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Introduction

This dissertation that involves three quantitative essays on competition in the global mobile phone industry contributes to the field of competitive dynamics by examining strategic decisions and performance outcomes of firms across multiple countries.

Majority of mobile phone vendors are MNEs who compete with same competitors in multiple countries with widely different institutional environments. Therefore, for these firms, the influence of institutional environments on action observability presents a challenge that cannot be neglected when they seek to build an effective multimarket contact (MMC) strategy. Accordingly, in the first study, we made an attempt to shed light on how institutional quality of an MNE's host country affect the observability of actions of the MNE's rivals in that country, that in turn influences the ability of the MNE to conduct an MMC strategy. Through the lens of signaling theory, we argue that observing signals and hence accurately interpreting them to reinforce the level of MMC with host country rivals is easier in countries with high institutional quality, and correspondingly more difficult in countries with low institutional quality. Moreover, since the research on competitive dynamics has long argued that industry concentration can change the intensity of rivalry among competitors, in this study we also examined how industry concentration alters the institutional quality-MMC relationship.

Furthermore, mobile phone industry is a prominent example of an innovative segment where firms frequently infringe or contest each other's patent rights. Accordingly, the second essay contributes to the literature on patent enforcement strategies and antecedents of market entry decisions by highlighting the crucial role that escalating patent wars in a country play in deterring potential entrants. Our findings also reveal that firm's market entry decision is positively influenced by the size of a firm's patent stock and a technological discontinuity in

the firm's industry, and that their positive influence is hindered as patent battles in a country escalate.

Beside its influence on firm's market entry decisions, patent wars in a country limit the competition in a given geographic market, since firms strategically use patents as offensive weapons to pose litigation threat against rivals which restricts the rivals' ability to innovate. Therefore, the third essay makes the first attempt to empirically show that as patent wars in a firm's host country escalate, high litigation threat on the firm that reduces the firm's incentive to innovate, adversely affects its performance in that country. Our findings also suggest that the strength of Intellectual Property Rights (IPR) in a firm's host country attenuates the negative effect of patent wars on firm's performance in that country.

These three essays were tested by analyzing data of 85 mobile phone vendors that operate in 46 countries from 2003 to 2015. Mobile phone industry is particularly suitable setting to test the proposed hypotheses, as the relatively long-time frame in this study is characterized by rapid changes in technologies, demand, and intensified competition among industry members.

Do You See What I See?

Institutional Quality, Action Observability and Multimarket Contact in the Global Mobile Phone Industry

Abstract

We argue that multinational enterprises (MNEs) that use multimarket contact (MMC) to coordinate strategy with rivals in host countries must contend with the institutional quality of host countries. Drawing on signaling theory and institution-based view, we propose that institutional quality can influence the observability of actions by an MNE's rivals in a host country, thereby affecting the MNE's ability to establish mutual forbearance with host country rivals. We also examine the impact of industry concentration on rivals' action observability and MNEs' MMC. We test our hypotheses using a sample of 85 mobile phone vendors in 46 countries.

Keywords: multimarket contact; institutional quality; action observability; industry concentration; signaling theory; institution-based view.

1. Introduction

Multinational enterprises (MNEs) that operate in multiple national markets can expect to confront the same rivals in different countries. Researchers have extensively examined the competitive dynamics that emerge when the same firms confront each other in multiple product markets. This research singles out multimarket contact (MMC) as allowing firms to establish mutual forbearance with competitors across multiple product markets, which in turn allows rivals to coordinate their strategies (Bernheim and Whinston, 1990; Chuang and Thomson, 2017; Greve, 2006; Karnani and Wernerfelt, 1985). Underpinning this research is the assumption that a firm's willingness to establish mutual forbearance by means of MMC depends on the *observability* of strategic actions: When action observability is high firms are able to accurately interpret the moves of their competitors, and also more confidently expect rivals to correctly interpret the strategic intentions behind their own moves (Gimeno and Woo, 1996, 1999; Thomas and Willig, 2006). In contrast, when action observability is low, it is difficult for firms to accurately interpret actions by competitors, nor can they be confident that their actions are correctly understood by rivals. As a result, although MMC may emerge a result of firms competing with the same firms in multiple markets, developing a strategy that uses MMC to coordinate actions is more difficult to attain in countries with low action observability.

The variability of action observability runs counter to the tendency of most MMC research to assume fixed, usually high, action observability. In this paper we argue, along with many researchers on international business, that the variability of action observability can be traced to the *quality* of the institutional environment in which MNEs operate, specifically the type of market regulations, transactional transparency, enforceable contracts, and intellectual property regimes (Khanna and Palepu, 2010; Khanna, Palepu, and Sinha, 2005; Montiel, Husted, and Christmann, 2012). What we also argue is that while the influence

of institutional environments on action observability is not controversial, a review of extant literature suggests that with the notable exceptions of studies by Ma (1998), Yu and Cannella (2007), and Yu, Subramaniam, and Cannella (2009), the implications of this issue are seldom examined by MMC researchers.

The scarcity of MMC research on the implications of action observability can be attributed to the fact that this research mostly focuses on single countries – usually developed economies where institutional environments facilitate high action observability. For scholars of international business, however, it is striking how many of the firms in single-country MMC studies are also MNEs that compete in multiple countries with widely different institutional environments. For these firms, the impact of institutional environments on action observability presents a challenge that cannot be avoided when they seek to build on their MMC to coordinate strategy with rivals. For researchers who wish to understand how firms respond to variability of institutional quality across countries in which MNEs operate, the question that arises, and one that we wish to examine in this paper is: How does the level of institutional quality in an MNE's host country influence the level of MMC with other rivals in the same country?

We address this question through the lens of signaling theory (Spence, 1973). Signaling theory focuses attention on the observability (or visibility) of signals as a key condition for selecting actions that deter rivalry, or facilitate cooperation (Connelly, Certo, Ireland, and Reutzel, 2011; Heil and Robertson, 1991). Drawing on signaling theory (Connelly *et al.*, 2011; Pollock and Gulati, 2007) and insights from the institution-based view of strategy (Khanna and Palepu, 2010; Montiel *et al.*, 2012), we argue that observing signals, and hence accurately interpreting them is essential to sustain MMC-based strategies. More specifically, we expect that as institutional quality increases in a given host country, this will result in greater action observability, which in turn will allow the MNE to build up and

reinforce a strategy based on MMC with rivals that have operations in the host country as well as in other foreign locations.

Our study contributes to extant literature in several ways. First, our research expands the current research on MMC by MNEs to include the institution-based view of strategy. The institution-based view of strategy has examined how the institutional environment affects firm strategies such as entry modes (Brouthers, 2002; Meyer, Estrin, Bhaumik, and Peng, 2009) and location choices (Khanna *et al.*, 2005; Mahoney and Chi, 2001; Paik and Zhu, 2016; Peng, Sun, Pinkham, and Chen, 2009; Peng, Wang, and Jiang, 2008). However, although research on MNEs suggests that competitive advantage is influenced by host countries' institutional environment (Guler and Guillén, 2010; Henisz and Macher, 2004), authors have argued that greater attention should be paid to competitive dynamics between MNEs and rivals under different institutional settings (Mutlu, Zhan, Peng, and Lin, 2015). In this study, we explore this area. Building on arguments proposed by signaling theorists in management research (e.g., Connelly *et al.*, 2011; Heil and Robertson, 1991; Pollock and Gulati, 2007), we argue that a firm's ability to undertake an international MMC-based strategy depends on action observability, which in turn is influenced by the institutional quality of the host countries in which it operates.

Second, our study looks at how industry concentration across different countries changes the relationship between institutional quality and action observability. Evidence from international business research suggests that industry concentration influences the ability of firms to develop a MMC-based strategy that is sustainable (Baum and Korn, 1996; Gimeno, 1999). We also know from competitive dynamics research that industry concentration can alter the intensity of rivalry among industry members (Basdeo, Smith, Grimm, Rindova, and Derfus, 2006; Baum and Korn, 1996; Chuang and Thomson, 2017; Derfus, Maggitti, Grimm, and Smith, 2008; Yu and Cannella, 2013). Combining these two insights we argue that

industry concentration should also influence the way institutional quality impacts action observability and MNEs' MMC-based strategy. To our knowledge, this is the first study to date that examines the joint effect of industry- and institution-based variables on an MNE's action observability and MMC-based strategy.

The rest of our paper is structured as follows. We first provide an overview of the theory, deriving three hypotheses that focus on the relationship between institutional quality, action observability, and MMC. We then turn our attention to the role of industry concentration in changing the relationship between institutional quality, action observability, and MMC – deriving four more hypotheses on this relationship. Next, we describe our research setting: the global mobile phone handset industry; and our sample: 85 mobile phone vendors competing in 46 countries from 2003 to 2015. We follow this with a discussion of the operationalization of our main constructs, the analysis of the data, and the presentation of results. We conclude with a discussion of the implications for theory and practice of the study, its limitations and suggestions for further research.

2. Theory Overview and Hypotheses

2.1 Mutual Forbearance, Multimarket Competition and Action Observability

Multimarket contact (MMC) allows firms to mitigate competition with rivals, thereby reducing the threat of price wars, and de-escalating marketing campaigns that are costly to both sides without visible gains (Chuang and Thomson, 2017; Gimeno, 1999; Porter, 1985; Yu *et al.*, 2009). MMC provides the foundation for a multimarket strategy that seeks inter-firm coordination across markets, giving a firm the capacity to credibly respond to its rivals' moves not only in the market in which these moves are initiated, but also in other markets where the focal firm and rivals interact (Baum and Korn, 1996). However, while MMC is a necessary condition for mitigating rivalry across multiple markets (in as much as firms that operate in different countries compete with other firms in these markets), it is not sufficient on

its own. For firms to be able to create a strategy that is based on MMC, i.e. a strategy aimed at managing competitive interaction in markets in which they encounter competitors, it is also important for firms to *recognize* their mutual interdependence (Edwards, 1955). Once firms recognize their mutual interdependence, they can develop tacit cooperation with rivals that rests on mutual forbearance – the avoidance of actions that are potentially damaging to both sides (Chuang and Thomson, 2017; Gimeno and Woo, 1999).

Most current literature on multimarket strategy deals with MMC across markets within a single country (e.g., Baum and Korn, 1996; Gimeno and Woo, 1996; Gómez, Orcos, and Palomas, 2017; Greve and Baum, 2001). However, the same logic in principle applies to international rivalry that takes place across disparate national markets. Firms that find themselves competing against the same rivals simultaneously in different countries are able to recognize their mutual interdependence across borders. This gives rise to MMC; but to use MMC to establish mutual forbearance that lowers the risk of costly retaliation, firms also need adequate *observability* of actions in these countries (Greve, 2008; Thomas and Willig, 2006).

Signaling theorists discuss the observability of firms' actions in general terms under the rubric of "signal observability". They define signal observability as the extent to which a signal sent by the signaler can be clearly communicated and easily perceivable by the signal receiver (Connelly *et al.*, 2011; Daley and Green, 2014). A "signal" typically refers to an "action" undertaken by an actor that is relevant to the strategy of another actor (Connelly *et al.*, 2011). Extant research finds that the observability of signals generated by actions is a key prerequisite for creating effective strategic interaction among firms (Connelly *et al.*, 2011; Heil and Robertson, 1991). Observability allows firms to communicate their intentions via strategic actions, and likewise interpret accurately actions taken by their rivals. It underpins mutual forbearance, and therefore reinforces multimarket strategies aimed at mitigating rivalry. If firms know that their moves are easily observed, they are more likely to avoid

actions that can threaten their rivals' position because they are aware that these actions may trigger costly retaliatory countermoves (Baum and Korn, 1999; Yu and Cannella, 2013).

2.2 Institutional Quality and Action Observability

Although studies in the MMC literature have often assumed full observability of actions, there is acknowledgement that "in many markets, however, prices are difficult to observe or are combined with non-price competition through service and product features that are difficult to evaluate" (Greve, 2008: 230). Full observability of actions therefore cannot be taken for granted, and may not exist even under the best circumstances (Pollock and Gulati, 2007). Instead, as we argue in this paper, a more realistic assumption is that action observability of firms' actions varies across countries, depending on the institutional quality of the country in which firms operate. The influence of institutional quality on observability is not easily apparent when companies operate in a country with strong legal and regulatory institutions. But it is difficult to ignore when firms compete in a country with weak legal and regulatory institutions that reduce observability of market operations (Khanna and Palepu, 1997, 2010). Lower observability is especially difficult to ignore in emerging economies, where, as Arnold and Quelch (1998: 9) note "there is little or no market data, nonexistent or poorly developed distribution systems, relatively few communication channels, and both a lack of regulatory discipline and a propensity to change business regulations frequently and unpredictably". By contrast, as suggested by Oehmichen, Schrapp, and Wolff (2017: 645), "high-quality institutional environment […] facilitates strategic deciders' access to required information" thanks to the greater observability of industry members' strategic action.

