

INCUMBENTS, TECHNOLOGICAL CHANGE AND INSTITUTIONS: HOW THE VALUE OF COMPLEMENTARY RESOURCES VARIES ACROSS MARKETS

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This article examines the influence of complementary resources on the performance of incumbents after a radical technological change. In investigating this relationship, we join the technological management literature and the institution-based view of strategy and maintain that the value of complementary resources is contingent on the institutional environment in which the firm operates. In particular, we submit that formal institutions, both economic and political, moderate the relationship between the stock of complementary assets and firm performance. We test our hypotheses in the context of the world mobile telecommunications industry (39 countries and 134 mobile service providers). Our findings reveal how these resources are more valuable for incumbents in markets where market-supporting institutions are weaker and political stability is higher. Copyright © 2014 John Wiley & Sons, Ltd.

INTRODUCTION

Recent history is full of failures of incumbents when confronting a radical technological change. These failures occur because a radical technological innovation often entails uncertainty, the entry of new competitors, and changes in the market structure (Benner, 2007; Tushman and Anderson, 1986). It frequently results in the failure of incumbent firms to survive in the new technological setting, being displaced by newcomers (Utterback, 1994) through a process that Schumpeter (1942) called “creative destruction.” Traditionally, the research literature has focused its attention on

the numerous disadvantages that incumbents face when this change takes place. These disadvantages include a lack of incentives and capabilities to develop the new technology, which tends to cannibalize their current profits (Arend, 1999; Lavie, 2006) in a competence-destroying process (Tushman and Anderson, 1986). Uncertainty about the future success of the technology, organizational inertia, and prior strategic commitments are examples of causes that decrease incentives and capabilities to make efficient investments in new technology (Hill and Rothaermel, 2003).

However, in the last two decades, an important amount of literature has highlighted the existence of exceptions to the “chronic” failure of incumbents (Helfat and Lieberman, 2002; Hill and Rothaermel, 2003; Kim and Min, 2012; Lavie, 2006). Extant research has posited complementary assets as one of the key elements that incumbents should hold in order to maintain their competitive advantage and not to be displaced (Mitchell, 1989, 1991;

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Rothaermel, 2001; Teece, 1986; Tripsas, 1997). We closely follow Rothaermel and Hill (2005) in identifying complementary resources as those particularly valuable for commercializing a new technology after a competence-destroying technological discontinuity. These resources include large-scale distribution channels, brand value, reputation, and strong links to users (Helfat and Lieberman, 2002; Mitchell, 1991; Teece, 1986). They help incumbents in the new stage of competition as they are difficult for new competitors to imitate (Helfat and Lieberman, 2002) and are potentially useful in the new technological field (Hill and Rothaermel, 2003; Mitchell, 1991).

The current paper expands previous technology management literature by incorporating the role of institutions in encouraging incumbents' opportunities to success after a radical technological change. Our main research interest is to analyze how institutions depict the boundary conditions for incumbents' advantages. In particular, we consider that the value of complementary assets in conferring incumbents an advantage over new entrants is not equal across markets but contingent on the economic and political institutional context in which the firm operates. Teece (1986) suggested that institutional factors, such as the efficacy of legal mechanisms of property rights protection, influence who will benefit from an innovation. However, previous research has usually neglected the influence of the institutional landscape on the competitive position of incumbents to develop and succeed after technological changes (Lavie, 2006). From a macroinstitutional viewpoint, the influence of institutions on the success or failure of incumbents has frequently been overlooked, mainly because most research studies have focused on only one country (Banbury and Mitchell, 1995; Ceccagnoli, 2009; Kim and Min, 2012; Lieberman, 1989; Mitchell, 1989, 1991).

By incorporating the institution-based view of strategy—which posits that the dynamic interaction between organizations and institutions determines strategic choices and outcomes (Peng *et al.*, 2009)—into the technological management discourse, the current paper aims to extend previous research literature on how incumbents confront a technological discontinuity. We follow North (1990) in decomposing formal institutions into economic and political, and elaborate on the idea that both moderate the impact of the stock of complementary assets on performance after a radical technological change. We examine how,

in markets with a lower development of economic or market-supporting institutions (e.g., weaker property rights protection and insufficient market intermediaries such as banks, solicitors, and financial analysts), the ownership of complementary resources is more important for incumbents to succeed than when a stronger institutional framework prevails. We complete the analysis by evaluating the effect that the instability of political institutions (that is, a higher likelihood that the rules of the market change because of arbitrary policy decision makers) has on the value of complementary resources in creating incumbent advantages.

We empirically test our hypotheses within the world mobile communications industry. More precisely, we analyze incumbents' performance after the technological disruption that took place with the transition from fixed to mobile communications. We use a longitudinal panel spanning the period 1998–2009 and covering 39 markets in five continents. This wide scope allows us to identify substantial institutional differences and determine how economic and political institutions moderate the value of complementary resources. The data refer to the competitive performance of 46 incumbents of fixed-telephony technology that compete in wireless technology against 88 newcomers.

The contribution of this article is twofold. First, we join the technology management and institution-based view literatures in trying to understand how complementary resources can help incumbents to succeed in turbulent environments. The previous literature, particularly in empirical studies, has mainly focused on industry and resource-based views (Mitchell, 1992; Tripsas, 1997). However, these perspectives do not answer why incumbents in the same industry and with similar resource endowments perform differently. The institution-based view, whose importance has dramatically increased in the last decade, can be useful to give us a more nuanced picture about why incumbents with similar resources obtain different outcomes depending on the economic and political institutional environment in which they compete.

Second, while previous research has mostly focused on one-country analyses, we offer additional empirical evidence supporting incumbents' survival in dynamic technological environments by considering the advantages of incumbents across national markets. In this way, we internationalize management literature by presenting evidence from a wide sample of countries, which allows us

to claim a higher level of generalizability for our results.

LITERATURE REVIEW

Incumbents and technological change

A technological discontinuity is a technical advance so significant that no increase in scale, efficiency, or design can make older technologies competitive (Tushman and Anderson, 1986: 441).¹ Supercomputers, semiconductors, mobile phones, and videocassette recorders are examples of new markets created through a radical innovation (Markides and Geroski, 2005). Under these circumstances, established firms must decide on their participation in the next stage of the industry (Helfat and Lieberman, 2002; Wu, Wan, and Levinthal, 2014). Given that these firms may lack incentives and capabilities and have adaptation problems in the new technological environment, the literature has highlighted the existence of a process of “creative destruction” through which incumbents are displaced from the market (Schumpeter, 1942). As a result, they have been accused of a “myopic” perspective in facing technological innovation (Christensen, 1997).

Hill and Rothaermel (2003) provide an overview of the main economic, organizational, and strategic reasons that explain the lack of or the slow response of incumbents to the development or implementation of a new technology that threatens to cannibalize their performance and, in some cases, displace them from the market. First, the existence of economic uncertainty about the success and future rents of an innovation decreases the incentives of incumbents to invest in the new technology. Christensen (1997) posits an “innovator’s dilemma” in which disrupting technologies initially underperform relative to established ones, and thus provides a disincentive to incumbents to shift to the new technology until it is too late. Arend (1999) maintains that this behavior is rational because incumbents concentrate on short-term efficiencies, mainly derived from shareholder or stock market pressures. Thus, external pressures contribute to slowing down the reaction of incumbents, which frequently causes a loss of their competitive position and,

even, the opportunity to compete in the new era (Banbury and Mitchell, 1995; Lieberman, 1989).

Second, extant literature has also highlighted the existence of organizational inertia that reduces the capability of incumbents to adapt successfully to the new technological environment (Lieberman and Montgomery, 1988). Organizational inflexibility, the result of an excess of formalization and top managers’ resistance to change in dynamic environments (Burgelman, 1994) make adapting difficult.

Finally, the existence of strategic precommitments with other firms, suppliers, and customers has been argued to be another source of inflexibility (Ghemawat, 1991). Christensen (1997) explains that focusing on current users usually motivates incumbents to improve incrementally products and technologies in terms of quality. This focus means that incumbents ignore disruptive technologies that fit no current customers’ needs but that, eventually, allow newcomers to benefit from this myopic focus of incumbents.

These arguments have been counteracted in the research literature as they neglect some technological and investment capabilities and resources that incumbents have been able to generate (Lavie, 2006), including basic research and development (R&D) routines that enable these incumbents to identify new opportunities better and make more effective investments (Hill and Rothaermel, 2003). Moreover, if there are some isolating mechanisms of pioneer advantages (e.g., preemption of scarce resources, network effects, or switching costs), it is predictable that the incumbent will be especially interested not only in adopting the new technology, but also in developing it before the entry of newcomers. In fact, the existence of pioneer advantages has been highlighted as one of the isolating mechanisms of the advantages of incumbents (Jones, 2003). Thus, the uncertainty surrounding technological change neither implies the lock-out of incumbents from the market nor an incumbent’s lack of incentives to invest in the new technology.

Arguments that defend the inflexibility of incumbents to react quickly to a radical technological change are based on a static viewpoint of firm capabilities. Lavie (2006) shows the existence of different mechanisms of capability reconfiguration (i.e., substitution, evolution, and transformation) that allow incumbents to respond to a technological innovation. Moreover, their reaction capability also depends on the corporate culture with

¹ Previous literature has referred to radical technological discontinuity with other terms such as radical technological innovation (Hill and Rothaermel, 2003), radical technological change (Utterback, 1994), and disruptive technology (Christensen, 1997). The current paper uses these terms interchangeably.

respect to the legitimization and institutionalization of autonomous action (Hill and Rothaermel, 2003).

