Pioneers*	*Followers*	*Pioneers*	*Followers*	*Pioneers*	*Followers*	*Pioneers*	*Followers*
Austria	0.53	0.23	0.49	0.25	0.44	0.28	0.44	0.28	0.44	0.21	0.44	0.23	0.40	0.25	0.39	0.28	0.39	0.28	0.40	0.27
Belgium	0.65	0.33	0.62	0.19	0.55	0.22	0.54	0.23	0.54	0.23	0.54	0.25	0.49	0.26	0.47	0.27	0.45	0.28	0.45	0.28
Czech Republic	--	--	0.50	--	0.45	0.13	0.44	0.14	0.42	0.15	0.42	0.17	0.41	0.18	0.40	0.19	0.40	0.20	0.40	0.21
Denmark	--	--	0.38	0.08	0.38	0.09	0.38	0.12	0.39	0.11	0.39	0.12	0.38	0.22	0.38	0.20	0.38	0.22	0.37	0.22
Finland	0.63	--	0.49	0.03	0.47	0.05	0.44	0.06	0.42	--	0.42	--	0.43	0.14	0.42	0.17	0.40	0.19	0.39	0.22
France	--	--	0.48	0.26	0.48	0.26	0.49	0.25	0.49	0.25	0.49	0.26	0.47	0.26	0.47	0.27	0.47	0.27	0.47	0.27
Germany	0.40	0.10	0.40	0.10	0.40	0.10	0.40	0.10	0.40	0.10	0.40	0.11	0.38	0.12	0.36	0.14	0.36	0.14	0.36	0.14
Greece	--	0.27	0.34	0.32	0.32	0.37	0.31	0.25	0.30	0.20	0.30	0.22	0.28	0.22	0.28	0.22	0.30	0.32	0.30	0.40
Hungary	--	--	0.57	--	0.53	--	0.46	--	0.42	--	0.42	--	0.39	--	0.39	--	0.39	--	0.39	--
Ireland					0.59	0.39	0.57	0.40	0.56	0.40	0.56	0.40	0.50	0.39	0.48	0.26	0.46	0.27	0.45	0.28
Italy	0.61	0.34	0.55	0.35	0.48	0.24	0.47	0.25	0.47	0.26	0.47	0.27	0.40	0.27	0.40	0.26	0.40	0.25	0.40	0.26
Netherlands	0.52	0.32	0.48	0.21	0.44	0.14	0.42	0.14	0.39	0.15	0.39	0.16	0.40	0.16	0.50	0.17	0.51	0.20	0.49	0.25
Norway	--	--	0.50	--	0.50	--	0.50	--	0.50	--	0.50	--	0.50	--	0.50	--	0.50	--	0.50	--
Poland	--	--	--	--	--	--	0.34	0.31	0.34	0.33	0.34	0.32	0.33	0.33	0.33	0.34	0.33	0.20	0.32	0.18
Portugal	0.41	0.17	0.40	0.20	0.39	0.22	0.39	0.22	0.39	0.22	0.39	0.20	0.40	0.20	0.40	0.20	0.40	0.20	0.40	0.20
Spain	0.60	0.20	0.57	0.21	0.56	0.22	0.56	0.22	0.53	0.23	0.53	0.25	0.47	0.27	0.46	0.27	0.46	0.27	0.45	0.27
Sweden	0.33	--	0.34	--	0.33	--	0.33	--	0.33	--	0.33	--	0.32	--	0.32	--	0.31	--	0.31	--
Switzerland	--	--	0.69	--	0.70	0.15	0.63	0.18	0.64	0.18	0.64	0.19	0.63	0.18	0.63	0.18	0.62	0.19	0.62	0.19
United Kingdom	0.33	0.22	0.30	0.23	0.28	0.24	0.27	0.24	0.26	0.25	0.26	0.24	0.24	0.24	0.24	0.24	0.25	0.23	0.25	0.23
Average	0.50	0.24	0.48	0.20	0.46	0.21	0.44	0.21	0.43	0.22	0.43	0.22	0.41	0.23	0.41	0.23	0.41	0.23	0.41	0.24
Pionners-Followers	0.26		0.27		0.25		0.23		0.21		0.21		0.18		0.18		0.18		0.17	