Low-quality institutions are known to reduce action observability in various ways (Khanna and Palepu, 2010; Montiel *et al.*, 2012; Oehmichen *et al.*, 2017). For example, industry associations that collect and provide information are usually absent in emerging economies; or, if present, restrict access to their financial and competitive data. Market

research agencies that perform the crucial role of providing information on competitors in advanced economies often confine their activities to basic market surveys. Government enforcement of rules that structure business transactions and guarantee commercial contracts are uneven or largely absent. Courts are slow to act, and when they do, are often inconsistent in their rulings.

If the context in which signaling occurs is noisier because of poor institutional quality, we would expect the usefulness of the signal communication between firms to diminish (Connelly *et al*., 2011; Zahra and Filatotchev, 2004), thus reducing an MNEs' ability to obtain clear information on the behavior of host country rivals. In contrast, in countries with high institutional quality the actions of the MNE's rival firms are more likely to be accurately interpreted because the strong institutions in the host country are less likely to distort the signals sent by host country rivals. This leads to the following hypothesis:

Hypothesis 1: There is a positive relationship between the level of institutional quality in an MNE's host country and the observability of actions of rivals in that country.

2.3 Action Observability and MMC-based Strategy

Signaling theory argues that action observability is central to mutual forbearance – the key mechanism that firms can employ by developing an MMC-based strategy with rivals (Greve, 2008; Thomas and Willig, 2006). However, as we noted earlier, institutional conditions can affect action observability, with some economies enjoying high action observability whereas others have low action observability. When high action observability prevails, firms are better able to build an effective MMC-based strategy that coordinates actions with rivals that operate in a host country, as well as markets elsewhere. The reason why an MNE is likely to increase the level of MMC with its host country rivals when action observability is high can be explained by looking at the retaliatory and cooperative dynamics of inter-firm interaction. First, high action observability in the host country allows the MNE to more easily warn host

country rivals about the possible consequences of retaliation in the markets they share elsewhere should they attack the MNE aggressively in the host country (Ferrier, Smith, and Grimm, 1999; Mutlu *et al.*, 2015). Second, high action observability allows the MNE to more easily alert its host country rivals of its willingness to collude in the host country, as well as making collusive MMC in other countries more credible and thus more sustainable. In contrast, low action observability environment leads MNE's to expect difficulties when it comes to understanding the intentions behind its rivals' actions, and also to anticipate problems when communicating its intentions to its rivals in the host country (Thomas and Willig, 2006). This weakens the MNE's incentive to use MMC with rivals in its host country as means of avoiding damaging competitive rivalry, and makes sending cooperative signals to rivals in the focal country less effective and hence less likely.

Hypothesis 2: There is a positive relationship between the observability of actions of rivals in an MNE's host country and the MNE's MMC with its host country rivals.

2.4 Mediating Role of Action Observability on the Institutional Quality-MMC Relationship

As we noted earlier, action observability can vary considerably across countries that have different levels of institutional quality. Extant literature accepts that this may affect the way an MNE uses MMC-based strategies to establish mutual forbearance with its host country rivals. But what is noteworthy about most current studies is that they test the mutual forbearance hypothesis among rivals in developed countries – where typically competitive markets are supported by strong institutions, and thus create environments where action observability is high. For instance, Shankar (1999) found that in the US pharmaceutical companies use multimarket contact to deter aggressive competition by their US rivals by relying on marketing spending. These rivals may be reluctant to invest aggressively in marketing their products in the US because the advantage they may gain in the US has to be

weighed against the threat of retaliatory attacks in other countries they share in common with their US rivals. Since strong institutions in the US permit clear interpretation of the magnitude and competitive intent behind strategic moves, the threat of retaliatory attack in other countries is credible. Drawing on signaling theory (Connelly *et al*., 2011; Heil and Robertson, 1991) and the institution-based view of strategy (Mutlu *et al*., 2015; Peng *et al*., 2008), we expect that in countries with high institutional quality MNEs' actions are more easily observed and understood by their rivals; which we contend, helps them to establish MMC-based strategies. In fact, as noted by various authors, countries with well-developed and high quality institutions enjoy less environmental uncertainty and fewer information asymmetries – conditions that allow firms to effectively use institutions to mitigate the risk of potential opportunistic behaviors by rivals (Guler and Guillén, 2010; Henisz and Macher, 2004).

In contrast, when we turn our attention to countries with low institutional quality, we find that MNEs must deal with extensive institutional voids that reduce signal observability, making it more difficult for the MNE to clearly observe signaling intent of its rivals, as well as making it harder for its rivals to accurately interpret the MNE's signals in the host country (Khanna *et al.*, 2005; Müller, 2001; Mutlu *et al.*, 2015). This creates an environment where the firm cannot easily evaluate the strategies of country rivals, leading to greater risk that the firm will initiate moves that invite costly retaliation from rivals.

The above contrast between countries with high versus low institutional quality, and the consequences this has for signal observability, is not reflected in the findings of most current MMC studies largely because of the unstated assumption of full observability in these studies (Yu and Cannella, 2013). This assumption may approximate reality when MMC studies deal with competition and mutual forbearance across different markets in a single country with highly developed institutions, but does not accurately represent the situation when MMC is formed across multiple countries – some of which have lower institutional

quality. As we pointed out earlier, since MNEs compete in host countries that are heterogeneous in terms of quality of institutions, the assumption of full observability must be modified if we are to examine how the variability of institutional environments in which MNEs operate affects their MMC-based strategy vis-à-vis host country rivals.

Thus far we have emphasized how the level of action observability influences the actions MNEs take in response to actions by competitors (Chen and Hambrick, 1995). However, signaling theorists have argued that reacting to a competitor's move is linked to the ability of the firm to communicate its intentions to its competitors (Green and Porter, 1984; Heil and Robertson, 1991; Heil and Langvardt, 1994). In other words, when considering how to react to a competitor, firms not only need to accurately interpret what the action means, they also have to anticipate how their reactions will be understood. In countries with low institutional quality often gives rise to interpretative ambiguity that distorts the competitive signals between firms and host country rivals. This means that for an MNE competing in a country with low institutional quality, signals sent by its host country rivals in the form of competitive motives (e.g. price competition) cannot be easily observed by the MNE; and likewise, for the host country rivals it will not be easy to observe retaliation by the MNE in that country. We contend that, because of this poor action observability, the MNE is less able to effectively use MMC to alert host country rivals of its intent to retaliate in other countries. This will lead an MNE to see mutual forbearance by means of MMC as inherently uncertain because the MNE and host country rivals will have difficulty in interpreting each other's retaliatory intentions. In contrast, in countries with high institutional quality, an MNE can accurately observe and interpret the signals conveyed by the retaliatory actions of rivals. Furthermore, an MNE can also be more confident that it can clearly signal its willingness to retaliate in the same host country, as well as in other countries in which they have competitive contact with the same rivals. The multimarket link means that in a host country where the full

signal observability prevails, it is much easier to link actions that threaten the MNE position in the host country with potential retaliation in other markets that are shared with the same rivals. For example, price rivalry that can be damaging to all competitors in a host country is much easier to deter in environments of high observability because any move to cut prices is much more easily detected, and is more likely to invite retaliation in other markets that are shared with the same rivals. In contrast, in a host market where interpretative ambiguity distorts observability, price reduction will not only be harder to observe, but the intention behind it (e.g., deliberate attempt to gain market share by cutting prices), is not so easily interpreted. This in turn reduces the ability of an MNE to establish MMC with its host country rivals.

Accordingly, we should expect that the higher the institutional quality in a host country where the MNE competes, the more rivals' action in that country will be visible to the MNE, and in turn the more the MNE is likely to increase the level of MMC with its host country rivals. This leads to the following hypothesis:

> *Hypothesis 3: Observability of actions of rivals in the MNE's host country mediates the relationship between the level of institutional quality in that country and the MNE's MMC with its host country rivals.*

2.5 The Role of Industry Concentration in the MNE's Host Country

Industry concentration – the degree to which most of the aggregate sales (or production) in an industry is generated by a few large firms – has been described as an important industry structural characteristic with strong influence on inter-firm rivalry (Scherer and Ross, 1990). Research also shows that increasing concentration allows firms to reliably track each other's moves (Derfus *et al.*, 2008; Scherer and Ross, 1990). Industry concentration is therefore viewed as an important corollary of action observability and signaling effectiveness. Firms in

highly concentrated industries find it easier to establish and maintain forbearance than firms that operated in fragmented industries.

In this section, we look at how introducing industry concentration into the theoretical framework discussed in Hypotheses 1-3 changes the relationship between action observability and MNEs' MMC. We do this in two parts. We start by first examining the direct effect of industry concentration on action observability and MMC respectively, with the level of institutional quality held constant. We next turn our attention to the moderating role of industry concentration, first in the relationship between institutional quality and action observability, and then in the relationship between institutional quality and MMC.

Prior work in the competitive dynamics literature asserts that low industry concentration gives rise to causal uncertainty: Firms find it difficult to ascertain the relationship between their actions and those of their rivals, and as a result are unable to develop tacit coordination that is mutually beneficial (Gimeno and Woo, 1996). In the absence of tacit coordination, disequilibrium becomes the norm, as managers, lacking reliable knowledge of competitive dynamics in their industry (Baum and Korn, 1996), opt for actions that further destabilize the industry (Chen, Lin, and Michel, 2010; Koka, Madhavan, and Prescott, 2006). By contrast, a highly concentrated industry that features few industry incumbents promotes collusion that reduces uncertainty about the intentions behind potentially competitive or cooperative actions. Cause-and-effect relationships are more easily established and monitored. Interpretations of industry dynamics are therefore more likely to converge, and a common understanding of the nature, scope, and pace of competition tends to emerge (Derfus *et al.*, 2008).

Moreover, as shown by some authors, while relatively small firms in fragmented (low concentrated) industries are more likely to engage in moves that go unnoticed by rivals (Basdeo *et al.*, 2006; Chen and Hambrick, 1995), relatively large incumbents in concentrated

industries cannot avoid scrutiny as easily. In many instances, large firms attract attention when obliged to publicly disclose information about competitive decisions to key stakeholders (Basdeo *et al.*, 2006). In other instances, firms will take advantage of high concentration to make their competitive actions as visible as possible (Ghemawat, 1991). This may involve making formal, widely publicized pre-announcements of moves in order to prepare rivals and thus avoid misunderstanding that can lead to escalating competition (Heil and Roberson, 1991).

Based on these arguments we expect that, all the other things being equal, MNEs that operate in countries where industry concentration is low will find it harder to observe and comprehend the actions of the fragmented host country rivals, while MNEs that operate in countries with high concentration of incumbents, will find actions of the few relatively large incumbents particularly visible. Thus, we posit:

Hypothesis 4: There is a positive relationship between industry concentration in an MNE's host country and the observability of actions of the rivals in that country.

Thus far, we have looked at the relationship between industry concentration and action observability. However, research also shows that industry concentration is a key determinant of an industry's ability to manage rivalry (Derfus *et al.*, 2008; Scherer and Ross, 1990). Generally speaking, economic theory suggests that in a fragmented industry (i.e., low concentration) no firm has the market power to set prices and determine production; and no combination of firms can emerge to effectively organize collusion. In this scenario, competition erodes margins and thus drives down profitability. In contrast, in a highly concentrated industry, an oligopoly consisting of few dominant rivals takes up a large portion of the market, and uses the high market power derived from collusive behaviors to mitigate competitive intensity (Derfus *et al*., 2008; Scherer and Ross, 1990). This would suggest that

an MNE's host country characterized by high level of industry concentration will find it easier to establish collusive agreements with its host country rivals via MMC. Thus we posit:

Hypothesis 5: There is a positive relationship between industry concentration in an MNE's host country and the MNE's MMC with its host country rivals.

Higher industry concentration may allow firms to more easily observe rivals' action (Hypothesis 4) and collude more effectively (Hypothesis 5), but returning to our main argument it is important to recall that a country's institutions are the context in which industry tacit cooperation takes place. The influence that industry concentration therefore exerts on action observability, and by implication MMC, takes place in an institutional context. This means that in addition to the independent effects of industry concentration on observability and MMC that we note in the previous two hypotheses, we must examine the moderating effect of industry concentration on the relationship between institutional quality and action observability on the one hand, and institutional quality and MMC on the other.