The incumbent also benefits from the relationships previously established with users, banks, and governments. These relationships can help incumbents to understand better the change in the environment and provide valuable information about how to adapt to it (Mitchell and Singh, 1996). Once the new product or technology is developed, incumbents can continue profiting from these links (Rothaermel, 2001).

In sum, incumbents do not necessarily fail at identifying opportunities and developing a radical innovation. Further, when they decide to develop the innovation, previous literature suggests that incumbents have an advantage over newcomers because they own complementary resources (Mitchell, 1991, 1992; Teece, 1986; Tripsas, 1997). Teece (1986) defined complementary assets as the resources that a firm needs to commercialize an innovation successfully and classifies them into generic and specialized. Generic assets refer to those that do not need to be adjusted to the innovation and that can be acquired in the market or built internally. Such assets do not confer any advantage because newcomers can easily imitate them. The opposite is the case for specialized complementary assets that are difficult for newcomers to replicate (Teece, 1986; Tripsas, 1997). Some examples are marketing, sales and logistic services, market knowledge, brand value, reputation, regulatory knowledge, and client lists (Helfat and Lieberman, 2002; Mitchell, 1991, 1992; Stieglitz and Heine, 2007). These assets—not related to the core competences that will be destroyed after the radical technological change (Hill and Rothaermel, 2003; Tushman and Anderson, 1986)—enable firms to avoid displacement in the new technological landscape. In this context, complementary assets counteract the early-mover advantages of newcomers (Stieglitz and Heine, 2007) and facilitate entering into corporative arrangements, partnerships, and networks (Hill and Rothaermel, 2003; Teece, 1986), and into new product markets (Wernerfelt, 1984).

The institutional context

Institutions have been broadly defined as “the rules of the game in a society or, more formally, as the humanly devised constraints that shape human interaction” (North, 1990: 2). The interaction between institutions, organizations, and strategic

choices has recently become a research issue in the management literature (Peng, Wang, and Jiang, 2008). Strategic choices and performance of organizations should be understood in the institutional framework where they operate (Khanna and Rivkin, 2001; Peng, 2002; Peng, Lee, and Wang, 2005).

Surprisingly, institutions have traditionally been left in the “background,” as a simple control variable in international studies. However, their importance has been emphasized in the last two decades as they may condition the relationship between strategy and performance. Recent research has considered the institution-based view as a third leg for a strategy tripod (Peng *et al.*, 2009) to complement the well-established industry and resource-based views. For this reason, an increasing interest in the study of institutions in the management and international business fields can be observed (Ahuja and Yayavaram, 2011; Chan, Isobe, and Makino, 2008; Meyer *et al.*, 2009; Peng *et al.*, 2009). The institutional approach can also be used to analyze why similar firms in the same industry with similar resources and endowments obtain different performances depending on the institutional environment in which they are embedded (Stevens and Dykes, 2013). Although the interplay between institutions and extant strategic management theories is starting to grow, further theoretical and empirical development is needed (Singh, 2007).

Broadly, it has been argued that strong institutions reduce the uncertainty surrounding economic exchanges since they show the limits of what is considered legitimate (North, 1990; Peng *et al.*, 2009). Institutions reduce the information asymmetries among the contracting parts and their possible opportunistic behavior and play an important role in supporting the effective functioning of the market, reducing risk and costs (Meyer *et al.*, 2009; North, 1990).

The literature has divided institutions into formal (e.g., laws, regulations, discipline of economic and political markets and contracts) and informal (e.g., country culture, codes, norms, trust-based relationships, religion and traditions) (Dunning and Lundan, 2008; North, 1990). The current study focuses on the role of formal institutions in the consecution of incumbent advantages. More precisely, we closely follow North (1990) in decomposing market-level formal institutions into economic and political rules.

Economic rules refer to the protection of the property rights of individuals and organizations; in

other words, to the extent to which they have the freedom to use and alienate an asset or resource, as well as to possess the income derived from the property (North, 1990). In this vein, we borrow the well-established concept of *market-supporting institutions* proposed by Meyer *et al.* (2009) to refer to economic institutions. Strong market-supporting institutions are those that “support the voluntary exchange underpinning an effective market mechanism,” while weak ones are those that “fail to ensure effective markets or even undermine markets” (Meyer *et al.*, 2009: 63). Strong market-supporting institutions are usually characterized by a high property rights protection, the existence of financial and investor intermediaries that facilitate capital and information flows within a market, and a regulation that encourages business creation (Miller and Kim, 2012). In situations where market-supporting institutions are not sufficiently developed, informal ties acquire an important role in supporting economic exchanges. When formal institutions are weak, informal relationships have a greater influence on driving firm strategies and performance (Peng, 2003; Peng and Heath, 1996; Peng *et al.*, 2008). In such a context, the informal ties that the firm builds with other stakeholders, including consumers, investors, and employees, will play an important role in reducing uncertainty and limiting opportunistic behaviors by replacing nonexistent or inefficient formal mechanisms.

Political rules are also important in reducing uncertainty as they “define the hierarchical structure of the polity, its basic decision structure, and the explicit characteristics of agenda control” (North, 1990: 47). When the political decision-making process is embedded in a strict control system that prevents politicians from taking decisions arbitrarily, there is less risk of unexpected changes in the rules of the game (Henisz, 2003). Previous research has identified *political instability* or *political risk* with the likelihood that the government changes the regulation and policies of the market (García-Canal and Guillén, 2008; Henisz, 2000). Political instability usually translates into a higher risk of property expropriation and a breach of the commitment between organizations and governments toward a specific policy (García-Canal and Guillén, 2008). For this reason, the higher the *political instability* in a market, the higher the uncertainty about future policies and regulations (Henisz, 2000).

Below, we attempt to address the impact of both economic and political institutions on the analysis

of incumbent advantages. We theorize that, after a radical technological change, complementary assets enable incumbents to maintain their relationships with the business network to perform better than newcomers. We also consider that the effect of complementary assets on the performance of incumbents will be dependent on the strength of the market-supporting institutions and the policy instability of the market.

HYPOTHESES

Incumbency, complementary assets and performance

A radical technological change can be competence-destroying for incumbents. Nevertheless, their competitive position can be sustained in the new technological stage under certain circumstances such as the ownership of specialized complementary assets linked to the commercialization of the innovation (Teece, 1986). These assets are usually located in the downstream value chain or market-related activities and include: established reputation, detailed understanding of product usage, strong links to users and marketing, sales, aftersales support, and large-scale distribution systems (Hill and Rothaermel, 2003; Mitchell, 1991, 1992; Rothaermel and Hill, 2005).

Specialized complementary assets are particularly valuable when the user base does not substantially change (Mitchell, 1991, 1992; Rosenbloom and Christensen, 1994). Although the new technological innovation changes product and process paradigms, if it does not entail selling to completely new customers, downstream accumulated resources keep their value in the next stage through an adequate coordination with new core activities (Hill and Rothaermel, 2003; Stieglitz and Heine, 2007). Additionally, the maintenance of downstream assets allows incumbents to be known not only by users but also by other agents, including investors, trade associations, banks, and employees, who take part in the downstream value chain activities and who allow the firm to be embedded in the corporate network of the market (Lynn, Reddy, and Aram, 1996). In fact, Mitchell and Singh (1996) show that collaborative relationships for activities outside the core of the technological shock enable incumbents to adapt better to the new technological stage, noting that marketing partners help incumbents “to gain a better

understanding of the nature of the sudden environmental change and how to respond to it" (Mitchell and Singh, 1996: 188).

Specialized complementary assets confer an advantage to incumbents because (unlike generic assets), they are difficult for newcomers to imitate (Rothaermel and Hill, 2005; Teece, Pisano, and Shuen, 1997). As Teece (1986) points out, specialized complementary assets, such as reputation or strong links with users, must be built over time. In other cases, imitation is difficult because these assets are based on tacit know-how, such as R&D skills and the understanding of product usage (Mitchell, 1991, 1992). The replication of complementary assets can also be excluded by legal restrictions such as patents and copyrights (Mitchell, 1992; Teece, 1986).

The impact of incumbents' ownership of complementary assets on firm performance has been analyzed in the extant literature. In the medical diagnostic imaging industry, Mitchell (1989) shows that the ownership of these assets increases the probability of entry into a new technological stage. Mitchell (1992) also determines that market-related assets provide incumbents with greater survival and market share advantages. Tripsas (1997), in the typesetter industry, concludes that specialized complementary assets protect incumbents from competence-destroying innovations. Rothaermel and Hill (2005) show that specialized complementary assets improve incumbent industry performance, whereas generic assets diminish it in a multi-industry context.

In sum, the stock of specialized complementary assets is expected to increase the performance of incumbents after a radical technological change. They enable incumbents to commercialize the innovation and to maintain their links with users and their collaborative relationships with other agents involved in the downstream value chain activities. Accordingly, our first hypothesis is the following.

Hypothesis 1: Specialized complementary assets are positively related to performance.

The moderating role of the institutional context

Incumbent advantages and market-supporting institutions

Previous links to users and other agents of the downstream value chain will be crucial for success after

a radical technological change. These previous collaborative relationships help incumbents in the new landscape by reducing uncertainty and diminishing contractual hazards. As we explain below, the ownership of complementary resources are particularly important in contexts of weak market-supporting institutions (Meyer *et al.*, 2009).