TABLE 6
The Effect of Environmental Dynamics on FMA (HAC System GMM Estimates)

	(A.1) MSHARE System GMM	(A.2) MSHARE System GMM	(A.3) MSHARE System GMM	(B.1) EBITDA System GMM	(B.2) EBITDA System GMM	(B.3) EBITDA System GMM
First mover	0.0101*	0.0104*	0.0139*	0.0291**	0.0282**	0.0444**
	(1.84)	(1.84)	(1.86)	(2.40)	(2.30)	(2.46)
Internationalization	-0.0000363	-0.0000450	-0.0000472	0.0000939	0.000147	0.000162
	(-0.44)	(-0.52)	(-0.60)	(0.30)	(0.49)	(0.53)
Number of operators	-0.00403***	-0.00418**	-0.00374**	-0.0117**	-0.0111**	-0.0115**
	(-2.61)	(-2.56)	(-2.08)	(-2.55)	(-2.24)	(-2.29)
Market growth		-0.00788*	-0.000534		0.0543**	0.0526*
		(-1.70)	(-0.13)		(2.23)	(1.84)
Technological discontinuity		0.00108	0.00326*		-0.00683	0.00811
		(0.84)	(1.78)		(-0.94)	(0.73)
Market growth * first mover			-0.0157**			0.00537
			(-2.55)			(0.23)
Technological discontinuity * first mover			-0.00447*			-0.0286**
			(-1.68)			(-2.07)
Lagged market share	0.923***	0.921***	0.929***			
	(32.26)	(31.29)	(26.45)			
Lagged EBITDA				0.726***	0.732***	0.722***
				(12.17)	(11.86)	(11.60)
Constant	0.0334***	0.0341***	0.0285**	0.136***	0.134***	0.131***
	(3.08)	(3.13)	(2.26)	(5.35)	(5.66)	(5.75)
Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes
N	1860	1860	1860	1863	1863	1863
AR(1)	-3.079***	-3.092***	-3.056***	-3.187***	-3.158***	-3.173***
AR(2)	-1.415	-1.355	-1.402	0.831	0.830	0.827
Hansen Statistic	8.086	6.907	7.178	13.54	11.47	11.19