First, looking at the relationship between institutional quality and action visibility we can expect it to be stronger in concentrated industries and weaker in fragmented industries. The reason is that if the industry in an MNE's host country with high institutional quality is highly concentrated, the presence of high-quality institutions will allow the MNE and its rivals to ascertain with greater confidence cause-and-effect relationships of potentially competitive and cooperative relationships, and hence to better observe and comprehend each other's moves (Basdeo *et al.*, 2006; Derfus *et al*., 2008). By contrast, although in a country with high institutional quality the proper functioning of institutions make rivals' actions highly visible, if the industry in this country is fragmented, a far more competitive environment is likely to emerge; firms will confront conflicting signals and considerable noise that hinder coherent interpretation (Chen *et al.*, 2010; Ocasio, 1997). These conflicting

signals in turn are likely to hamper the action observability generated by high-quality institutions. We thus propose the following hypothesis:

Hypothesis 6: Industry concentration in an MNE's host country positively moderates the relationship between the level of institutional quality in the MNE's host country and the observability of actions of rivals in that country.

Finally, we argue that the positive relationship between observability of rivals' action in an MNE's host country and the MNE's MMC with its host country rivals will become stronger in highly concentrated industries. We can expect this relationship to become stronger because higher action observability, as is the case of a country with high institutional quality, combined with higher industry concentration makes it easier for firms to monitor each other's moves, which in turn makes it easier for the MNE to collude with its host country competitors by relying on MMC in other countries. In other words, we expect the industry concentration to strengthen the signal communication between firms in countries with institutional quality, thereby increasing an MNE's propensity to pursue MMC with its host country rivals. Thus, we posit:

Hypothesis 7: Industry concentration in an MNE's host country positively moderates the relationship between the observability of actions of rivals in the MNE's host country and the MNE's MMC with its host country rivals.

Figure 1 depicts the hypothesized relationships in our research model.

Please Insert Figure 1 about here
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3. Methods

3.1 Research Setting

The empirical setting of our analysis is the worldwide mobile phone industry. Our sample includes data about 85 mobile phone vendors that operate in 46 countries from 2003 to 2015.

The global mobile phone industry is a suitable setting for the purposes of this paper for several reasons. First, the majority of mobile phone vendors are MNEs and, as such, confront the same competitors in multiple countries. This gives rise to a higher level of competitive interaction in which competitive moves by a vendor against rivals in a country are often counterbalanced by rivals responding in other countries they have in common. Evidence suggests that in the mobile phone industry such moves are usually based on innovation, imitation, pricing, and marketing campaign (Ante, 2014; Giachetti, Lampel, and Li Pira, 2017; Paik and Zhu, 2016; Price, 2015).

Second, since most mobile phone vendors compete internationally, they have to adapt to the different institutional structures of the countries where they operate, and therefore deal with different regulatory regimes, laws and political systems. Furthermore, depending on the country in which they operate, these MNEs must contend with different structural characteristics of the industry, varying degrees of industry concentration, and different levels of consumer demand. The relatively long-time frame in this study allows us to capture the impact of these changing environmental dynamics on MNEs' multimarket strategies.

Information about mobile phone vendors' annual market shares and units sold in the various countries was collected from *Euromonitor International* (2003-2015). Information about countries institutional environment was collected from the World Bank (2016). Information about action observability was collected form *LexisNexis*. In the next section, we explain in detail how we used this information to operationalized the key constructs in our analysis.

3.2 Measures

3.2.1 Multimarket contact (MMC)

Consistent with the extant literature (Yu *et al.*, 2009), we measured an *MNE's MMC with its host country rivals* with an indicator that captures the degree of MMC between a focal firm

and its competitors in a given market ("country" in our case). We consider that there is a multimarket contact between two mobile phone vendors when they compete in at least two countries at the same time (in a given year *t*). To construct our measure of MMC, we first calculated the total number of countries where the focal mobile phone vendor encounters the rest of host country rivals. Since in our measure, each pair of vendors should engage in more than one distinct country, if the focal vendor competes with a rival in only one country, then this pair of firms is not included in the measure of MMC of the focal vendor. Next, we divided the total number of countries where the focal mobile phone vendor encounters the rest of host country rivals by the number of multimarket rivals the focal vendor has in that country. More specifically, the MMC for firm *i* in country *m* at time *t* is as follows:

(1) $$MMC_{imt} = \frac{\sum_{j \neq i} \sum_{m} (M_{imt} \times M_{jmt})}{\sum M_{imt} \times N_{MMCt}}, \quad for\ all\ j \ \ \sum_{m} \left(M_{imt} \times M_{jmt} \right) > 1.$$

where *j* refers to a specific multimarket rival and *m* refers to focal country. M_{imt} is a dummy variable which equals to 1 if firm *i* operates in country *m* at time *t* and 0 otherwise. Similarly, M_{jmt} is an indicator variable that equals to 1 if firm *j* operates in country *m* at time *t* and 0 otherwise. N_{MMCt} is the total number of competitors *j* that focal firm *i* meets in country *m* at time *t*. As mentioned before, focal firm *i* and rival firm *j* must meet in at least one country other than *m*. This measure ranges from zero to the number of countries the focal mobile phone vendor *i* operates outside the host country *m*. We considered a mobile phone vendor to compete in a certain country in a given year *t*, if it sells phones in that country in that year. Consistent with other studies in the strategy literature, we used Euromonitor International as our source of information on vendors' sales by country (Giachetti *et al.*, 2017; Fenech and Tellis, 2016).[1]

[1] An example from our country-level data (taken from *Euromonitor International*) can help to clarify the MMC measure. If we take the Chinese vendor Huawei as focal MNE, Spain as the host country, and 2011 as the year of observation, in order to compute MMC for Huawei in Spain in 2011, we first need to count the number of countries where Huawei competed with its host country rivals, taking into consideration the premise of competing in at least two countries at the same time. Accordingly, Huawei in 2011 in Spain competed in 6

3.2.2 Institutional quality

To measure *institutional quality* we followed studies in the international management literature (e.g., Cuervo-Cazurra and Genc, 2008; Oh and Oetzel, 2011; van Hoorn and Maseland, 2016) that use the six *Worldwide Governance Indicators* developed by the World Bank (2016). More specifically, the measure's six dimensions of governance are as follows: (1) *Voice and accountability* (VA) captures the extent to which citizens can take the advantage of their freedom rights and participate in selecting their government; *Political stability and absence of violence/terrorism* (PV) measures the perceptions of the likelihood that the government would be devastated or destabilized by unconstitutional or violent means, involving terrorism and politically-motivated violence; *Government effectiveness* (GE) measures perceptions of the quality of civil service, public services, policy formulation, the implementation and credibility of public services, and the degree of its independence from political pressures; *Regulatory Quality* (RQ) measures the extent to which government is able to formulate and implement policies and regulations that allow and support private sector development; *Rule of Law* (RL) captures the quality of property rights protection, contract enforcement, the police, and the courts and the also the likelihood of crime and violence; *Control of corruption* (CC) measures the degree to which public power is exerted for private gain and public policies are influenced by private interests (Kaufmann and Kraay, 2008; Kaufmann, Kraay, and Zoido-Lobatón, 1999). For each of these dimensions the World Bank provides an estimate of the level of effectiveness of the institutional system of a country within a range between 0 (weak) and 100 (strong). Consistent with the suggestions of

countries with TCL (that owned the brand Alcatel), 25 with Apple, 23 with HTC, 25 with LG, 20 with Motorola, 25 with Nokia, 24 with BlackBerry, 25 with Samsung, 24 with Sony-Ericsson, 19 with ZTE. Thus, Huawei had a total number of 216 market (country) overlaps with its multimarket rivals in Spain, and this number is the numerator of our MMC variable. Since Huawei had 10 multimarket rivals in Spain at that time, which is the denominator of our MMC variable, we obtained Huawei's level of MMC with its rivals in Spain dividing the total number of market overlaps (216) by 10. This means that in 2011 Huawei experienced a level of MMC (MMC_{imt}) with its multinational rivals in Spain equal to 21.6.

Kaufmann *et al.* (1999) and Globerman and Shapiro (2003), we constructed the measure of institutional quality by assigning the average value of the six Worldwide Governance indicators to each country in which a firm *i* operates at year *t*.

3.2.3 Action observability

In this paper we define action observability as the degree to which the institutional environment allows firms to observe the actions of their competitors. Measuring action observability requires an approach that separates the property of the signal conducting environment from the actor's ability to observe. An analogy can be made to measuring the visibility of driving in fog conditions (Muller and Trick, 2012). Researchers have established measurement scales for reduced visibility in fog conditions, while acknowledging that this may vary depending on the eyesight and driving experience of the individuals involved. Ideally, it would be desirable to measure action observability directly by surveying firms, but the resource expenditures needed to survey observability at the firm level across all the markets are far too great. We therefore adopted an indirect approach, by using media news reporting to assess action observability. Our reasoning for adopting this approach are as follows: First, the media is in the business of observing and reporting the actions of firms locally and globally. They have the motivation and resources to record actions if they are observable. Second, the variability of individual firms in response to action observability is minimized by media organizations which have a relatively uniform, across the board, criteria for collecting information. Third, firms may or may not be aware of the strategic actions of rivals on their own, but they usually become aware of actions when these are reported in the media (Paik and Zhu, 2016). Thus, while the ability of media organizations to collect information on firms' strategic actions is a function of the observability of these actions, the subsequent reporting constitutes an important component of information environment in which firms operate.

Our decision to use media articles discussing strategic actions taken by firms in a country as a measure of action observability is further supported by recent studies by Hannah and Eisenhardt (2017), Paik and Zhu (2016), Tan (2016) and Zavyalova, Pfarrer, Reger, and Shapiro (2012), that note how media coverage plays a significant role in influencing rivals' action visibility in technology-intensive industries. We used LexisNexis as our main source of data when constructing the measure. Specifically, we count the number of media articles on mobile phone vendors' "strategic actions in a given country" in all major world publications such as the New York Times, Wall Street Journal, Financial Time, Guardian, Independent, Business Times, Korea Times, South China Morning Post and The Australian. LexisNexis provide a number of filters at the "industry-", "subject-" and "geography-" level that serve to orient the search towards articles related to specific topics. We selected "mobile and cellular telephone" as filter at the industry-level, "company strategy" as a filter at the subject-level, while at the geography-level we selected countries in our sample. "Company strategy" included by default several keywords related to several possible strategy variables, like "alliances and partnerships", "mergers and acquisitions", "business development", "business expansion", "covenants not to compete", "competitive intelligence", etc. After having set these search criteria, for each year, we count the number of articles discussing mobile phone vendors' strategy in each of the sampled countries. We also distinguished between articles that dealt with one country, as opposed to articles that covered developments in multiple countries. To ensure consistency, we adjusted the count for articles that discuss strategic actions undertaken in multiple countries, adding each country noted in the article to the total country count. Our measure of action observability is therefore a country-level variable that captures the frequency of appearance in media articles of mobile phone vendors' strategy pursued in a specific country. Table 1 shows the number of articles discussing vendors'

strategy in each of the sampled countries. Per each country, we report also the average level of institutional quality across the 2003-2015 observation period.

Please Insert Table 1 about here

3.2.4 Industry concentration

We measured the *industry concentration* in a given country using the Herfindahl-Hirschman Index, which is calculated by squaring the market share of each competing mobile phone vendor in a country, and then summing them as follows:

(2) $HHI_{mt} = \sum_{i=1}^{N} MS_{imt}^2$

where MS_{imt} is the market share of firm *i* in country *m* in a given year *t,* and *N* is the number of firms competing in country *m* at year *t*. The *HHI* may vary between 1/*N* and 1 ($1/N \leq HHI \leq 1$), with small values of the index implying that the demand for mobile phones in the country is served by many firms with similar market shares, none of them with a strong market power; while the closer the *HHI* is to 1 is an indication the market demand is served by few dominating firms.