A context of weak market-supporting institutions is characterized by market failures, which imply that firms are subject to contractual hazards (Meyer *et al.*, 2009). In this context, there is insufficient development of intermediation institutions such as financial analysts, professional societies, trade associations, investment bankers, auditors, solicitors, brokers, and consultants. These intermediaries increase information exchanges between contractual parties, resolving problems of asymmetric information and reducing costs associated with product, labor, and capital markets (Chan *et al.*, 2008; Khanna and Palepu, 2000; Meyer *et al.*, 2009; North, 1990). Thus, inefficient intermediaries increase transaction costs, resulting in a lower predictability of the future behavior of other contracting parties. In these conditions, the risk of opportunistic behavior increases and it is necessary to spend additional resources to augment the available information (Tong, Reuer, and Peng, 2008), which increases the costs of drafting contracts (Ketchen, Boyd, and Bergh, 2008; Peng, 2002; Peng *et al.*, 2008). A weak (formal) institutional environment also increases the costs of contract protection because these markets are characterized by imperfect judicial systems, which means a low protection of property rights (Chan *et al.*, 2008; Cuervo-Cazurra and Genc, 2008; Ghemawat and Khanna, 1998).

When a radical technological change takes place and market-supporting institutions are weak (in other words, the rules of the game are not clear enough), incumbents can take advantage of their ownership of complementary assets to reduce contractual risks. The maintenance of logistic, sales, and service systems, among others, facilitates interaction with the same system of users and organizations as in the past. These agents have greater information about incumbents than about newcomers and, thus, information asymmetries are lower, which puts incumbents in a better position than new entrants (Delios and Beamish, 1999; Meyer *et al.*, 2009). Downstream organizations and users, based on previous contractual relationships, can better predict the opportunistic behavior of

these incumbents. Therefore, contractual risks are perceived as lower for incumbents, who will be in an advantageous position in the commercialization of the innovation.

However, when market-supporting institutions are strong, the importance of maintaining valuable complementary assets for counteracting market failures decreases. External mechanisms, such as market intermediaries and efficient judiciary systems, are used in order to increase information availability, enforce contracts, access capital, protect property rights, and simplify the bureaucracy of starting up a new business (Chan *et al.*, 2008; Cuervo-Cazurra and Genc, 2008; Peng *et al.*, 2005). In this context, contracting with newcomers is less risky and, thus, they are less damaged by the institutional environment even when complementary assets are lacking.

In sum, we posit that, after a radical technological change, the ownership of specialized complementary assets influences the performance of incumbents more strongly when market-supporting institutions are less developed. In such a context, complementary assets not only favor commercialization of the radical innovation, but also serve to decrease information asymmetries and contractual risks with private organizations and users of the downstream value chain.

Hypothesis 2: The weaker the market-supporting institutions, the higher the influence of the stock of complementary assets on performance.

Incumbent advantages and political instability

Whereas market-supporting institutions constrain the relationship between individuals and firms by defining the scope of contracts and their enforcement in order to protect property rights of individuals, political institutions focus on the government of a country as the main player to influence economic exchanges. We consider that a market is characterized by *political instability* when politicians can arbitrarily take decisions that change the rules of the game in a market. However, how this political instability can influence incumbent advantages is debatable. It has been argued that firms in markets with higher political instability can try to influence politicians to take favorable decisions through what have been called “political activities,” such as lobbying, government ownership on company boards, campaign contributions, voluntary

agreements, and even bribery (Lawton, McGuire, and Rajwani, 2013). In this sense, incumbents are in a favorable position to influence the policy-making process given that they have previous experience in the market, possess financial and intangible resources to develop a more effective political activity, and are usually characterized by larger size than newcomers. This last factor has been shown to be a predictor of the propensity of firms to initiate political activities (Hansen and Mitchell, 2000; Hillman and Hitt, 1999; Schuler and Rehbein, 1997). Incumbents may try to exploit previous relationships with existing politicians or state officials to gain favorable conditions to commercialize the innovation through their complementary assets that restrict the entry of new competitors. For example, politicians can increase entry barriers or taxes on new businesses and impose bureaucratic requirements that delay the entry of new competitors. From this perspective, the value of complementary assets to increase firm performance would be greater for incumbents in markets with higher political instability in which politicians have more power to easily change rules in the market.

Accordingly, we initially postulate that

Hypothesis 3a: The higher the political instability of a market, the higher the influence of the stock of complementary assets on performance.

However, there are other arguments that assert that larger, domestic, and more experienced firms are not necessarily the only ones that can take advantage of their political activity. For example, it has been observed that smaller firms, such as newcomers when they begin, can join with others to engage in collective political activity and influence policy-making decisions (Cook and Fox, 2000; Hillman and Hitt, 1999). Moreover, in a globalized economy, García-Canal and Guillén (2008) show that policy-making discretion, due to the lack of institutional constraints on the executive branch, favors the entry of foreign firms into a market when they have previously developed skills to influence political decisions in their home countries. As a consequence, incumbents are not necessarily in a better position than domestic or foreign newcomers to take advantage of the unstable political environment. Moreover, the existence of political instability means that the institutional environment will tend to change over time (García-Canal and Guillén, 2008), which implies that previous agreements

that incumbents have achieved with their governments can become obsolete because politicians are less constrained to accomplish them. In this vein, Frynas, Mellahi, and Pigman (2006: 339) propose that “favorable industry structures related to political resources could prove transitory if the rules of the game change, which is more likely in contexts of political instability.” Further, the knowledge of how to deal with bureaucratic and regulatory issues that incumbents have accumulated from previous experience—and that have been recognized to be part of their complementary assets since they serve to commercialize an innovation (Stieglitz and Heine, 2007)—will become obsolete if political stability results in a higher risk of changing the rules of the game. For this reason, we also postulate that

Hypothesis 3b: The higher the political instability of a market, the lower the influence of the stock of complementary assets on performance.

RESEARCH SETTING, SAMPLE AND VARIABLES

The telecom industry: a case of radical innovation

The telecommunications industry has been considered a paradigmatic case of an activity that has experienced a radical technological change with the shift from fixed to wireless technology (Markides and Geroski, 2005; Rothaermel and Hill, 2005). Fixed telephone services are based on a technology that uses a solid medium, such as metal wire and optical fiber, to allow voice transmissions. This technology was used until the last years of the 20th century as the main instrument for communication. Given its economic and social importance, together with the high investment required to develop it, it has been considered a natural monopoly that has been usually exercised by one state-owned firm (Armstrong, 1997; Banerjee and Ros, 2004).² Incumbent firms have been privatized in most countries during the last three decades, coinciding with the introduction of wireless technology.

² Some exceptions to this rule can be found in countries such as Argentina and the United States, where the vast territorial extension explains the existence of two or more firms offering fixed landline services at the regional level.

Wireless technology, based on radio waves, was developed in the second half of the 20th century (Gruber, 2005). This innovation included the use of new methods, materials, and knowledge to allow voice transmission, although the final users of the innovation did not substantially change. Analog mobile phones started to be commercialized in the late 1980s, but it was in the early 1990s, with the appearance of digital technologies—second-generation or 2G —, that the real takeoff of wireless technology took place. In this decade, wireless communications started to substitute fixed lines in many countries, especially in those that had technological problems in fixed-line technology (Banerjee and Ros, 2004).

Figure 1 shows that fixed telephony penetration rates during the last years of the 20th century and the first decade of 21st century have not substantially increased around the world in comparison with mobile communications whose diffusion rate increased dramatically during the last decade. As a result of this evolution, the number of mobile users was higher than the number of fixed main lines for the first time in 2002 (ITU, 2014). Gans, King, and Wright (2005) provide an accurate overview of the works that study this substitutive effect. These studies show that an individual's spending on fixed-line telephony decreases when the user also has a mobile phone (Horvath and Maldoom, 2002). Cadima and Barros (2000) observe a reduction in fixed-line services demand when there is access to mobile services. Interestingly, the improvement in mobile services has led to higher competition, lower prices, and higher functionality, which has increased the attractiveness of mobile technology to satisfy communications needs (Gans *et al.*, 2005; Gruber, 2001; Gruber and Verboven, 2001; Rodini, Ward, and Woroch, 2003). This substitution effect can be appreciated in Figure 2.

In sum, mobile technology has meant a radical technological innovation. In such a context, we expect that incumbents will maintain the value of specialized complementary assets of downstream activities in the new technological landscape. For example, Rothaermel and Hill (2005) determine that switching networks of incumbents are considered as specialized complementary assets because they continue to be useful with the wireless technology and are difficult for newcomers to replicate because of the high costs of building their own switching networks.

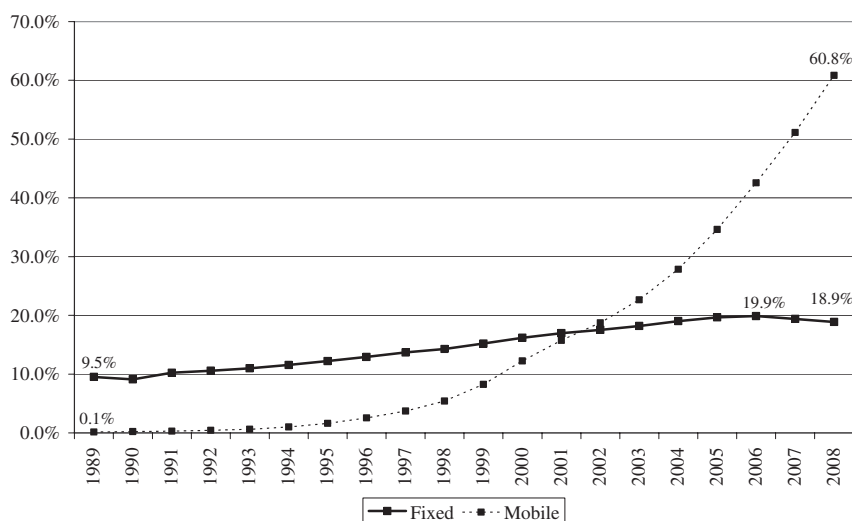


Figure 1. World fixed and mobile telephony penetration rate (1989–2008). Source: The World Bank Group (2013)