t statistics in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

FIGURE 1
Market Growth and Persistence of First Movers' Market Share

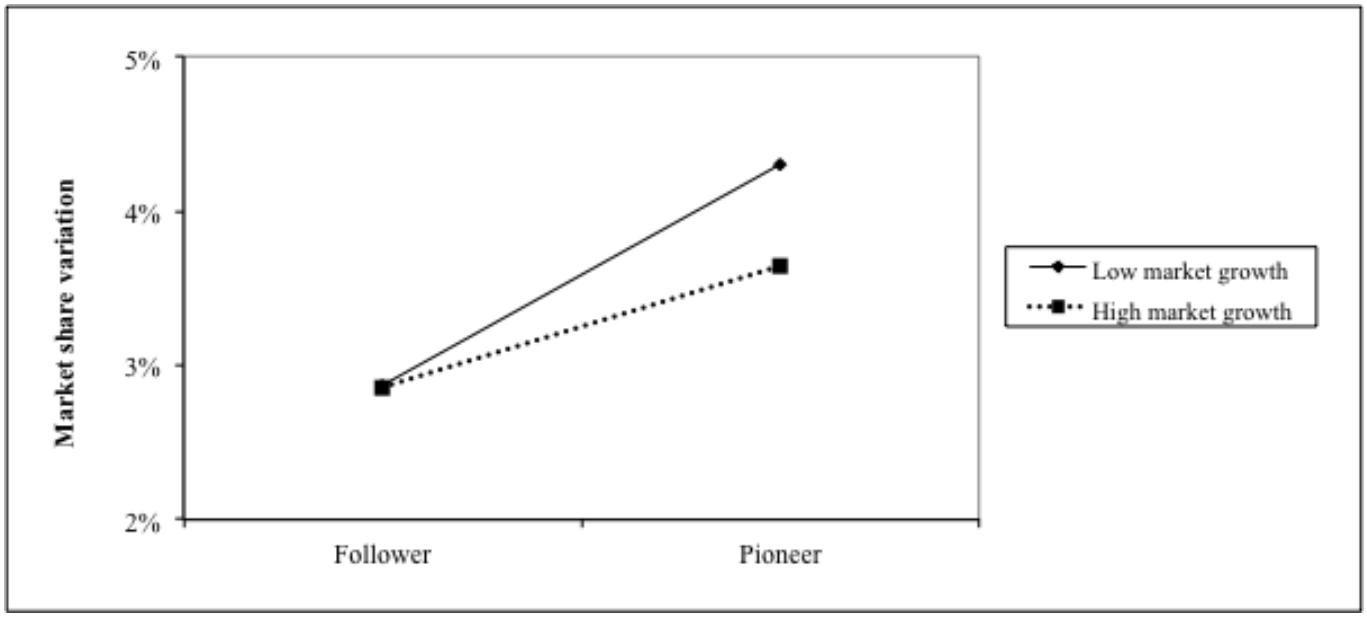
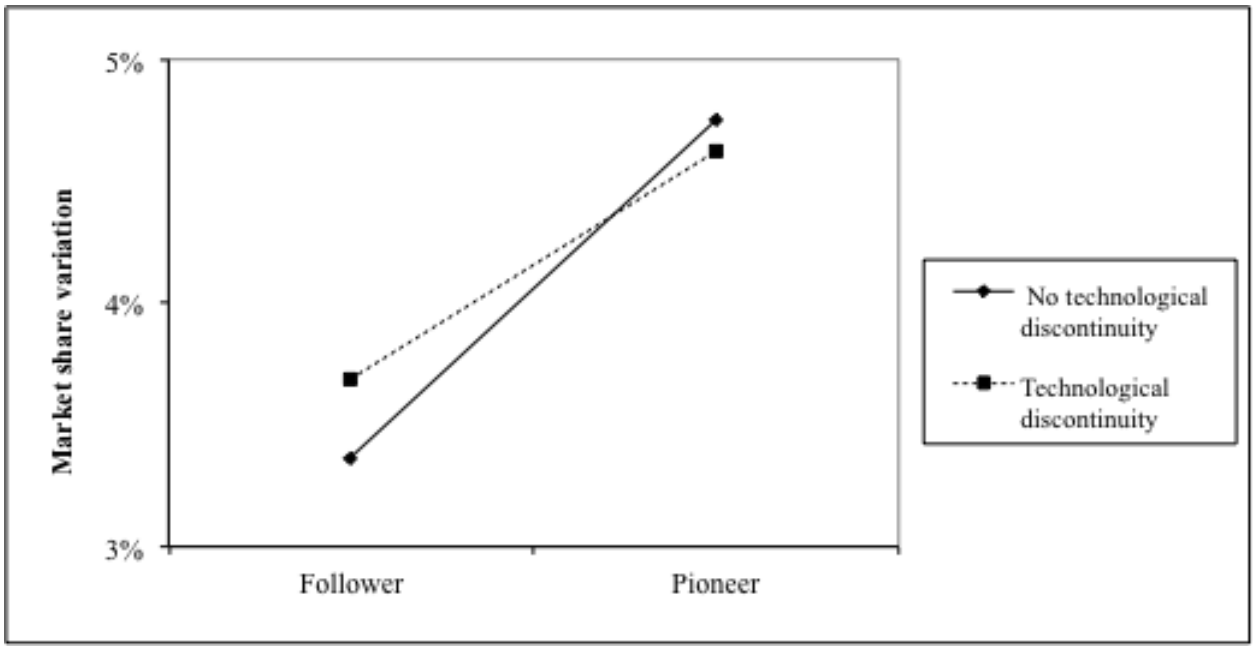


FIGURE 2
Technological Discontinuity and First Movers' Performance

A. Market Share



B. Profitability