3.2.5 Control variables

We control for various firm- and country-level characteristics likely to influence the main independent-dependent relationship in several ways. As for firm-level controls, first, we included *firm size* to assess whether the largest firms are also more likely to use MMC as a competitive weapon against host country rivals. Firm size was measured by taking natural logarithm of a firm's sales at the country level. Second, we controlled for *market importance*, since it has been shown to affect a firm's MMC behavior in a given market (Chuang, Dahlin, Thomson, Lai, and Yang, 2018). We measured market importance for a focal MNE by taking the ratio of units sold of the focal MNE in a certain country to total unit sold by the focal MNE across all countries in which it competes in a given year (Domínguez, Garrido, and

Orcos, 2016). The bigger the value for a certain country for a given year, the higher the importance of that country for the focal MNE. Third, consistent with extant literature, we take account of firms that were involved in *acquisitions* with other vendors over our observation period, and compare pre-acquisition to post-acquisition main effect on MMC (Gimeno and Woo, 1996). We are interested in capturing cases in which, when the acquisition of a rival takes place, the acquirer takes full control of the acquired firm's mobile phone operations, and thus adds to its country portfolio the countries (and rivals) of the acquired firm, with likely consequences for its MMC-based strategy. Popular examples of takeovers of this type are the acquisition of the French Alcatel's mobile phone division by the Chinese TCL in 2005, the Palm acquisition by Hewlett-Packard in 2010, the acquisition of Motorola's mobile phone division by Google in 2012, and the acquisition of Nokia mobile phone division by Microsoft in 2014. We searched LexisNexis for media articles with information about acquisitions in the mobile phone industry, and in order to control for the post-acquisition effect on MMC, we used a dummy variable giving it the value 1 for the year of the acquisition onwards, and 0 for the years before the acquisition. We also control for the *market leader* firm in a given country, since the market leader and its challengers may not only have different views on market conditions, but also take different actions in response to these conditions (Derfus *et al.*, 2008; Ferrier *et al.*, 1999). We measured the market leader using a dummy variable which takes a value of 1 if the MNE in certain year is ranked number one in terms of its units sold in a certain country, and 0 otherwise.

We also added country-level controls to our analysis. We controlled for *GDP per capita growth* rate in the host country, as emerging markets, typically experiencing particularly rapid growth of GDP per capita, are often characterized by a competitive environment where several local players that do not have significant international operations take a substantial portion of the market. GDP per capita growth was measured as the annual

growth rate of a country's per capita gross domestic product (GDP) in US dollars, as reported in the World Development Indicator database. Furthermore, we controlled for the *population growth rate* in the host country, since growing populations offer opportunities for countries to strengthen their economies that, in turn, attract new investment opportunities by MNEs, thereby potentially increasing the intensity of competition in the host country. Population growth was measured as the annual growth rate of a country's population, as reported in the World Development Indicator database. Lastly, the growth rate of the demand can change considerably depending on the host country in which an MNE is competing (Shankar, 1999). Therefore, depending on the level of institutional quality we would expect market growth rates in a country to have an impact on an MNE's ability to develop MMC with its host country rivals in other countries. We operationalized *market growth* in a certain country by calculating the rate of change of aggregate units sold by all handset vendors in a country relative to the previous year.

Finally, we included *year dummies* in all models to control for possible changes of MMC due to other time-related factors that we did not directly measure, like product technology evolution and competition among network operators.

4. Analysis and Results

Given the multiple firms, multiple years structure of our database, we deemed panel data techniques to be the appropriate methods for testing our hypotheses. Applying the Hausman test, we also concluded that the use of fixed-effects regression is preferable to random-effects. We therefore used robust fixed-effects regression (firm- and country-dummies) to test our hypotheses in order to control for heteroscedasticity and time-series dependence in the data (Cameron and Trivedi, 2009). We lagged all variables by one year but the MMC one, to make realistic assumptions about the fact that MMC is a deliberate response to changing institutional and industry structural factors, as well as action observability. Moreover,

independent variables were standardized to permit comparison of their coefficients and, thus, assess the relative magnitude of predictors' effect on action observability and MMC. Additionally, we calculated variance inflation factors (VIFs) for all regressions to determine whether there was multicollinearity in the analysis. Among all regressions, the range of VIF scores was 1.13 to 1.86, thereby less than the recommended threshold of 10 (Chatterjee and Hadi, 2006). Table 2 reports the descriptive statistics of the variables.

Please Insert Table 2 about here

4.1 Institutional Quality on Action Observability, and Action Observability on MMC

Table 3 presents a set of regression models with action visibility as dependent variable, while Table 4 shows a set of regression models with MMC as dependent variable. Model 1 in Table 3 and Model 6 in Table 4 include controls, while in the remaining models we added our key regressors to test Hypotheses 1-5, and their interaction with industry concentration to test Hypotheses 6-7, as explained in detail below.

Hypothesis 1 proposed that institutional quality in an MNE's host country would be positively associated with the observability of actions of the rivals in that country. As shown in Table 3, Model 4, the coefficient for institutional quality is positive and highly significant ($\beta = 0.28$, $p < .001$), thereby supporting Hypothesis 1.

Please Insert Table 3 about here

Hypothesis 2 states that the higher the observability of actions of rivals in the MNE's host country, the more likely the MNE will be to engage in a high degree of MMC with its host country rivals. As evident in Table 4, Model 12, Hypothesis 2 is supported, as action observability shows a positive and highly significant association with MMC ($\beta = 1.24$, $p < .001$).

Please Insert Table 4 about here

To examine the mediating effect of action observability on institutional quality and MMC as proposed in Hypothesis 3, we follow the procedure outlined by Baron and Kenny (1986). They proposed that a mediating effect exists when (1) the independent variables and presumed mediators each significantly account for the variations in the dependent variable; (2) the independent variables significantly account for the variations in the presumed mediators; and (3) the effects of the independent variables on the dependent variable are reduced significantly when the presumed mediators are incorporated into the examined model. Condition 1 is met, as both institutional quality and action observability are significantly related to MMC (Table 4). Condition 2 is satisfied, as Table 3 showed that institutional quality is significantly related to action observability. Finally, condition 3 is met, as a comparison between Model 10 and 12 in Table 4 shows that the effect of institutional quality on MMC changes its significance from the p-value of 0.004 (Model 10: $\beta = 2.52$; $p < 0.01$) to 0.012 (Model 12: $\beta = 2.17$; $p < 0.05$) when action observability is included.

Finally, as can be noted in Table 3 and 4, the size of standardized coefficients of our two key regressors, i.e. institutional quality (Table 3 and 4) and action observability (Table 4), is larger than most of the other variables included in the models, suggesting their effect is not negligible.

4.2 The Effect of Industry Concentration

We next turn our attention on the effect of industry concentration, Table 3 presents the results of our hypotheses of the direct effect of industry concentration on action observability (Hypothesis 4) and the moderating effect of industry concentration on the institutional quality-action observability relationship (Hypothesis 6), and Table 4 presents the results of our hypotheses of the direct effect of industry concentration on MMC (Hypothesis 5), and the

moderating effect of industry concentration on the action observability-MMC relationship (Hypothesis 7).

Hypothesis 4 states that the higher the industry concentration in an MNE's host country the higher the observability of actions of rivals in that country. Hypothesis 4 is clearly supported as shown in Table 3, Model 3, with the positive and statistically highly significant coefficients for industry concentration ($\beta = 0.08$, $p < .001$). Hypothesis 6 states that higher industry concentration in an MNE's host country will display stronger association between institutional quality in the MNE's host country and observability of actions of the rivals in that country. However, as Model 5 in Table 3 shows that the coefficient for the interaction between industry concentration and institutional quality is negative and statistically not significant ($\beta = -0.01$, $p > .01$), thereby not supporting Hypothesis 6.

Hypothesis 5 proposed that industry concentration in an MNE's host country is positively associated with the MNE's MMC with its host country rivals. As shown by Model 9 in Table 4, the coefficient for industry concentration is positive and highly significant ($\beta = 0.94$, $p < .001$), thus supporting Hypothesis 5. Lastly, Hypothesis 7 states that industry concentration in an MNE's host country positively moderates the relationship between the observability of actions of the rivals in the MNE's host country and the MNE's MMC with its host country rivals. In Table 4, Model 13 reports that the coefficient of the interaction between action observability and industry concentration is negative but statistically insignificant (Model 5: $\beta = -0.34$, $p > .01$), thereby not supporting Hypothesis 7.

4.3 Robustness Tests

Action observability is the product of a country's institutional environment. The size of the economy, or the size of the market, should not therefore influence action observability. However, arguably the number of media articles published every year in country might be influenced by the size of the economy and the size of the market: The number of news items

in the United State, for example, is likely to be much larger than a country such as Denmark. The disparity in volume of reporting may result in a biased measure of action observability. To check whether our results are robust we decided to weigh the action observability variable by measures of country size. In this way, we correct for the effect of economy and market size for countries with similar number of media articles, with countries that are smaller in size showing greater observability of actions.

In Tables 5 and 6 we repeated the analyses presented in Tables 3 and 4, but this time we weighed the action observability variable by a *country GDP,* and by the *size of the mobile phone market* in a country. More specifically, in Models 14, 16-19 the variable action observability was divided by the natural logarithm of a country GDP, while in Model 15, 20-23 we divided action observability by the natural logarithm of the total number of mobile phones sold in a country. As can be observed, results are very consistent with those presented in Table 3 and 4, i.e. main effects of institutional quality on action observability and action observability on MMC, as well as the mediating effect of action observability are supported, while the moderating effects are not.[2]

Please Insert Tables 5 and 6 about here
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5. Discussion

5.1 Implications

The primary purpose of our study is to examine the effect of the institutional quality of an MNE's host country on the observability of actions of its rivals in that country, and how this in turn affects the MNE's MMC with these rivals. At present, we have studies that explore the influence of institutions on firm strategies such as entry modes and location choices

[2] We repeated the analysis weighting action observability also by the logarithm of a *country GDP per capita* and by the logarithm of a *country population*, and results (not reported in the paper) were again consistent with those in Table 3 and 4.

(Brouthers, 2002; Guler and Guillén, 2010; Henisz and Macher, 2004). We also have MMC studies that have been conducted in business environments where high observability prevails. In contrast, to our knowledge there are no studies that explore how the diversity of host country institutional systems influences MMC-based strategy of MNEs. A number of authors have suggested that future MMC research should examine how institutions with different levels of quality influence MNEs' collusive behaviors with rivals in international markets (Domínguez *et al.*, 2016; Yu and Cannella, 2013), but to our knowledge this study is the first to examine the institutional quality-MMC relationship by modifying the assumption that high observability of actions can be taken for granted when rivals are trying to establish mutual forbearance.

It has long been recognized by most scholars that a firm's multimarket strategy entails observability of actions in a given market (Domínguez *et al.*, 2016; Greve, 2008; Yu and Cannella, 2013). Taking this as our starting point, we therefore argue that action observability is important to an MNE's MMC-based strategy because it facilitates mutual forbearance (Baum and Korn, 1996; Bernheim and Whinston, 1990; Scott, 1982; Yu and Cannella, 2007, 2013). It is also clear that since action observability is influenced by the quality of institutions – where quality is an indicator of relative absence of institutional voids – variations in countries' institutional systems will influence action observability which in turn will impact MNEs ability to exercise mutual forbearance.

To specify the mechanism that explains these dynamics we turned to the theory of signaling (Connelly *et al.*, 2011) as a way to bridge the literatures on institutions with the one on multimarket contact. Our findings suggest that the higher the level of institutional quality in an MNE's host country, the more the MNE is likely to take the advantage of the greater observability to increase the level of MMC with its host country rivals. Viewed internationally, one can compare action observability in developed economies that are

institutionally mature with that of emerging economies where institutions are still in the process of formation. In institutionally mature economies, well-developed institutions facilitate signaling by an MNE's host country rivals, making competitive or cooperative moves easier to interpret accurately. This allows the MNE to have confidence that increasing the level of MMC with its host country rivals will yield the desired response from rivals. In contrast, when MNEs operate in host countries with low quality of institutions, information asymmetries and interpretative ambiguity distort signal communication between the rivals, thereby making it far more difficult for firms to monitor and accurately assess each other's intentions. This in turn hampers an MNE's intention and ability to establish mutual forbearance by means of an MMC-based strategy. Our results show that the higher the quality level of institutions in an MNE's host country the more the MNE will observe its rivals' actions in that country, that in turn increases its MMC with its host country rivals. This sheds light not only on the important role played by a host country institutional environment in driving an MNE's international multimarket strategies, but more broadly on the extant literature on the antecedents of MMC (e.g., Greve, 2000, 2006; Korn and Baum, 1999), and demonstrates how signaling theory and institution-based view of strategy can be combined to produce parsimonious yet strong model of MMC.