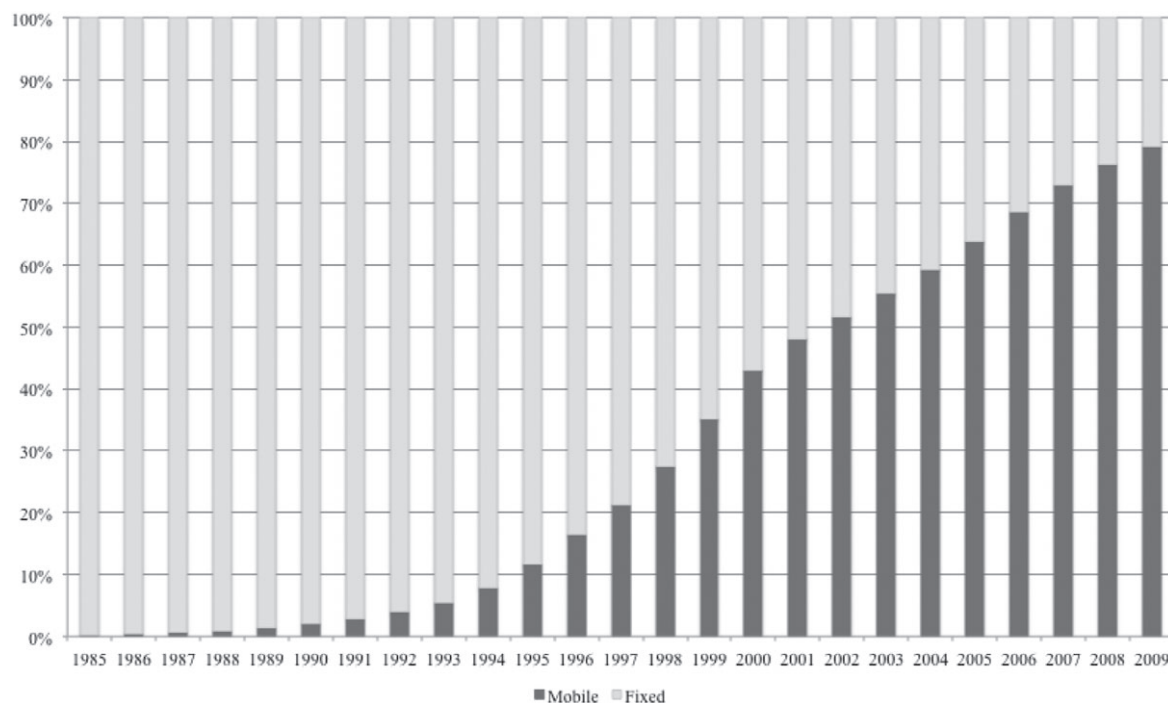


Figure 2. % of connections (by type of technology over total, 1985–2009). Source: The World Bank Group (2013)

Governments have played a key role in fostering competition in the telecommunications industry. Fixed telephony companies were subject to a high control from governments in terms of prices and quality standards given that fixed telephony was understood as a natural monopoly. From the mid-1980s, starting in the United Kingdom and the United States, a reform took place with the

aim of privatizing firms and developing regulation to favor competitive entries (Gruber, 2005). With the development of mobile services, competition started in most markets. With the launch of 2G services, new companies appeared in the market. In this new context in which both technologies coexist, fixed telephony has been considered as a basic service whereas mobile telephony is

understood as a value-added service. For this reason, fixed telephony has been traditionally subject to a stricter regulation from governments than the mobile industry. As Gruber (2005) states, mobile communications are subject to two main levels of regulation, preentry and post-entry. Preentry regulation determines spectrum assignment, equipment standardization, and market entry through licenses.³ Post-entry regulation of mobile services has tended to be minimal in comparison with fixed telephony and the preentry regulation of mobile services.

Sample and variables

Our database includes the whole population of mobile communications providers that operated in 39 markets between the last quarter of 1998 and the third quarter of 2009, that is, after the radical technological change in the telecom industry took place.⁴ Our panel data come from multiple sources but the main one is the Merrill Lynch Global Wireless Matrix. Merrill Lynch (2010) provides quarterly information on several of the variables of interest such as the name of the firm, the number of subscribers, the number of firms per market and their performance. We have also collected information about incumbency and date of entry, mainly from industry reports and the corporate information of the firms. Additionally, our source of information to measure market-supporting institutions is the Heritage Foundation (2010) that provides the Index of Economic Freedom, as well as the Political Constraints Index developed by Henisz (2000) to measure political instability.

The sample includes a total of 46 incumbents and 88 newcomers that provide 3,509 observations.⁵ The wide scope of countries and continents included in our sample allows us to analyze how

the variability in economic and political rules influences incumbent advantages.⁶

Dependent variable

Performance. Performance is measured through EBITDA (Earnings Before Interest, Taxes, Depreciation and Amortization) divided by the total revenues of the firm in its market. This is a country-specific profitability measure.

Independent variables

Complementary assets. We have previously defined complementary assets as those that are helpful to commercialize a new technology after a competence-destroying technological discontinuity (Rothaermel and Hill, 2005). Extant literature has measured complementary assets in very different ways. For example, Mitchell (1989) measures them through a threefold approximation: the ownership of a direct distribution system (binary variable), the experience of the firm with the old product before the launch of the innovation as a proxy of reputation (continuous variable), and the industry market share in the year before the new product was launched as a proxy of other complementary assets such as research, development, and manufacturing systems (continuous variable). Ceccagnoli (2009) considers the ownership of complementary assets in manufacturing industries through a binary variable that takes the value 1 when there is a frequent interaction either between R&D and production personnel or between R&D and sales/marketing personnel. Tripsas (1997) also measures complementary assets in the typesetter industry through dummy variables that control for the ownership of these resources by incumbents and for the possibility of newcomers to build them. Finally, for the U.S. tele-communications switching industry where there was a radical change from electromechanical to semiconductor systems, Jones (2003) measures the stock of complementary assets as the average electromechanical component sales of an incumbent in the three years before its entry into the semiconductor technology.

100 percent of the incumbents are active in the last period under analysis (the third quarter of 2009).

⁶ The Appendix S1 shows the distribution of market-supporting institutions and political instability by country. As can be observed, there is a high variability in both institutional dimensions in our sample.

³ There have been two main mechanisms to allocate licenses: beauty contests, and auctions. For additional information, see Gruber (2005) and Whalley and Curwen (2006).

⁴ The countries considered in our research from 1998 to 2009 are Austria, Belgium, the Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Israel, Italy, the Netherlands, Norway, Poland, Portugal, Spain, Sweden, Switzerland, and the United Kingdom. Argentina, Australia, Brazil, Canada, Chile, Colombia, Indonesia, Japan, South Korea, Mexico, Morocco, New Zealand, Peru, Philippines, Singapore, South Africa, Turkey, the United States, and Venezuela were included from 2005 to 2009.

⁵ In telecommunications, incumbents from fixed telephony usually entered into the mobile business. For this reason, there is at least one incumbent per market. In the specific case of our sample,

In sum, we observe two main approaches to account for complementary assets: either a dummy variable (i.e., you have them or you do not) or a stock variable that incorporates some cumulative effect (Jones, 2003; Mitchell, 1989). Dummy variables do not give you the possibility of assessing differences in the stock of complementary assets among firms, which is why we are more inclined toward the second alternative. We follow Mitchell (1989) and Jones (2003) in operationalizing this variable. More precisely, we use the average installed base of an incumbent over population in the three years immediately prior to its entry into digital mobile technology. It is important to note that, for markets with only one operator providing fixed services, this variable is equal to the penetration rate.

The installed base of incumbents in the fixed line is taken as a proxy of the stock of complementary assets because it is proportional to the spread of marketing, sales and aftersales systems, the number of links with users, and other intangible resources that help to commercialize an innovation, such as reputation, brand value, and market knowledge. The greater the number of fixed line customers of an incumbent over the total market size, the higher the stock of complementary assets to facilitate the entry of the incumbent into the mobile industry. Moreover, the installed base has been proven to be per se a strategic asset in network industries such as fixed telephony (McIntyre and Subramaniam, 2009) and fills the requirements to be considered a key complementary asset since it maintains its value in the next technological stage (users in fixed and mobile industries are substantially the same [Rodini, Ward, and Woroch, 2003]) and it is difficult for newcomers to replicate (Shapiro and Varian, 1998; Teece *et al.*, 1997).

Market-supporting institutions. In measuring market-supporting institutions, we build an index based on the yearly Index of Economic Freedom (EFI) provided by The Heritage Foundation. The EFI measures the degree to which all liberties and rights of production, distribution, and consumption of goods and services are guaranteed in a market to support economic exchanges better (Miller and Kim, 2012). We closely follow Meyer *et al.* (2009) by selecting the five dimensions that best fit the concept of market-supporting institutions we use in this study, namely, trade freedom, business freedom, investment freedom, financial freedom,

and property rights protection. In this way, we measure the extent to which institutions in a market support economic exchanges by guaranteeing capital and information flows, property rights protection, and the entry of newcomers into a market. The index ranges from 0 (no freedom) to 100 (full freedom). This index has been previously used in the literature with very similar purposes (Goerzen and Beamish, 2003; Meyer *et al.*, 2009) and has been shown to correlate highly with other indexes that measure the institutional development of countries, such as the Corruption Perceptions Index ($r=0.80$) and the Worldwide Governance Indicators ($r=0.60-0.90$).

Political instability. Political instability is a concept that has been previously analyzed in the literature in very different contexts, such as in the analysis of the ownership decision in the internationalization process (Delios and Henisz, 2000), the national systems of innovation (Allard, Martinez, and Williams, 2012) and first-mover advantages (Frynas, Mellahi, and Pigman, 2006). A widely accepted proposal to measure political instability is the Index of Political Constraints developed by Henisz (2000), which ranges from 0 (no constraints on the executive branch's power to introduce policy changes, that is, the highest political instability) to 1 (full constraints on political decisions or the lowest political instability). We have followed this measure available in Henisz (2010) and, in doing so, we have subtracted the constraints index from unity to use it as a measure of political instability or governmental policy-making discretion free from institutional constraints in the same way as other authors (García-Canal and Guillén, 2008). Thus, our variable takes the value 1 in a scenario of full political instability and 0 in the case of full political stability. The use of the Henisz's (2000) indicator of political instability has been extensively used in previous studies with similar purposes, such as García-Canal and Guillén (2008), Holburn and Zelner (2010) and Tong and Li (2013).

Control variables

In addition to the variables used to test our hypotheses, we also control for some firm characteristics such as the time (in months) that the firm has been operating in the market (*Time in the market*). We proceed in this way because previous literature has suggested that, after a radical technological

change, performance could depend on the existence of first-mover advantages (Jones, 2003). Thus, a positive relationship between time in the market and performance is expected. The model also includes dummies controlling for the effect of a national merger between firms that appear in the sample during the period under study (*Merger*). Through another dummy, we control for the possibility that a company is incumbent in other markets than the focal one (*Foreign incumbency*), under the premise that there is some experience effect.⁷

We include additional controls for market and country-specific conditions. Market rivalry is captured by taking into account the number of firms operating in each market (*Firms*). This variable is expected to affect firm performance negatively. Population in each market (*Population*), in millions of inhabitants, is expected to have a positive impact on performance because of the higher potential market size. Given that institutional measures can be correlated to the level of economic development of countries, we also control for this fact through the GDP per capita of each market (*GDP pc*). Performance after a radical technological change may also be dependent on the risk aversion of customers to change from one technology to another. We control for this by including the uncertainty avoidance measure provided by Hofstede (1980) (*Uncertainty Avoidance*). Finally, the model considers regional and year dummies to control for geographic and time-specific influences, respectively. Thus, the specification we estimate is the following:

$$\begin{aligned} \text{Performance}_{ikt} = & \beta_0 + \beta_1 \text{Complementary assets}_{ikt} \\ & + \beta_2 \text{Market} - \text{supporting institutions}_{kt} \\ & + \beta_3 \text{Complementary assets}_{ikt} \\ & \times \text{Market} - \text{supporting institutions}_{kt} \\ & + \beta_4 \text{Political instability}_{kt} \\ & + \beta_5 \text{Complementary assets}_{ikt} \\ & \times \text{Political instability}_{kt} \\ & + \beta_6 \text{Control variables} + \epsilon_{ikt} \end{aligned}$$

⁷ Foreign incumbents are firms that belong to international groups that are incumbents in their home markets. When expanding abroad, international groups have entered markets by creating new firms (e.g., greenfields) or by acquiring existing ones (acquisitions). In most cases, the acquired firms were mobile newcomers. Entering by greenfields or acquiring newcomers means that foreign incumbents do not possess complementary assets in the host market and, thus, our variable of complementary assets for foreign incumbents is zero.

Table 1. Descriptive statistics ($N = 3,509$)

Variable	Mean	Std. dev.	Min	Max
1. <i>Performance</i>	0.29	0.31	−9.17	0.74
2. <i>Complementary assets</i>	0.11	0.19	0.00	0.68
3. <i>Market-supporting institutions</i>	72.78	11.83	31.08	92.14
4. <i>Political instability</i>	0.54	0.14	0.27	0.97
5. <i>Uncertainty avoidance</i>	66.96	24.03	8.00	112.00
6. <i>GDP pc</i>	27.82	15.25	1.20	67.80
7. <i>Firms</i>	3.72	0.93	2.00	7.00
8. <i>Merger</i>	0.02	0.13	0.00	1.00
9. <i>Population</i>	48.30	64.87	3.87	307.00
10. <i>Time in the market</i>	116.32	45.70	3.00	273.00
11. <i>Foreign incumbency</i>	0.30	0.46	0.00	1.00
12. <i>Africa</i>	0.02	0.15	0.00	1.00
13. <i>Asia</i>	0.10	0.30	0.00	1.00
14. <i>Pacific</i>	0.03	0.18	0.00	1.00
15. <i>America</i>	0.18	0.38	0.00	1.00

Descriptive statistics

Descriptive statistics and correlations are shown in Tables 1 and 2, respectively, both referring to 3,509 observations. As can be seen in Table 1, the average firm has an average EBITDA ratio of 0.29, complementary assets of about 0.11 and has been operating for almost 10 years (116 months). The average number of firms per market is almost four. When we analyze the correlation matrix in Table 2, we observe that EBITDA is positively correlated with complementary assets and political instability. The correlation of EBITDA is also positive with both time in the market and population. Nevertheless, the correlation is negative between EBITDA and the development of market-supporting institutions, the GDP per capita, the number of firms that operate in the market, and when a foreign incumbent is the owner of the national operator.

RESULTS

Table 3 shows the random effect estimates⁸ of our model. All the equations present heteroskedasticity

⁸ The Hausman test shows that there are systematic individual effects. By running a fixed-effects regression, time-invariant variables are dropped. A time-invariant variable, the stock of complementary assets, is the basis of our first hypothesis. Extant literature argues that, in cases in which the time-invariant variables

Table 2. Correlation matrix ($N = 3,509$)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. <i>Performance</i>															
2. <i>Complementary assets</i>	0.17*														
3. <i>Market-supporting institutions</i>	-0.07*	0.18*													
4. <i>Political instability</i>	0.12*	-0.10*	-0.37*												
5. <i>Uncertainty avoidance</i>	-0.02	-0.10*	-0.50*	-0.13*											
6. <i>GDP pc</i>	-0.07*	0.27*	0.75*	-0.33*	-0.50*										
7. <i>Firms</i>	-0.08*	-0.08*	0.13*	0.09*	-0.21*	0.10*									
8. <i>Merger</i>	0.01	0.00	-0.03	0.00	-0.03	-0.03	-0.04*								
9. <i>Population</i>	0.04*	-0.12*	-0.19*	0.32*	-0.07*	-0.14*	0.63*	-0.03							
10. <i>Time in the market</i>	0.36*	0.27*	0.11*	0.07*	-0.14*	0.09*	-0.04*	0.02	0.00						
11. <i>Foreign incumbency</i>	-0.09*	-0.31*	0.06*	-0.06*	-0.09*	0.04*	0.01	0.05*	-0.04*	-0.09*					
12. <i>Africa</i>	0.06*	-0.07*	-0.21*	-0.12*	-0.05*	-0.23*	-0.15*	-0.02	-0.02	0.08*	-0.10*				
13. <i>Asia</i>	0.10*	-0.05*	-0.22*	0.32*	-0.06*	-0.19*	0.12*	-0.01	0.15*	0.18*	-0.18*	-0.05*			
14. <i>Pacific</i>	0.00	0.04*	0.19*	-0.04*	-0.13*	0.06*	-0.07*	0.00	-0.09*	0.14*	-0.05*	-0.03	-0.06*		
15. <i>America</i>	-0.01	-0.14*	-0.30*	0.16*	0.07*	-0.35*	0.26*	0.03	0.48*	-0.12*	0.11*	-0.07*	-0.16*	-0.08*	

* $p < 0.05$

and autocorrelation consistent (HAC) estimates. To test our hypotheses, we estimated four models in a nested way. Model 1 only considers the influence of the control variables. Model 2 analyzes the influence of complementary assets (Hypothesis 1). Model 3 includes the institutional context while Model 4 is the full model with the interaction between complementary assets and the economic and political institutional variables (Hypotheses 2 and 3). The F -Tests show that the latter is the model that better fits our data.

Model 1 shows the effects of control variables on firm performance. Overall, time in the market and population have a positive and significant effect on performance, while the degree of uncertainty avoidance, the number of firms and the GDP per capita present a significant and negative effect. The existence of a merger in a particular market and being a foreign incumbent do not have any significant influence on performance in the full model. It is important to note that the effect of the control variables is quite stable across the four models.

Model 2 shows, as predicted, that the incumbent's stock of complementary assets positively influences performance. Their positive and significant effect is maintained in the full model, thus supporting Hypothesis 1.

Model 3 shows that neither the economic institutions in a market nor the political institutions have a significant impact on firm performance, suggesting that the level of development of *market-supporting institutions* and the level of *political instability* do not have a direct impact on firm performance.

This nonsignificant effect is maintained in the full model (Model 4). However, this model shows that economic and political institutions have an indirect effect on firm performance through their interaction with complementary assets. The interaction between complementary assets and the economic institutional context has a negative and significant impact. This leads us to conclude that the weaker the development of *market-supporting institutions*, the higher the impact of the ownership of complementary assets on firm performance. This result provides support for our Hypothesis 2. Similarly, Model 4 shows that, while *political instability* does

are interesting from a theoretical point of view, the random effects model may be an appropriate alternative (Certo and Semadini, 2006; Yu, Subramaniam, and Canella, 2013).