Our framework is general: It outlines how institutions affect the observability of actions and the ability of MNEs to conduct an MMC-based strategy. But the industries in which MNEs often operate are structurally specific. In the second part of the paper we sought to introduce this structural specificity by including a key structural characteristic of the industry in an MNE's host country: industry concentration. We selected this structural aspect of industries because, starting from industrial organization (Scherer and Ross, 1990), research in multiple disciplines has shown that industry concentration is one of the primary determinants of rivalry among firms, with inevitable effects also on firms' MMC-based

strategy (Baum and Korn, 1996; Scott, 1980). Introducing this industry-level characteristic, we examined how it affects the observability of actions in an MNE's host countries with different institutional quality, and the MNE's MMC with its host country rivals. As expected, we found that industry concentration has positive effects on action observability and MMC. However, we found no evidence that an MNE's MMC-based strategy is influenced by the interplay between industry concentration and the level of institutional quality in the host country. This means that, although institutional quality and industry concentration affect action observability and MMC when considered in isolation, their joint role is not statistically different from their individual role. By examining how an MNE's MMC with its host country rivals is affected by the interplay between industry structural characteristics (i.e., industry concentration in the host country) and the institutional environment (i.e., the level of institutional quality in the host country), we add to the extant strategy and international business literature that looks at how firm strategy is influenced not only by firm- and industry-level conditions, but also by their interplay with the international environment of a country (Peng *et al.*, 2008, 2009).

5.2 Managerial Implications

It has long been accepted that MNEs have to contend with institutional variability of the countries in which they operate. In our paper we argue that institutional quality does not only affect the ease of doing business in a particular country, but also has ramifications when it comes to avoiding destructive rivalry with other MNEs, and possibly even building mutually beneficial coordination. Our paper introduces another level of analysis into the strategy planning of MNEs. In particular, it suggests that strategic planning by managers should include the level of institutional quality in a country (or set of countries). For example, MNEs often use scenario planning when analyzing country moves. Our study suggests that institutional quality and associated level of action observability should be included in

establishing the feasibility of different scenarios for competitive interaction (both positive and negative) with rival MNEs across markets.

Our results also alert MNEs to the transfer of MMC knowledge across regions and countries. Many MNEs have their origins in countries that have strong institutional quality, and they also tend to expand beyond their domestic origins to countries with similarly strong institutions. Building an MMC-based strategy during this expansion process may not be particularly challenging because of the relatively high observability of actions of host country rivals. But the relative ease of building MMC-based strategy in countries and regions with strong institutional quality can easily mislead, since when entering countries with low institutional quality the MNE's attempt to build an MMC-based strategy is an uphill struggle. Therefore, an appreciation for these difficulties should help managers of MNEs not only to be mindful when building an MMC-based strategy in counties with weak institutional quality not to rely on experience gained when building MMC-based strategy in countries with strong institutional quality, but also estimate in advance the resources needed to compete in the different countries in which the MNE is planning to enter.

5.3 Limitations and Suggestions for Future Research

Our study has a number of limitations that also highlight the potential for future research. First, our study only deals with a single industry (i.e., mobile phone industry). The key characteristics of this industry are frequent product introductions, rapid technological imitation, and therefore, in most countries, intense competition. The generalizability of our findings may not hold in other industries where the pace of technology is slower and consumer demand is more stable. Future research could test our theory in industries that are similar to the mobile phone industry in terms of key characteristics, but also extend our framework to other industries, for example natural resources or service industries.

Second, our study takes into account the institutional quality in an MNE's host country, but does not consider institutional quality in the MNE's home country, nor does it consider the extent to which home and host country institutions differ. Various studies have suggested that a MNE's home country characteristics as well as the institutional distance between home and host country can affect a firm strategy (Xu and Shenkar, 2002; Yu, Subramaniam, and Cannella, 2013). We thus hope future research on the effect of institutional voids on MMC-based strategies will further explore this issue.

Finally, since a key premise in our study is that action signals are more or less observable depending on the level of institutional quality, we measured the observability of actions considering strategic actions by the MNEs in a given country covered by media. However, we do not assess whether the actions of some mobile phone vendors attract more attention, for example due to industry status or reputation, as noted by other studies drawing on the signaling literature (Mukherjeea, Makariusa, and Stevens, 2018), and thus whether there are firms that act as reference points in attracting MMC behavior by other firms in the same market. As noted in the robustness tests section, information about how firms perceive the level of visibility of rivals may require primary firm data, e.g. in-depth interviews with managers of sampled firms (Basdeo *et al.*, 2006). Given our multiple-firm, multiple-country, longitudinal sample, obtaining this primary data for all firms in our sample is costly and difficult to obtain even if funds became available. Nevertheless, to further corroborate our theoretical framework and findings, such effort is clearly desirable, and may be practical for researchers undertaking qualitative research using case studies and small sample research.

6. Concluding Remarks

Young, Tsai, Wang, Liu, and Ahlstrom (2014: 332) have recently noted that: "Institutions have moved from the background to the foreground of strategic management research". The work of Williamson (1985) and North (1990) provided an important starting point for

researchers interested in the relationship between institutions and strategy. However, since institutions that govern market relations are usually underpinned by legal codes that are set and enforced by the nation states, most subsequent research on the relationship between institutions and strategy focused on single countries. Empirically, it was not difficult for researchers to see that institutional systems vary across countries; suggesting that the relationship between institutions and strategy should likewise vary. However, for most researchers the implication of this variability does not go beyond comparing the market evolution and strategic behavior of firms in different countries. It was only recently that researchers have begun to argue that an MNE strategy is influenced by institutional systems, not only in a host country, but also across the set of an MNE's international operations.

For many MNEs, competition in a host country is linked via rivals in this market to competition with the same rivals in other markets. Multimarket contact allows firms to develop multimarket strategy. But developing and sustaining this strategy depends on being able to ensure that signals generated in the host country are clearly and accurately communicated and understood. The variability of institutional systems complicates this task considerably. Our main purpose in this paper was to show how institutional quality in an MNE's country changes the visibility of actions of the MNE's host country rivals, thereby influencing the MNE's MMC-based strategy. Our hope is that having shown the crucial role that institutional quality plays in facilitating or hindering MMC-based strategy, research can turn its attention to fuller exploration of how MNEs develop and sustain MMC-based strategy across different industries and countries.

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Table 1. Average levels of institutional quality and action observability by country over the 2003-2015 period

Country	Average Institutional Quality (2003-2015)	Action Observability	
		Average Number of Media Articles per Year (2003-2015)	Total Number of Media Articles (2003-2015)
Sweden	96.57	12.38	161
Denmark	96.24	4.69	61
Norway	96.02	3.31	43
Netherlands	94.28	16.85	219
Austria	93.66	3.00	39
Canada	93.34	122.00	1586
Australia	92.45	47.08	612
Germany	89.87	81.62	1061
Hong Kong, China	87.82	42.15	548
United Kingdom	87.77	163.38	2124
Singapore	87.41	39.54	514
Japan	85.44	108.31	1408
United States	84.62	484.08	6293
France	84.33	41.77	543
Chile	83.62	2.46	32
Portugal	81.63	4.46	58
Taiwan	77.49	47.08	612
Czech Republic	77.42	3.23	42
Spain	76.49	22.92	298
Hungary	74.41	4.38	57
South Korea	72.47	33.69	438
Poland	72.02	2.15	28
Italy	68.66	8.15	106
Israel	67.56	10.31	134
United Arab Emirates	66.46	10.54	137
Greece	66.35	4.31	56
Malaysia	61.67	17.15	223
South Africa	60.82	8.54	111
Romania	55.59	1.85	24
Brazil	51.63	17.23	224
Turkey	50.18	3.85	50
Mexico	47.24	6.54	85
Thailand	46.03	17.92	233
India	43.82	52.08	677
Saudi Arabia	43.14	4.77	62
Morocco	42.81	1.92	25
Colombia	41.67	1.23	16
Argentina	40.30	2.54	33
Philippines	39.33	11.15	145
China	36.66	168.15	2186
Vietnam	35.08	4.38	57
Indonesia	34.60	18.69	243
Egypt	31.48	5.31	69
Ukraine	30.57	3.08	40
Russia	27.67	10.54	137
Venezuela	12.14	2.00	26

Table 2. Descriptive statistics

		Mean	Sd	Min	Max	1	2	3	4	5	6	7	8	9	10	11
1	Multimarket Contact	26.679	13.159	0.000	44.000	1.000										
2	Institutional Quality	64.955	23.042	8.935	97.948	0.050	1.000									
						[0.001]										
3	Action Observability	45.884	99.606	0.000	938.000	-0.247	0.162	1.000								
						[0.000]	[0.000]									
4	Industry Concentration	0.283	0.104	0.097	0.775	0.260	-0.163	-0.320	1.000							
						[0.000]	[0.000]	[0.000]								
5	Firm Size	6.056	2.001	-1.609	11.267	-0.005	-0.145	0.334	-0.181	1.000						
						[0.718]	[0.000]	[0.000]	[0.000]							
6	Market Importance	0.121	0.282	0.000	1.000	-0.697	-0.107	0.268	-0.246	0.193	1.000					
						[0.000]	[0.000]	[0.000]	[0.000]	[0.000]						
7	Acquisitions	0.082	0.275	0.000	1.000	-0.132	-0.020	0.015	-0.112	-0.017	-0.029	1.000				
						[0.000]	[0.169]	[0.310]	[0.000]	[0.241]	[0.048]					
8	Market Leader	0.122	0.327	0.000	1.000	0.179	-0.000	-0.035	0.078	0.364	-0.090	-0.095	1.000			
						[0.000]	[0.997]	[0.017]	[0.000]	[0.000]	[0.000]	[0.000]				
9	GDP Per Capita Growth	0.022	0.038	-0.151	0.162	-0.163	-0.291	0.055	0.068	0.152	0.171	-0.054	0.012	1.000		
						[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.413]			
10	Population Growth	0.009	0.016	-0.129	0.162	0.166	-0.097	-0.049	0.089	-0.006	-0.089	-0.038	0.016	-0.203	1.000	
						[0.000]	[0.000]	[0.001]	[0.000]	[0.681]	[0.000]	[0.011]	[0.296]	[0.000]		
11	Market Growth	0.116	0.241	-0.456	2.904	0.012	-0.207	-0.030	0.283	0.062	0.003	-0.091	0.044	0.344	0.117	1.000
						[0.413]	[0.000]	[0.044]	[0.000]	[0.000]	[0.855]	[0.000]	[0.003]	[0.000]	[0.000]	

All variables are lagged by one year, except Multimarket Contact; *p*-values in square brackets.
N =4519

Table 3. Robust fixed-effects regression for the effect of institutional quality and industry concentration on action observability

	Model 1 Action Observability	**Model 2** Action Observability	**Model 3** Action Observability	**Model 4** Action Observability	**Model 5** Action Observability
Constant	-0.284	-0.295	-0.330	-0.341	-0.341
	(0.046)	(0.047)	(0.053)	(0.054)	(0.054)
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Independent Variables					
Institutional Quality		0.277		0.284	0.288
		(0.056)		(0.054)	(0.055)
		[0.000]		[0.000]	[0.000]
Industry Concentration			0.076	0.077	0.073
			(0.017)	(0.018)	(0.018)
			[0.000]	[0.000]	[0.000]
Interaction					
Institutional Quality × Industry Concentration					-0.009
					(0.012)
					[0.458]
Controls					
Firm Size	-0.038	-0.042	-0.023	-0.027	-0.026
	(0.020)	(0.020)	(0.019)	(0.020)	(0.020)
	[0.060]	[0.041]	[0.230]	[0.171]	[0.187]
Market Importance	-0.237	-0.235	-0.225	-0.223	-0.222
	(0.134)	(0.134)	(0.132)	(0.132)	(0.132)
	[0.077]	[0.080]	[0.088]	[0.091]	[0.093]
Acquisitions	-0.031	-0.032	-0.029	-0.029	-0.029
	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)
	[0.019]	[0.018]	[0.026]	[0.023]	[0.024]
Market Leader	0.003	0.004	0.001	0.002	0.001
	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)
	[0.844]	[0.813]	[0.950]	[0.920]	[0.928]
GDP Per Capita Growth	0.008	-0.002	0.008	-0.003	-0.003
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
	[0.311]	[0.772]	[0.331]	[0.724]	[0.699]
Population Growth	0.012	0.009	0.009	0.006	0.006
	(0.006)	(0.007)	(0.006)	(0.006)	(0.007)
	[0.061]	[0.187]	[0.151]	[0.382]	[0.357]
Market Growth	0.008	0.005	0.001	-0.002	-0.003
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
	[0.175]	[0.405]	[0.832]	[0.725]	[0.574]
Year Dummies	Included	Included	Included	Included	Included
N	4519	4519	4519	4519	4519
Within R-sq	0.164	0.168	0.173	0.177	0.177

Estimates are based on standardized variables; standard errors are reported in parentheses; *p*-values are reported in square brackets.

Table 4. Robust fixed-effects regression for the effect of institutional quality, action observability and industry concentration on multimarket contact

	Model 6 MMC	**Model 7** MMC	**Model 8** MMC	**Model 9** MMC	**Model 10** MMC	**Model 11** MMC	**Model 12** MMC	**Model 13** MMC
Constant	24.886	24.790	25.282	24.324	24.220	24.745	24.643	24.501
	(0.360)	(0.367)	(0.351)	(0.353)	(0.362)	(0.339)	(0.350)	(0.345)
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Independent Variables								
Institutional Quality		2.437			2.519		2.168	2.176
		(0.875)			(0.864)		(0.857)	(0.855)
		[0.006]			[0.004]		[0.012]	[0.011]
Action Observability			1.389			1.276	1.238	0.913
			(0.222)			(0.220)	(0.220)	(0.211)
			[0.000]			[0.000]	[0.000]	[0.000]
Industry Concentration				0.943	0.951	0.847	0.856	0.781
				(0.226)	(0.222)	(0.225)	(0.221)	(0.216)
				[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Interaction								
Action Observability × Industry Concentration								-0.336
								(0.216)
								[0.120]
Controls								
Firm Size	1.874	1.842	1.927	2.054	2.023	2.084	2.056	2.055
	(0.271)	(0.270)	(0.267)	(0.275)	(0.274)	(0.272)	(0.271)	(0.271)
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Market Importance	-2.790	-2.771	-2.460	-2.645	-2.624	-2.357	-2.348	-2.312
	(0.801)	(0.804)	(0.769)	(0.788)	(0.792)	(0.762)	(0.766)	(0.767)
	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.002]	[0.002]	[0.003]
Acquisitions	-0.092	-0.094	-0.048	-0.066	-0.069	-0.029	-0.032	-0.033
	(0.140)	(0.139)	(0.138)	(0.139)	(0.138)	(0.137)	(0.136)	(0.136)
	[0.514]	[0.498]	[0.727]	[0.635]	[0.619]	[0.834]	[0.814]	[0.811]
Market Leader	-0.144	-0.139	-0.149	-0.171	-0.166	-0.173	-0.168	-0.166
	(0.132)	(0.130)	(0.125)	(0.127)	(0.125)	(0.121)	(0.120)	(0.120)
	[0.274]	[0.288]	[0.233]	[0.177]	[0.186]	[0.152]	[0.161]	[0.166]
GDP Per Capita Growth	0.131	0.041	0.120	0.127	0.034	0.117	0.037	0.050
	(0.108)	(0.111)	(0.106)	(0.106)	(0.108)	(0.104)	(0.106)	(0.107)
	[0.226]	[0.715]	[0.259]	[0.229]	[0.754]	[0.259]	[0.725]	[0.641]
Population Growth	0.100	0.073	0.084	0.062	0.034	0.051	0.027	0.034
	(0.139)	(0.139)	(0.138)	(0.139)	(0.138)	(0.138)	(0.137)	(0.138)
	[0.473]	[0.598]	[0.546]	[0.654]	[0.803]	[0.711]	[0.842]	[0.804]
Market Growth	0.269	0.241	0.258	0.185	0.155	0.184	0.158	0.151
	(0.116)	(0.116)	(0.119)	(0.110)	(0.108)	(0.112)	(0.110)	(0.110)
	[0.021]	[0.039]	[0.030]	[0.091]	[0.150]	[0.101]	[0.151]	[0.170]
Year Dummies	Included	Included	Included	Included	Included	Included	Included	Included
N	4519	4519	4519	4519	4519	4519	4519	4519
Within R-sq	0.221	0.224	0.240	0.236	0.240	0.252	0.255	0.256

Estimates are based on standardized variables; standard errors are reported in parentheses; *p*-values are reported in square brackets.

Table 5. Robust fixed-effects regression for the effect of institutional quality and industry concentration on weighted action observability

	Model 14 Action Observability / Log Country GDP	**Model 15** Action Observability / Log Mobile Phone Market Size
Constant	-0.346	-0.348
	(0.053)	(0.052)
	[0.000]	[0.000]
Independent Variables		
Institutional Quality	0.296	0.288
	(0.056)	(0.055)
	[0.000]	[0.000]
Industry Concentration	0.073	0.074
	(0.018)	(0.018)
	[0.000]	[0.000]
Interaction		
Institutional Quality × Industry Concentration	-0.011	-0.017
	(0.013)	(0.013)
	[0.391]	[0.170]
Controls		
Firm Size	-0.027	-0.034
	(0.020)	(0.019)
	[0.163]	[0.073]
Market Importance	-0.218	-0.205
	(0.129)	(0.123)
	[0.094]	[0.096]
Acquisitions	-0.030	-0.030
	(0.013)	(0.013)
	[0.023]	[0.020]
Market Leader	0.002	0.003
	(0.016)	(0.016)
	[0.915]	[0.849]
GDP Per Capita Growth	-0.003	0.002
	(0.008)	(0.008)
	[0.731]	[0.833]
Population Growth	0.006	0.007
	(0.006)	(0.006)
	[0.317]	[0.260]
Market Growth	-0.005	-0.008
	(0.006)	(0.006)
	[0.444]	[0.180]
Year Dummies	Included	Included
N	4519	4519
Within R-sq	0.183	0.188

Estimates are based on standardized variables; standard errors are reported in parentheses; *p*-values are reported in square brackets.

Table 6. Robust fixed-effects regression for the effect of institutional quality, weighted action observability and industry concentration on multimarket contact

	Action Observability / Log Country GDP				Action Observability / Log Mobile Phone Market Size			
	Model 16	**Model 17**	**Model 18**	**Model 19**	**Model 20**	**Model 21**	**Model 22**	**Model 23**
	MMC	MMC	MMC	MMC	MMC	MMC	MMC	MMC
Constant	24.220	24.762	24.660	24.514	24.220	24.784	24.682	24.534
	(0.362)	(0.339)	(0.350)	(0.345)	(0.362)	(0.335)	(0.346)	(0.343)
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Independent Variables								
Institutional Quality	2.519		2.151	2.163	2.519		2.150	2.158
	(0.864)		(0.857)	(0.854)	(0.864)		(0.855)	(0.853)
	[0.004]		[0.012]	[0.012]	[0.004]		[0.012]	[0.012]
Action Observability		1.306	1.267	0.942		1.360	1.322	0.997
		(0.220)	(0.221)	(0.213)		(0.219)	(0.219)	(0.208)
		[0.000]	[0.000]	[0.000]		[0.000]	[0.000]	[0.000]
Industry Concentration	0.951	0.844	0.853	0.777	0.951	0.834	0.843	0.755
	(0.222)	(0.225)	(0.221)	(0.216)	(0.222)	(0.225)	(0.221)	(0.216)
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Interaction								
Action Observability × Industry Concentration				-0.338				-0.357
				(0.217)				(0.231)
				[0.120]				[0.122]
Controls								
Firm Size	2.023	2.087	2.059	2.058	2.023	2.099	2.070	2.070
	(0.274)	(0.272)	(0.271)	(0.271)	(0.274)	(0.272)	(0.271)	(0.270)
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Market Importance	-2.624	-2.356	-2.347	-2.310	-2.624	-2.360	-2.351	-2.310
	(0.792)	(0.762)	(0.766)	(0.767)	(0.792)	(0.761)	(0.765)	(0.767)
	[0.001]	[0.002]	[0.002]	[0.003]	[0.001]	[0.002]	[0.002]	[0.003]
Acquisitions	-0.069	-0.028	-0.031	-0.031	-0.069	-0.025	-0.029	-0.029
	(0.138)	(0.137)	(0.136)	(0.136)	(0.138)	(0.137)	(0.136)	(0.136)
	[0.619]	[0.841]	[0.820]	[0.819]	[0.619]	[0.854]	[0.833]	[0.832]
Market Leader	-0.166	-0.173	-0.169	-0.166	-0.166	-0.175	-0.171	-0.168
	(0.125)	(0.120)	(0.119)	(0.119)	(0.125)	(0.119)	(0.119)	(0.119)
	[0.186]	[0.150]	[0.158]	[0.164]	[0.186]	[0.143]	[0.151]	[0.156]
GDP Per Capita Growth	0.034	0.116	0.037	0.049	0.034	0.110	0.031	0.042
	(0.108)	(0.104)	(0.106)	(0.107)	(0.108)	(0.104)	(0.106)	(0.106)
	[0.754]	[0.263]	[0.727]	[0.647]	[0.754]	[0.289]	[0.770]	[0.693]
Population Growth	0.034	0.050	0.027	0.034	0.034	0.050	0.026	0.034
	(0.138)	(0.138)	(0.137)	(0.138)	(0.138)	(0.138)	(0.137)	(0.138)
	[0.803]	[0.715]	[0.845]	[0.807]	[0.803]	[0.718]	[0.849]	[0.804]
Market Growth	0.155	0.185	0.159	0.153	0.155	0.188	0.162	0.155
	(0.108)	(0.112)	(0.110)	(0.110)	(0.108)	(0.112)	(0.110)	(0.110)
	[0.150]	[0.099]	[0.148]	[0.167]	[0.150]	[0.092]	[0.139]	[0.159]
Year Dummies	Included	Included	Included	Included	Included	Included	Included	Included
N	4519	4519	4519	4519	4519	4519	4519	4519
Within R-sq	0.240	0.253	0.255	0.256	0.240	0.254	0.257	0.258

Estimates are based on standardized variables; standard errors are reported in parentheses; *p*-values are reported in square brackets.

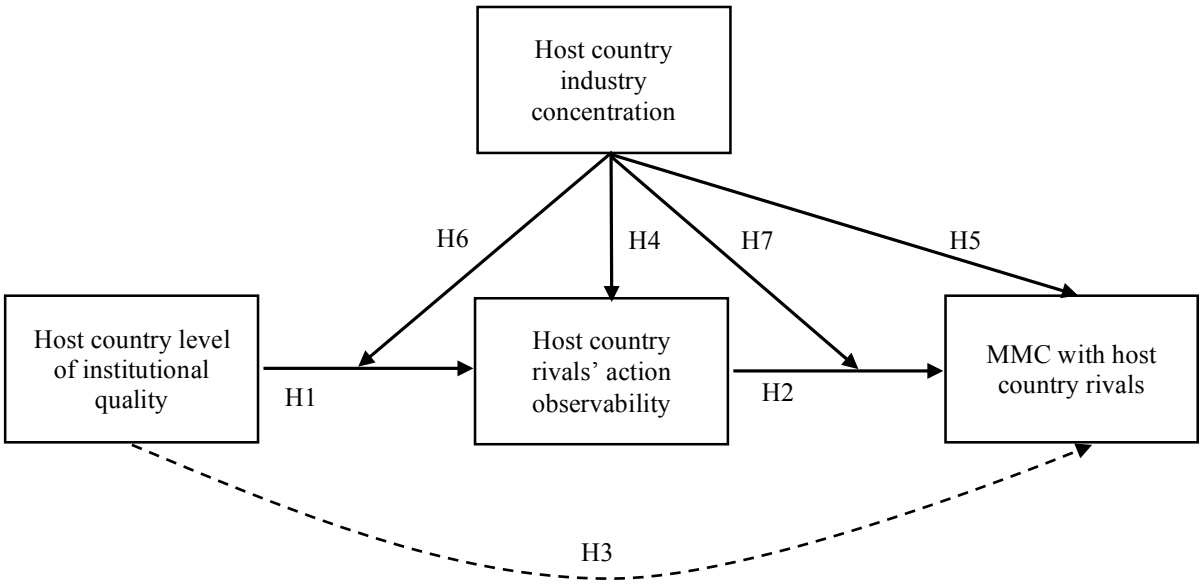

Figure 1. The research model: Antecedents of MNEs' MMC with host country rivals

How Do Patent Wars Affect Firms' Decision to Enter New International Markets? An Analysis of Patent Infringement Lawsuits in the Global Mobile Phone Industry

Abstract

A spiral of patent infringement lawsuits among firms in an industry generates what has been referred to as a patent war. This paper looks at how patent war intensity in a country influences a firm's decisions to enter that country. Our results show that intensity of patent wars in a country has a negative effect on a firm's likelihood of entering that country. We also show that patent war intensity negatively moderates the positive effect that the size of a firm's patent stock and a technological discontinuity in the industry have on market entry decision. We test our hypotheses with a sample of 85 mobile phone vendors operating in 46 countries from 2003 to 2015, navigating patent wars with changing and heterogeneous intensity. The paper contributes to the literature on patent enforcement strategies, technological change, and antecedents of market entry decisions.

Keywords: patent infringement lawsuits; market entry; patent stock; technological discontinuity; mobile phone.