Table 3. Complementary assets, institutions and performance (profitability)

Dependent variable		Model 1	Model 2	Model 3	Model 4
<i>Profitability</i>					
<i>Complementary assets</i>	H1 (+)		0.267*** (0.097)	0.267*** (0.099)	2.639*** (0.97)
<i>Market-supporting institutions</i>				0.0003 (0.002)	0.003 (0.003)
<i>Complementary assets × market-supporting inst.</i>	H2 (-)				-0.025** (0.010)
<i>Political instability</i>				0.009 (0.088)	0.065 (0.100)
<i>Complementary assets × political instability</i>	H3a (+)				-0.818** (0.390)
<i>Uncertainty avoidance</i>	H3b (-)	-0.001* (0.001)	-0.001* (0.001)	-0.001 (0.001)	-0.001* (0.001)
<i>GDP pc</i>		-0.002*** (0.001)	-0.003*** (0.001)	-0.003*** (0.001)	-0.004*** (0.001)
<i>Firms</i>		-0.043** (0.019)	-0.042** (0.018)	-0.042** (0.018)	-0.042** (0.018)
<i>Merger</i>		-0.008 (0.018)	-0.006 (0.019)	-0.006 (0.018)	-0.001 (0.018)
<i>Population</i>		0.001** (0.000)	0.001** (0.000)	0.001** (0.000)	0.001** (0.000)
<i>Time in the market</i>		0.003*** (0.000)	0.002*** (0.000)	0.002*** (0.000)	0.002*** (0.000)
<i>Foreign incumbent</i>		0.062 (0.069)	0.077 (0.072)	0.077 (0.074)	0.070 (0.072)
<i>Region dummies</i>	Yes	Yes	Yes	Yes	Yes
<i>Year dummies</i>	Yes***	Yes***	Yes***	Yes***	Yes***
Constant		0.319*** (0.081)	0.313*** (0.084)	0.286 (0.227)	0.132 (0.268)
<i>N</i>		3,509	3,509	3,509	3,509
<i>F-test vs. 1</i>			7.58***	10.69**	12.44**
<i>F-test vs. 2</i>				0.02	8.42*
<i>F-test vs. 3</i>					6.88**

* $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$

Standard errors in parentheses.

not have a direct significant impact on firm performance, it reduces the effect of complementary assets on performance in that its interaction term is negative. This result leads us to reject Hypothesis 3a, and to support Hypothesis 3b: the higher the political instability in the market, the lower the influence of the stock of complementary assets on performance.

Robustness tests and evaluation of results

On the analysis of market share advantages

We provide an additional robustness check of our results by analyzing the effect of complementary assets on firms' performance across different institutional contexts, but using an alternative measure

of performance (i.e., market share).⁹ According to Christensen's (1997) model of technological disruption, incumbents failed because they persisted in their high-margin customers and ignored the larger market based on low-margin customers. This reasoning means that, although profitability measures of performance might reveal incumbents' advantages, they would really be losing market power because of a decreasing market share. To avoid this potential bias, we have provided a complementary view to a pure profitability measure by using market share, defined as the number of users subscribed to the services of the firm in each market

⁹ We are grateful to an anonymous reviewer for suggesting the inclusion of the analysis of market shares as an alternative measure of firm performance.

divided by the total number of mobile users in that country. We have reestimated our model following the sequence presented in Table 3 and the new results are shown in Table 4. As for the profitability estimation, Model 1 only considers the influence of the control variables; Model 2 incorporates the influence of complementary assets (Hypothesis 1); Model 3 includes the economic and political institutional context; and Model 4 is the full model with the interaction terms (Hypotheses 2 and 3). The *F*-test reveals that the latter is the model that best fits our data.

As can be observed in Table 4, the effect of our main independent variables is substantially the same and our hypotheses are supported in similar terms as in the profitability estimation. Complementary assets have a positive influence on market shares but this effect decreases when market-supporting institutions are stronger and political instability is higher. Thus, Hypotheses 1, 2 and 3b are also supported when the market share dimension of firm performance is considered. Compared with the profitability model, three control variables either lose or gain significance. For example, the number of firms in the market negatively affects profitability but is not significant for market share. However, both merger and foreign incumbency become positive. As for merger, it does not guarantee per se obtaining a higher profitability, but it immediately increases market share. Foreign incumbency is positively related to market share but not to profitability. One possible explanation for this result is that foreign entrants, as newcomers into a market, tend to focus on low-margin customers in contrast to incumbents, who focus on high-margin customers (Christensen, 1997; Hill and Rothaermel, 2003; Rothaermel and Hill, 2005) and, although this has a positive effect in terms of market shares, this result does not occur with profitability.

On the analysis of the impact of formal institutions

To provide a more nuanced picture of the moderating effect of the strength of market-supporting institutions and political instability on the relationship between complementary resources and performance, we conducted additional analyses.

With respect to market-supporting institutions, we divided the sample into two groups. Group A includes the observations in which the level of market-supporting institutions is equal to or greater

than its mean (strong market-supporting institutions). Group B refers to the observations with a level of market-supporting institutions lower than its mean (weak market-supporting institutions).

As can be inferred from Table 5 (Models A.1–B.2), the impact of the control variables in the new models hardly changes. The number of firms and GDP per capita negatively affect firm performance, whereas the time that the firm has been operating in the market has a positive effect. The only differences can be found in the uncertainty avoidance variable, which completely loses significance when splitting the sample, and population, which remains positively significant only under contexts of weak market-supporting institutions.

As predicted, the impact of complementary assets on performance is higher when the firm operates in a context characterized by a lower development of formal institutions. Thus, complementary assets enable incumbents not only to obtain higher profitability than newcomers (β_A and $\beta_B > 0$), but also to overcome institutional obstacles in contexts characterized by a lower institutional development ($\beta_A < \beta_B$). These ideas are graphically depicted in Figure 3.

Using the random-effects coefficient estimates from the fully specified model in Table 3 (Model 4) and considering the average complementary assets by incumbent (0.11), we evaluate, *ceteris paribus*, the predicted change in performance associated with moving from a situation in which the level of market-supporting institutions is one standard deviation above its mean to another in which it is one standard deviation below it. The above-mentioned change would reduce the performance of incumbents by 3.3 percentage points when the level of market-supporting institutions is higher and vice versa. We should take into account that this analysis is also sensitive to the level of complementary assets. For example, for a firm with a high level of complementary assets (0.50), a decrease of one standard deviation in the level of market-supporting institutions would increase the performance of incumbents by 15 percentage points. This analysis corroborates that the strength of market-supporting institutions is (economically) important to understand the relationship between complementary assets and performance.

Similarly, for political institutions, we have also split the sample into two groups. Group C

Table 4. Complementary assets, institutions and performance (market share)

Dependent variable		Model 1	Model 2	Model 3	Model 4
<i>Market share</i>					
<i>Complementary assets</i>	H1 (+)		0.500*** (0.070)	0.499*** (0.070)	1.918*** (0.419)
<i>Market-supporting institutions</i>				−0.000 (0.001)	0.002* (0.001)
<i>Complementary assets × market-supporting institutions</i>					−0.016*** (0.005)
<i>Political instability</i>	H2 (−)			−0.006 (0.029)	0.028 (0.022)
<i>Complementary assets × market-supporting institutions</i>	H3a (+)				−0.471** (0.203)
<i>Uncertainty avoidance</i>	H3b (−)	−0.000 (0.001)	−0.000 (0.001)	−0.000 (0.001)	−0.000 (0.001)
<i>GDP pc</i>		−0.002 (0.002)	−0.003 (0.002)	−0.002 (0.002)	−0.002 (0.002)
<i>Firms</i>		−0.010 (0.007)	−0.010 (0.007)	−0.010 (0.007)	−0.011 (0.007)
<i>Merger</i>		0.033*** (0.009)	0.033*** (0.009)	0.033*** (0.009)	0.036*** (0.009)
<i>Population</i>		−0.000 (0.0002)	−0.000 (0.0002)	−0.000 (0.0002)	−0.000 (0.0002)
<i>Time in the market</i>		0.0005*** (0.000)	0.0003*** (0.000)	0.0003*** (0.000)	0.0003** (0.000)
<i>Foreign incumbent</i>		0.026** (0.012)	0.027** (0.012)	0.027** (0.012)	0.022** (0.011)
<i>Year dummies</i>	Yes***	Yes***	Yes***	Yes**	Yes
<i>Region dummies</i>	Yes	Yes	Yes	Yes	Yes
Constant		0.454*** (0.119)	0.402*** (0.0986)	0.431*** (0.133)	0.242** (0.112)
<i>N</i>		3,502	3,502	3,502	3,502
<i>F-test vs. 1</i>			50.44***	51.83***	70.88**
<i>F-test vs. 2</i>				0.24	15.32**
<i>F-test vs. 3</i>					14.77***

* $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$

Standard errors in parentheses.

includes those countries in which the level of political instability is equal to or greater than its mean (higher political instability), whereas Group D includes observations whose level of political instability is below its mean (lower political instability).

Table 5 (Models C.1–D.2) shows a change in the significance of most of the control variables. Only time in the market remains positive in both subsamples, whereas population, GDP per capita and uncertainty avoidance maintain their influence only in the group with higher political instability. Complementary assets are again statistically significant in both subgroups (β_C and $\beta_D > 0$) but their effect on firm performance is higher in contexts of lower political instability ($\beta_C < \beta_D$), and is graphically shown in Figure 4.

If we consider that complementary assets take the value of their mean (0.11), a change from a situation in which political instability varies from its mean to one standard deviation above, performance decreases by 1.3 percentage points. As previously, this effect increases with the level of complementary assets. When complementary assets are high (0.5), the decrease of political instability by one standard deviation from its mean results in a change in incumbent performance of 5.7 percentage points.