1. Introduction

Practical evidence suggests that patent litigation in technology-intense industries may have a prominent role in affecting a firm's decision to enter a new geographic market. For example, in 2015 the plan of the Chinese mobile phone vendor Xiaomi to expand into the US market has temporarily vanished after the company was slapped with a lawsuit by Blue Spike LLC, which claimed that Xiaomi had infringed on its patents related to data protection methods with its upcoming mobile phones. Xiaomi had to cope with a similar situation the previous year in India, when the Chinese vendor was sued by the rival Ericsson claiming Xiaomi's new phones infringed on Ericsson's wireless technology, and the Delhi High Court temporarily blocked Xiaomi's intention to launch its new phone models in India. These and other lawsuits forced Xiaomi to slow down its international expansion, and continue focusing on 'less litigious' countries where patents did not tend to be strictly enforced (Soo, 2015). As Hugo Barra, the former Vice President of Xiaomi during an interview with Bloomberg TV pointed out:

> "We are building our own portfolio of patents for defensive purposes, because you kind of have to have that. Think of it as a war chest of sorts […] This is one of many factors that determines when we are ready to enter certain markets" (Bloomberg, 2015).

And Xiaomi's top managers admitted there could be even further legal trouble from other established competitors, that because of decreasing market shares and profits in their mobile phone business were spending more time capitalizing on the large patent portfolios they had accumulated over the years. As noted by Xiang Wang, Xiaomi's senior Vice President of mobile in an interview with Forbes:

> "Definitely, we are aware of those challenges in the patent area […] We are in a battle" (Hall, 2016).

As in the mobile phone industry, in most industries a firm's decisions to enter a geographic market are not trivial, since the firm needs to carefully assess the threats and benefits of the target market before moving forward (Baum & Korn, 1996). The *competitive*

environment in a firm's target market has been regarded as one of the most crucial explanatory factors in market selection. Prior market entry research suggests that firms are more likely to enter geographic markets where the intensity of competition and then retaliation from incumbents is low, with the degree of competitive intensity being examined from multiple angles, like R&D intensity (Harrigan, 1981) and product innovation (Bae, 2002), advertising (Geroski, 1995; Harrigan, 1981; Siegfried & Evans, 1994) and promotional activity (Kim, Min, & Chaiy, 2015), the likelihood of collusive behaviors (Karakaya & Stahl, 1989; Siegfried & Evans, 1994), and price competition (Joskow, Werden, & Johnson, 1994; Kim et al., 2015; Morrison & Winston, 1990) among the target market rivals. However, there is a shortage of studies that examine whether and how a firm's decision to enter a new geographic market is influenced by battles in that market among firms who aggressively litigate each other's patent rights, what some author has called *patent wars* (Chia, 2012; Paik & Zhu, 2016), a phenomenon that has boomed in various technology-intensive industries since the mid-2000s (Cohen, Gurun, & Kominers, 2016). This paper aims to address this critical gap.

Since firms in many technology-intensive industries frequently infringe or contest each other's patent rights, their freedom to operate in a market is subject to the risk of patent infringement litigation by their competitors in that market (Lanjouw & Schankerman, 2001). Our study starts from the observation that the extent to which an industry becomes battleground for patent infringement lawsuits, and thus the level of patent litigation risk a new entrant firm may encounter, is different from country to country, as each country is unique in terms of its intellectual property (IP) rights protection system, and thus patent enforcement strategies have different levels of effectiveness depending on the country where they take place (Paik & Zhu, 2016). Given this heterogeneity of *patent war intensity* (and litigation

risk) across countries, this study was guided by the following research questions: does the intensity of patent wars in a country affect a firm's decision to enter that country, and how?

We answer to these questions by developing hypotheses drawing from three main streams of literature: the relatively recent patent enforcement strategy literature (Graham & Vishnubhakat, 2013; Lanjouw & Schankerman, 2001; Paik & Zhu, 2016; Polidoro Jr & Toh, 2011; Rudy & Black, 2018; Shaver, 2012; Yang, 2014), which arises from the fields of intellectual property law and strategy and focuses on how spirals of patent infringement lawsuits in an industry may affect firms' strategy; the technological change literature (Anderson & Tushman, 1990; Lee & Malerba, 2017; Tushman & Anderson, 1986) that has focused on how changes in technology affect firm strategy and performance; and the literature on the antecedents of market entry (Cockburn & MacGarvie, 2011; Malerba & Orsenigo, 1999; Rothaermel, Kotha, & Steensma, 2006).

The hypotheses we propose are aimed at complementing the extant literature in the following ways. First, while there are numerous studies looking at the antecedents of a firm's market entry (e.g., Geroski, 1995; Karakaya & Stahl, 1989; Kim et al., 2015; Malerba & Orsenigo, 1999; Siegfried & Evans, 1994) with some of them examining how market entry is affected by *competitive intensity* in a focal country (Harrigan, 1981; Kim et al., 2015; Morrison & Winston, 1990; Siegfried & Evans, 1994), to our knowledge there are no studies examining the role that patent wars in a country play in affecting firms' entry decisions.[3] This is surprising given the increasing race by firms in technology-intensive industries to patent their inventions as a means either to defend themselves from competitors' attack or to sue new rivals to kick them out from the market (Jaffe, 2000; Shaver, 2012). Our baseline

[3] Paik and Zhu's (2016) study is the only one we found to tackle empirically how firms respond to patent wars in international markets. However: (1) their dependent variable is not market entry but the percentage of a firm's total sales in a country, (2) they look at the intensity of patent wars at the global-level and not at the country-level, and (3) they consider only strategic decisions of firms that are not directly involved in litigation.

hypothesis proposes that the intensity of patent wars in a country represents a deterrence for potential entrants.

Second, we further complement the extant literature by examining how patent war intensity shapes the effect on market entry of two critical characteristics of a firm's internal and external technological environment, respectively: (a) a firm's *patent stock*, i.e. the extent to which a firm has a lot (as opposed to few) patents in its portfolio (Kortum & Lerner, 1999; Ughetto, 2010), and (b) *technological discontinuities* in an industry, i.e. radical changes in an industry technological environment resulting in an 'era of ferment' culminating in a new dominant design (Anderson & Tushman, 1990). As for a firm's patent stock, the literature about the strategic management of patents so far has shown that the strength of a firm's patent portfolio not only (1) signals a firm's innovative capabilities providing the foundation for its competitive advantage (Artz, Norman, Hatfield, & Cardinal, 2010; He, Lim, & Wong, 2006) and (2) deters imitation of its inventions (Andries & Faems, 2013), but also (3) lowers the likelihood that the firm may be involved in patent infringement lawsuits, thanks to the 'bargaining chips' (i.e., patents to offer in return) it can exchange with plaintiffs (Shapiro, 2001) and the threat of retaliation it can trigger by countersuing the plaintiffs (i.e., in case a firm's patented innovations are used by the plaintiffs without authorization) (Lanjouw & Schankerman, 2004). However, there are no studies examining how the interplay between the size of a firm's patent stock and patent war intensity in a country affects the firm's entry decisions. We propose that, although firms holding a wide portfolio of patents are more likely to enter a new country, fierce patent wars in this country will increase potential entrants' perception of being sued by the host country rivals, thus reducing their likelihood of entry.

With regard to technological discontinuities, the technological change literature has found radical changes in technologies to represent a window of opportunity for new entrant firms in an industry, since during the time of paradigm shift in the technological trajectories

every industry rival is a beginner with the new technology (Anderson & Tushman, 1990; Murmann & Frenken, 2006; Tushman & Anderson, 1986), and in this era of experimentation with the new technology, firms are likely to compete in markets niches with heterogeneous product variants based on adaptations of the new emerging technology, thus essentially reducing direct competition (Suarez & Lanzolla, 2005; Suarez & Utterback, 1995). However, there are no studies that examine how the effect of technological discontinuities on a firm's entry decisions is shaped by patent war intensity in a country. We contend that the opportunities offered by a radical technological change in an industry are likely to increase firms' propensity to enter new countries, but this incentive to enter is mitigated as patent wars in a country escalate.

Using panel data from 85 mobile phone vendors competing in 46 countries from 2003 to 2015, and country-level patent litigation battles these mobile phone vendors were involved with during those years, we find support for all of our hypotheses.

2. Theory Background and Hypotheses

2.1 Patent War Intensity and Firms' Market Entry Decisions

In this section we discuss how patent wars in a country can represent a deterrence for potential entrants. Our argument is based on the observation that not all countries have the same level of traffic in patent infringement lawsuits, i.e. patent war intensity, and this in turn influences a firm's perception about the litigation risk in a country (Paik & Zhu, 2016). For instance, contrarily to what happens in many emerging economies, usually in developed economies firms can easily enforce the IP rights which their patents specify, as the legal system penalizes illegal imitators through compensation payments (Polidoro Jr & Toh, 2011). In such environments, firms race to assemble patent portfolios so that they can use patents effectively as strategic weapons to maintain a differentiation advantage vis-à-vis competitors, as well as trigger aggressive litigation campaigns to enforce IP rights if required (Allred &

Park, 2007; Keupp, Friesike, & von Zedtwitz, 2012; Paik & Zhu, 2016; Shaver, 2012). In the mobile phone industry, a case in point is the impressive sequence of mobile phone patent infringement lawsuits triggered by Apple and Samsung against each other and against other vendors during the first half of the 2010s. These lawsuits and countersuits were filed almost entirely in developed countries, most of them in the US, a highly lucrative market for handset vendors, where intellectual property law and enforcement procedures function properly and effectively, and where the patent cases usually come with bigger awards for damages than other countries. In fact, although the US mobile phone market is highly 'litigious', it can be also highly profitable for plaintiffs that can sustain costly litigation. And the confirmation of this is that, in a step back from three years of legal hostilities, in 2014 Apple and Samsung have agreed to end all patent lawsuits between themselves but the ones pursued in the US. To give an idea of the extent to which Apple used patent litigation as a competitive weapon, in 2011 the US firm spent more money on legal fees than R&D.

Therefore, entrant firms have reason to fear the cost of defending a lawsuit brought to court by their target country rivals, and these entry costs are likely to increase the higher the patent war intensity in the country. These costs include (a) the royalties that would have to be paid if the entrant needs to find licenses from patent holders in the country, (b) R&D expenditures related to inventing around in case the plaintiff contests the entrant product technologies, and (c) a higher probability of having to pay infringement damages (Cockburn & MacGarvie, 2011).

Since firms seek positions in attractive or profit potential markets where they can defend against their incumbents to minimize the costs and risks of entry, prior to their entry into new countries they need to make an assessment of the probability of litigation in these countries because the costs of possible patent litigation can greatly outweigh the benefits of launching their new products (Lanjouw & Schankerman, 2001). Accordingly, we should

expect that the higher the intensity of patent wars in a country, the higher the magnitude of litigation threat it poses to the potential entrant firm, that in turn decreases its propensity to enter that country. This leads to the following hypothesis:

Hypothesis 1: There is a negative relationship between the intensity of patent wars in a country and a firm's likelihood of entry into that country

2.2 The Effect of Patent War Intensity on the Relationship between a Firm's Patent Stock and Market Entry

Does the size of a firm's patent stock accelerate a firm's international expansion? In this section, we take the perspective of potential entrant firms in a new country, and we discuss first how the size of a firm's patent stock affects the firm's likelihood of entry into that new country; next, we examine how this relationship is moderated by the intensity of patent wars in that country.