On the analysis of the sustainability of complementary assets

This study is not aimed at analyzing the precise impact of a technological disruption on the survival of incumbents, but rather at how incumbents

Table 5. Complementary assets and performance by market-supporting institutions, political instability and period

Dependent variable	By market-supporting institutions						By political instability				By period			
	Strong			Weak			High				1998–2004			
	(A.1)	(A.2)	(B.1)	(B.2)	(C.1)	(C.2)	(D.1)	(D.2)	(E.1)	(E.2)	(F.1)	(F.2)	(F.1)	(F.2)
<i>Profitability</i>														
<i>Complementary assets</i>		0.257* (0.140)		0.284** (0.129)		0.208** (0.095)		0.318* (0.178)		0.416* (0.224)		0.107* (0.056)		
<i>Uncertainty avoidance</i>	–0.001 (0.001)	–0.001 (0.001)	–0.001 (0.002)	–0.001 (0.002)	–0.001 (0.001)	–0.001* (0.001)	–0.000 (0.002)	–0.001 (0.002)	–0.000 (0.002)	–0.000 (0.002)	–0.001* (0.001)	–0.001* (0.001)	–0.001* (0.001)	
<i>GDP pc</i>	–0.003 (0.002)	–0.003* (0.002)	–0.003 (0.002)	–0.004* (0.002)	–0.002 (0.002)	–0.003* (0.002)	–0.001 (0.002)	–0.002 (0.002)	–0.005 (0.003)	–0.006* (0.004)	–0.002* (0.001)	–0.002* (0.001)	–0.002* (0.001)	
<i>Firms</i>	–0.058** (0.028)	–0.057** (0.027)	–0.036* (0.019)	–0.035* (0.019)	–0.047 (0.029)	–0.047 (0.029)	–0.033 (0.025)	–0.034 (0.025)	–0.054 (0.040)	–0.052 (0.040)	–0.015* (0.008)	–0.015* (0.008)	–0.015* (0.008)	
<i>Merger</i>	–0.003 (0.033)	–0.004 (0.034)	–0.023 (0.019)	–0.022 (0.019)	0.007 (0.013)	0.008 (0.013)	–0.026 (0.043)	–0.029 (0.044)	–0.074 (0.061)	–0.086 (0.063)	–0.014 (0.010)	–0.014 (0.010)	–0.014 (0.010)	
<i>Population</i>	0.000 (0.000)	0.000 (0.000)	0.001** (0.001)	0.001** (0.001)	0.001** (0.000)	0.001** (0.000)	0.001 (0.001)	0.001 (0.001)	0.001 (0.001)	0.001 (0.001)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	
<i>Time in the market</i>	0.002*** (0.001)	0.002*** (0.000)	0.004*** (0.001)	0.004*** (0.001)	0.002*** (0.000)	0.002*** (0.000)	0.003*** (0.001)	0.002*** (0.001)	0.006*** (0.001)	0.005*** (0.001)	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)	
<i>Foreign incumbency</i>	0.034 (0.092)	0.059 (0.104)	0.001 (0.022)	0.005 (0.022)	0.029 (0.040)	0.032 (0.040)	0.071 (0.117)	0.100 (0.131)	0.138 (0.161)	0.180 (0.179)	–0.038* (0.022)	–0.036 (0.023)	–0.036 (0.023)	
<i>Region dummies</i>	Yes**	Yes**	Yes	Yes	Yes***	Yes***	Yes***	Yes***	Yes	Yes	Yes	Yes	Yes	
<i>Year dummies</i>	Yes***	Yes***	Yes***	Yes***	Yes***	Yes***	Yes***	Yes***	Yes***	Yes***	Yes***	Yes***	Yes***	
<i>Constant</i>	–0.006 (0.304)	0.005 (0.300)	0.234 (0.156)	0.223 (0.158)	0.404*** (0.118)	0.410*** (0.119)	0.136 (0.213)	0.147 (0.225)	0.161 (0.253)	0.183 (0.257)	0.342*** (0.083)	0.346*** (0.083)	0.346*** (0.083)	
<i>N</i>	1,870	1,870	1,639	1,639	1,641	1,641	1,868	1,868	1,233	1,233	2,276	2,276	2,276	
<i>F-test vs. 1</i>		3.36*		4.87**		4.73**		3.21*		3.44*		3.68*		

* $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$
Standard errors in parentheses.

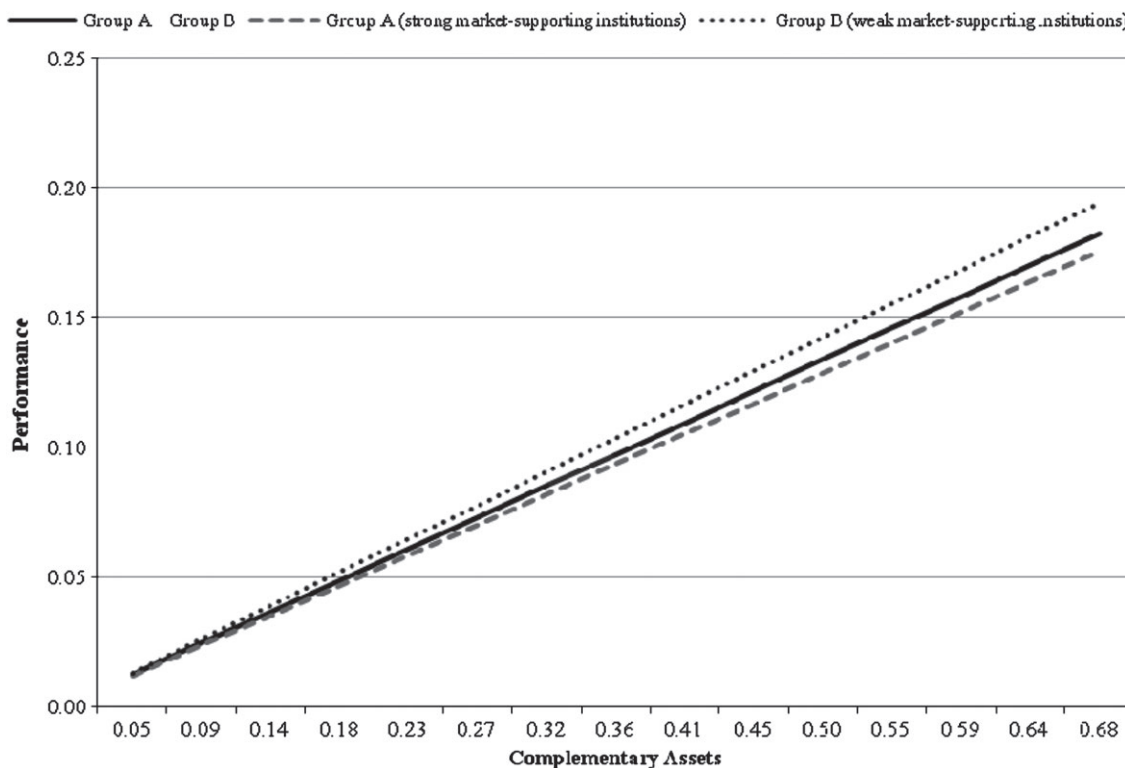


Figure 3. Complementary assets and performance by market-supporting institutions

perform *after* a radical innovation. However, it is reasonable to think that the value of complementary resources will be more important the closer in time the technological innovation occurs. Figures 1 and 2 show that the substitution effect between fixed and mobile communications started at the end of the 20th century and our research period extends until the end of 2009. To gain more knowledge of the role of complementary assets and the sustainability of their value, we have divided our research window (1998–2009) into two periods, under the general premise that complementary resources should be more helpful in the first stages of competition after the technological change. The first one (1998–2004) is closer to the technological disruption, while the second (2005–2009) is farther from it.

Table 5 (Models E.1–F.2) shows the estimations for the two subsamples. As expected, the importance of complementary assets for incumbents is higher the closer the technological disruption occurs. Complementary assets enable incumbents to perform four times better in the first than in the second period.

Figure 5 graphically illustrates the evolution of the relationship between complementary assets and performance over time. We observe that, for the first period (1998–2004) and high levels of complementary assets, the latter clearly enable incumbents to outperform newcomers while, for the second period (2005–2009), the contribution of complementary assets to incumbents' performance is much lower.

DISCUSSION

Incumbents have traditionally been accused of myopic behavior when confronting radical technological changes. However, recent literature has offered several arguments that could explain how incumbents may survive in turbulent environments. Complementary resources have been one of the most prominent of these arguments. The current paper brings the institution-based view of strategy into the analysis of this phenomenon by maintaining that the value of these resources is contingent on the institutional context in which the firm competes.

The institution-based view is being increasingly used in the management literature as a complement

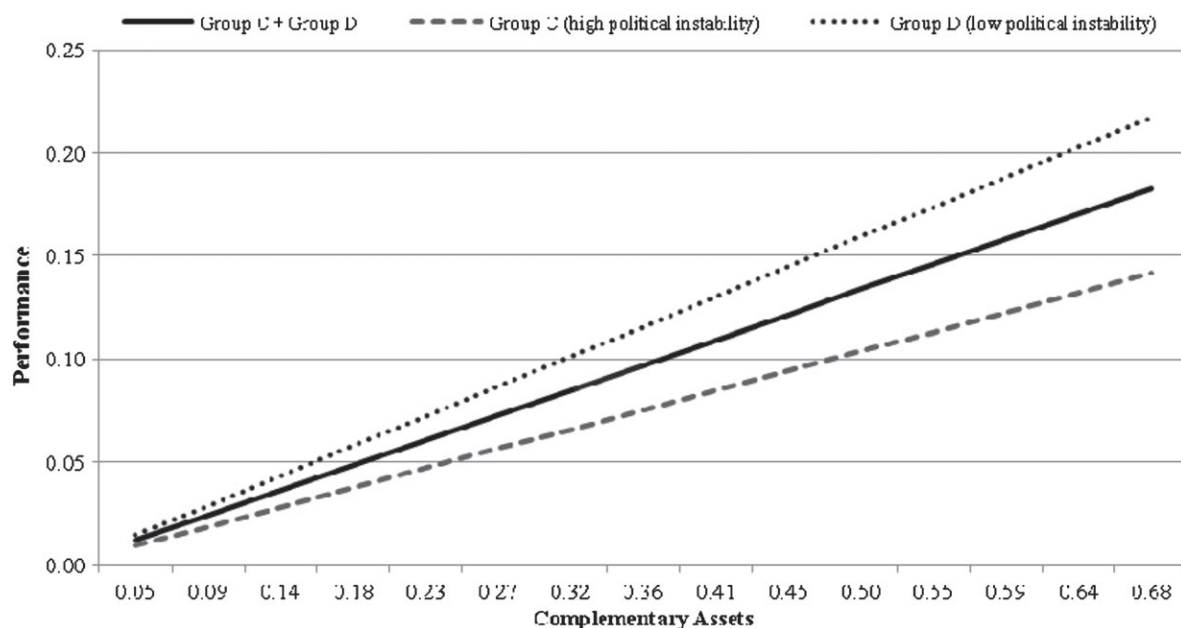


Figure 4. Complementary assets and performance by political instability

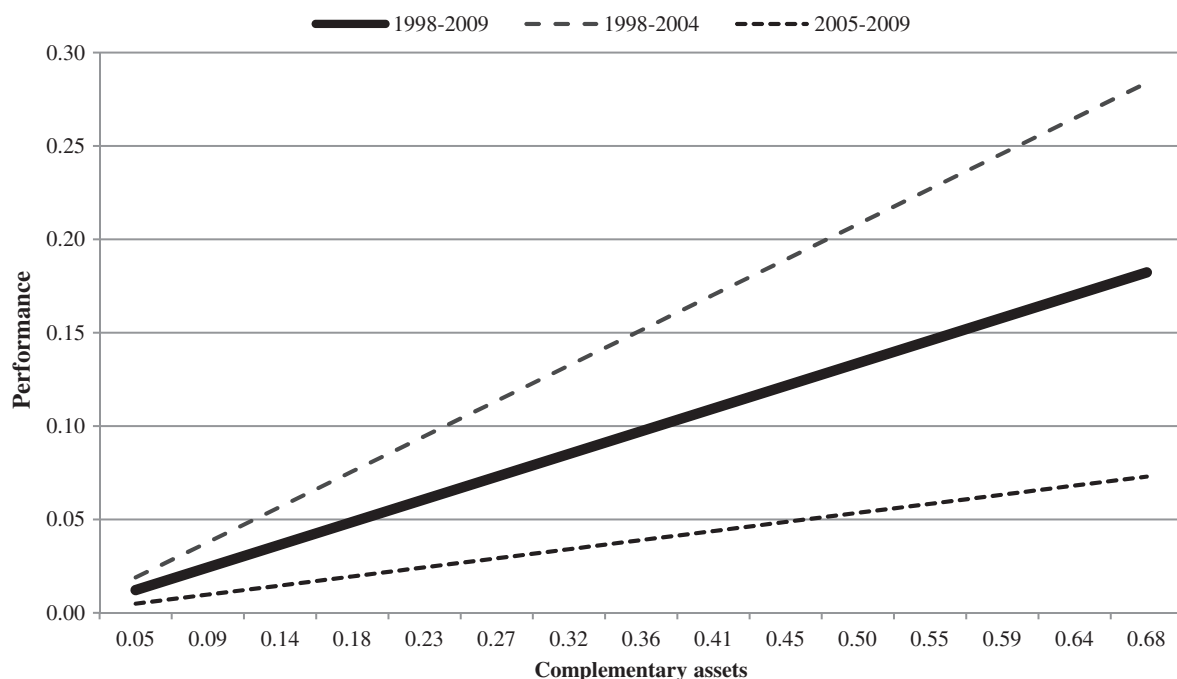


Figure 5. Complementary assets and performance by period

to the well-known industry and resource-based approaches. Nevertheless, this is, to our knowledge, the first attempt that joins research on technological management and this new institutional perspective. By incorporating this approach, we aim to respond to the calls of Peng *et al.* (2009), claiming that

the institution-based view must be considered as the third leading perspective in strategic management, and that of Bamberger (2008) on using context theories to narrow the micro–macro gap in management research. In fact, our findings show that context (institutions) matters and should be

more formally included in existing management theories.

Our empirical findings corroborate the importance of complementary assets as mediators in the relationship incumbent-performance after a radical technological disruption. This result is highly consistent with previous evidence (Hill and Rothaermel, 2003; Mitchell, 1991; Tripsas, 1997). More importantly, the study also provides some insights about the conditions that enable incumbents to survive in changing technological environments. Our results show that the value of complementary resources varies across both economic and political institutions. With regard to the economic institutions, complementary resources are more important to support incumbents' survival in markets with weaker *market-supporting* institutions or, in other words, environments characterized by a lack of or inefficient market intermediaries and formal systems. Under these circumstances, complementary assets not only enhance incumbents' performance, but also serve to counteract institutional constraints to economic activities, such as contractual risks, by increasing information, reducing transaction costs, and legitimating the firm's operations in the market. However, with strong *market-supporting* institutions, external formal mechanisms replace informal ties and protect the property rights of the parties, with the result that complementary assets become less important. As for political institutions, the effect of political instability on the achievement of incumbent advantages is controversial, given that there are arguments for both positive and negative effects. In our study, we have shown that political instability reduces the value of complementary assets as a source of incumbents' competitive advantage. The underpinning logic is based on the volatility of political commitments. Although incumbents would be favored by previous links to influence governments to increase entry barriers, political instability makes these commitments less credible. Moreover, under political instability, the rules of the game are more likely to change, making obsolete the incumbents' understanding of the regulatory and bureaucratic rules that help to commercialize an innovation. Previous relationships with the government and knowledge of the regulatory framework lose importance for the commercialization of the new technology.

Our research also has some implications for the management literature. Most previous research has focused on incumbent disadvantages. Nevertheless,

we have offered empirical evidence that incumbent advantages, based on the ownership of complementary assets, may exist. The main premise is that these assets, built by incumbents with their stakeholders in the former technological setting, are difficult for newcomers to replicate. For these resources to have value, the theoretical boundary conditions depend on the institutional context. This result would suggest a joint use of resource and institution-based views in order to provide a more nuanced and complete picture of the problem. This suggestion could be extended to the analysis of most of the decisions taken by multinationals, where institutions do play a role. In fact, several research studies have started to adopt an integrated perspective (Ahn and York, 2011; Brouthers, Brouthers, and Werner, 2008; Gaur, Kumar, and Singh, 2013; Meyer *et al.*, 2009; Stucchi, 2012), which seems to be a promising avenue for further research.

Several managerial implications could also be derived from our study. First, new entrants can better counteract incumbent advantages in markets with stronger market-supporting institutions. The existence of a higher protection of property rights, efficient economic intermediaries, and a *friendly* regulation toward new entrants will facilitate entry, which will lead to a faster commercialization of the innovation even when newcomers do not have complementary assets from the previous technological stage. This could be the case of Hutchison, the Hong Kong based mobile operator, which has rapidly entered into markets with strong market-supporting institutions such as Austria, Sweden, Denmark, and the United Kingdom. Managers should also be aware of their firms' potential to influence political decisions. In markets characterized by a high political instability, newcomers may find it easier to take advantage of their political capabilities, if any. For instance, García-Canal and Guillén (2008) showed that, in regulated industries such as telecom, international groups tend to enter into markets with higher political instability in order to be able to negotiate favorable entry conditions with local governments.

In spite of the contribution of our research in integrating technological management and institution-based view literatures, several issues will deserve additional attention. First, we have focused on the role of complementary resources that are based on the relationships previously built by the incumbent. However, further empirical and theoretical study is needed to determine how these

complementary assets are integrated within technological and investment capabilities, as additional sources of incumbent advantages.

Second, the link between resources and formal institutions should be more strongly elaborated. We have given attention to the development of *formal* institutions by differencing between economic and political institutions. However, other empirical studies are based on different classifications of institutions such as formal and informal (Holmes *et al.*, 2013), economic, political, and social (Chan *et al.*, 2008) and political, administrative, and cultural institutions, among others (Berry, Guillén, and Zhou, 2010). Future research should look for a more integrated view of the role of institutions in the management literature.

Finally, we have adopted a static viewpoint of the institutional context as we do not consider how variations over time in the level of market-supporting institutions and political instability can affect the value of complementary assets. Institutional transitions in some emerging economies have received increasing research attention (e.g. Lee, Peng, and Lee, 2008; Peng, 2003), which highlights how, when economic market-supporting institutions become stronger, network-based strategies lose importance whereas market-based strategies are crucial to compete. This result suggests that, for our study, institutional transitions are a source of erosion of incumbents' advantages because the importance of complementary assets for maintaining informal relationships with market agents decreases when network-based strategies are less crucial. Thus, adopting a dynamic perspective of the institution-based view in analyzing technological management appears to be an interesting research line for the future.

CONCLUSIONS

This research has brought the institution-based view of strategy into the technology management literature to examine how the positive effect of the ownership of complementary resources on performance after a radical technological change is contingent on the institutional landscape in which the firm operates. In particular, we submit that incumbents' advantages over newcomers that have their origin in these assets are moderated by formal institutions. We distinguish between economic and political institutions and we show that the positive

effect of complementary assets on firm performance is higher in contexts of weaker market-supporting institutions and higher political stability. Under these circumstances, incumbents can take greater advantage of their previous relationships with the economic and political environment in which their complementary assets are embedded.

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SUPPORTING INFORMATION

Additional supporting information may be found in the online version of this article:

Appendix S1. Average market-supporting institutions and political instability (by country, 1998–2009)¹.