Many technology-intensive industries, like consumer electronics, are characterized by products that are made by several high-tech components, most of them protected by patents, and with these patents owned by different competing firms. This leads to 'patent thicket': "an overlapping set of patent rights requiring that those seeking to commercialize new technology obtain licenses from multiple patentees" (Shapiro, 2001: 119). However, firms with extensive patent portfolios can tackle this situation mainly in two ways. First, they have the option to enter into broad patent cross-licensing agreements with their rivals, i.e. contracts where parties grant licenses to each other for the exploitation of the patents each owns, as a way to settle patent disputes or offset their litigation risks (Lemley & Shapiro, 2005; Paik & Zhu, 2016). Such agreements are particularly useful because, since the structure of high-tech products is usually comprised of a complex web of patents, it is impossible for a firm to forecast all relevant patent holders and ensure whether or not it is infringing their patents. Accordingly, a firm having broader patent portfolio can better defend itself from plaintiffs as

it can offer more bargaining chips (Lemley & Shapiro, 2005). For example, in 2014, Samsung and Google, to not litigate each other's patent rights and to fend off intense competition from rivals such as Apple and Nokia, signed a broad cross-licensing deal on mobile technology patents, which covers the two firms' existing patents, as well as the ones filed over the following 10 years (Grush, 2014). Second, firms with large stock of patents can confidently threaten their rivals with 'weapons' to countersue (Andries & Faems, 2013; Jaffe, 2000; Paik & Zhu, 2016; Shapiro, 2001). That is because if the firm has lots of patents, some of them are likely to be used in the products of the rival who considers suing the firm, and therefore the firm might alert the potential plaintiff that claims most likely will be followed by counterclaims. For example, although Samsung new line of smartphones introduced in 2009 resembled Apple's iPhones in many ways, the latter waited nearly two years before suing the former. And when Apple first sued Samsung in 2011 for infringing a number of design and utility patents for basic functions of the iPhone, Samsung after few months responded countersuing Apple saying the California-based vendor had infringed on Samsung patents around wireless communications and camera phones, and the legal battle between the two tech-giants continued for years. We expect such strength of firms with large patent stocks to make them more self-confident that they will be able to pursue a 'safer' utilization and exploitation of their patented inventions in foreign locations. Thus, we posit:

Hypothesis 2a: With patent war intensity in a country held constant, there is a positive relationship between the size of a firm's patent stock and the firm's likelihood of entry into that country

Although we contend that the greater the strength of the patent portfolio of a potential entrant the higher the likelihood it will enter new countries (Hypothesis 2a), as noted by Spender and Grant (1996: 7), "at the firm level, success at patenting does not necessarily correspond to success in translating patents into competitive advantage". Accordingly,

returning to our main argument it is important to recall that a country's competitive environment is the context in which entry will take place or not. The influence that a firm's patenting activity therefore exerts on its likelihood to enter new countries will take place in an environmental context where the level of patent wars varies over time and among potential target countries. This means that in addition to the independent effect of the size of a firm's patent stock on the likelihood of entry that we presented in the previous hypothesis, it is important to examine the moderating effect of patent wars in a potential target country on the relationship between the size of a firm's patent stock and likelihood of entry into that country.

We expect the relationship between a firm's patenting activity and its likelihood of entry into new countries to be stronger in countries with low levels of patent wars and weaker in countries with high level of patent wars. The reason is that if the intensity of patent wars in a country where a firm plans to enter is low, the firm will not see constraints to fully exploit the potential of its technological knowledge, since there is essentially a low risk to be involved in dangerous patent litigation. Therefore, the firm's idea of using its wide portfolio of patents as bargaining chips or weapons to countersue is perceived by the firm as viable. By contrast, if the intensity of patent wars in a country where a firm plans to enter is high, the firm will perceive to not be able to fully exploit the potential of its technological knowledge, since there is a relatively high threat of patent infringement and costly litigation that could outweigh the benefits of possessing patents to use as bargaining chips to offer to potential plaintiffs or as a weapon to countersue (Tansey, Neal, & Carroll, 2005). In fact, since firms patenting a lot find it all too easy to unintentionally infringe on a patent when designing a product technology, if patent war intensity in a country is high, entering that country they potentially expose themselves to costly litigation and/or injunctions forcing them to cease production of key products (Shapiro, 2001). This likelihood of being involved in bloody litigation is particularly evident in technology-intensive industries like the mobile phone

industry, where thousands of patents can potentially read on a given product, and thus the chance that a firm with a large patent portfolio will step on a land mine is quite high.[4] For example, the Chinese multinational technology company Lenovo, after a rapid growth in the Chinese mobile phone market from mid-2000s, characterized by weak IP right protection and very few patent-enforcement lawsuits, from the end of the 2000s obtained the granting of several mobile-phone-related patents outside China to prepare its entrance into the mobile phone markets of developed countries like US and Europe. However, as noted by the Vice President of Litigation and Intellectual Property at Lenovo:

> "We spend tens of millions of dollars each year to patent our innovations. Yet, despite all our diligent patenting efforts, Lenovo is still forced to run a gauntlet of patent claims from others" (Blumberg, 2018).

In fact, although Lenovo at the beginning of the 2010s had cumulated a rich portfolio of mobile-phone-related patents, the company decided to postpone its geographic expansion strategy in developed economies because of the aggressive patent battles that exploded in those years, thereby focusing its international expansion in developing economies like Indonesia and Philippines, characterized by a weaker IP rights protection. Only from 2014 the Chinese vendor expanded across the global mobile phone market, favored by an apparently reduction in lawsuits launched by aggressive plaintiffs like Apple, Samsung and Google (Bradshaw, 2014).

Therefore, we propose that, although firms with higher patenting activity might feel more confident that the risk of being suited in a new country is low, if the intensity of patent wars in this country escalates, a far more competitive environment is likely to emerge, and no matter how well-protected firms are, their patent portfolio might still be insufficient to fight against lawsuits filed against them. Accordingly, we expect the intensified patent wars in a

[4] The patent thicket increases the likelihood that "new products will inadvertently infringe on patents issued after these products were designed" (Shapiro, 2001: 119).

country to mitigate the high propensity of market entry of firms with a strong patent stock. Therefore, we posit:

> *Hypothesis 2b: The intensity of patent wars in a country negatively moderates the relationship between the size of a firm's patent stock and the firm's likelihood of entry into that country*

2.3 The Effect of Patent War Intensity on the Relationship between Technological Discontinuity and Market Entry

Technological discontinuities have been defined as radical technological innovations resulting in a "technical advance so significant that no increase in scale, efficiency, or design can make older technologies competitive with the new technology" (Tushman & Anderson, 1986: 441). Technological discontinuities trigger a period of technological ferment in which firms experiment with the new technology, and that terminates with a 'dominant design', which emerges as a combination of a number of proven concepts (Suarez & Utterback, 1995). Once a dominant design is established and accepted within an industry, the dominant design turns into a guidepost for consecutive product and process development efforts (Anderson & Tushman, 1990; Utterback & Suárez, 1993). Technological discontinuities might occur both at the inception of an industry, or later in its life cycle, even during the maturity stage (Tushman & Anderson, 1986). Although technological discontinuities have been shown to influence the performance of new entrants in an industry (Suarez & Utterback, 1995; Tripsas, 1997; Tushman & Anderson, 1986; Utterback & Suárez, 1993), little is known about how technological discontinuities affect entry decisions as patent wars in a country intensify. As we did for Hypotheses 2a and 2b, in this section we take the perspective of potential entrant firms in a country, and we discuss first how a technological discontinuity in an industry affects the firm's likelihood of entry into a new country; next, we examine how intensity of

patent wars in a country moderates the relationship between technological discontinuity and a firm's likelihood of entry that country.

Discontinuous innovations which disrupt an industry and make existing knowledge obsolete are distinctly different form previously dominant technologies, and thus require a change in firms' knowledge, skills and capabilities to develop and produce their new products (Tushman & Anderson, 1986). Since technological discontinuities force firms to build brand new knowledge and resources to exploit new products, new entrants are likely to perceive to be no longer at a disadvantage in relation to incumbent firms in terms of the value they can offer to customers, since essentially "everybody is a beginner" (Park & Lee, 2006: 721) in the use of the new technology. Accordingly, technological discontinuities are likely to lower barriers to entry since breakthrough innovations triggering a discontinuity require even market share leaders to set up new value networks and rethink their business models, and this may reduce their competitive advantage vis-à-vis followers and smaller rivals, that usually are more likely to bet on the new emerging technology as a way to catch-up with leading players (Anderson & Tushman, 1990; Bergek, Berggren, Magnusson, & Hobday, 2013; Lee & Malerba, 2017; Murmann & Frenken, 2006). As noted by some authors, "technological change brings in new competitors, who think their improvements will draw customer away from the incumbent and its dated products" (Suarez & Lanzolla, 2005: 125).

Moreover, in the era of ferment which precedes the dominant design, no strong patent positions are likely to have been established by firms introducing the new radical technologies, thus making easier for new entrant to circumvent first-movers' patented inventions (Suarez & Utterback, 1995), and thus entering new countries. In fact, since in the era of ferment following the beginning of a radical new technology, firms within the industry experiments with the new technology, they are likely to produce very heterogeneous variants of the same type of products (Abernathy & Clark, 1985; Utterback & Suárez, 1993). In this

phase, being products quite different from each other, there is not a consolidated set of patents related to the new technology, which is still in a phase of evolution because customers' response to product offers is unclear. As noted by some authors, "prior to the appearance of a dominant design many of its separate features may be tried in varied products which are either custom designed or designed for a particular and demanding market niche" (Suarez & Utterback, 1995: 418). Since when a technological discontinuity emerges firms are likely to launch in the country heterogeneous product variants, each with its own set of patents (because it is not clear which dominant design will establish), we expect this will increase potential entrants' perception that they will not find aggressive competition in the new country. Thus, we posit:

Hypothesis 3a: With patent war intensity in a country held constant, there is a positive relationship between a technological discontinuity and a firm's likelihood of entry into that country

Although a technological discontinuity in a firm's industry provides a window of opportunity for a firm pursuing expansion of its businesses into other geographic markets, its entry decision is contingent upon the competitive environment of the target country which it may want to enter (Afuah & Utterback, 1997). When a technological discontinuity emerges in a firm's product market, incumbents can attempt to strengthen their competitive position by enforcing and making aggressive investments in IP rights, thus signaling to potential entrants that any entry into their product market will be met with retaliation through litigation (Polidoro Jr & Toh, 2011). For example, the launch of Apple's iPhone in 2007 and Google's Android operating system in 2008 triggered a technological discontinuity in the mobile phone industry, contributing to the diffusion of a new generation of smartphone devices that after nearly half decade became the dominant design, i.e. a rectangular device with a full-multi-touch display, a wide portfolio of apps displayed as square icons, and usually sold at a much

higher price that traditional feature phones. Since 2007, an increasing number of inventions were patented related to this new configuration of portable devices, and every handset vendor was in effect a beginner with these new product configurations that was transforming the mobile phone industry. In those years, on the one hand newly established handset vendors like HTC, Huawei, Meizu and Xiaomi entered the industry with the aim to exploit this new wave of apparently profitable devices (Giachetti, 2018), on the other hand established players like BlackBerry, LG and Sony Ericsson exploited this window of opportunity by renewing their product line with new generation devices (Giachetti & Marchi, 2017). However, the growth plan of some of these firms was interrupted few years later, before a dominant design based on the new emerging technology was established. In fact, lawsuits, countersuits, and trade complaints based on patents and designs in the market for smartphones, and in particular the market of those devices based on Android and Apple's operating system (iOS), increased significantly. For instance, during an interview in 2011, Hua Hailiang, the marketing director of the Chinese vendor Meizu, declared that, although Apple were revolutionizing the mobile phone industry opening up opportunities for new entrants like Meizu, they decided to interrupt their expansion plan outside China, in countries with stronger IP protection, because of the fierce ongoing patent battles among big players in these markets:

> "Right now we just want to do well in the Chinese market […] We never wanted to compete with the other big players […] We don't want to clash with anyone, and as a small player, we don't want the trouble […] Lawsuit's been very troubling for these guys" (Lai, 2011).

These arguments would suggest that the incentives to enter into a new country fostered by a technological discontinuity can be outweighed as patent wars in that country escalate. Thus, we posit:

> *Hypothesis 3b: The intensity of patent wars in a firm's target country negatively moderates the relationship between a technological discontinuity and the firm's likelihood of entry into that country*

3. Methods

3.1 Research Setting and Sample

To test our hypotheses, we examined the patent strategies of 85 mobile phone vendors in 46 countries, from 2003 to 2015. Mobile phones are convergent portable devices that come loaded with several software and hardware components. They are 'convergent' in a sense that they combine technologies originating in other product categories offering new functionalities to the base product (e.g., email, text messaging, web browsing, a built-in camera, a voice recorder, a Bluetooth, a music player, etc.). Most of these technologies as well as other hardware and software components are patented, either by vendors themselves or by firms from other industries. Without patents mobile phone firms may both fail to protect their inventions from imitation and be the target of patent litigation (Graham & Vishnubhakat, 2013).

Mobile phones have been commonly distinguished in two categories: (1) 'feature phones', offering mainly basic phone and multimedia functionalities; and (2) 'smartphones', namely handsets equipped with advanced operating systems offering PC-like functionalities. The first smartphones were introduced at the end of the 1990s by Nokia, while competing vendors like Motorola and Ericsson began entering this category in the early 2000s (Giachetti & Marchi, 2017). Although in this study we consider the mobile phone industry as a whole, including any type of mobile phone vendor and thus patents related to any type of mobile phone technology, most of patent lawsuits were centered on smartphone-related technologies. The choice to start our analysis in 2003 is because from this year smartphones and their related technologies have begun diffusing (Giachetti & Marchi, 2017), and mobile phone vendors have intensely started patenting across many countries to expand their patent portfolio in an effort to protect their innovations against possible infringements.

Our decision to collect data until 2015 is because throughout this observation period we were able to capture an important technological discontinuity. Since the early 2000s notably, the competition in the mobile phone industry has focused on the mobile phone vendors' ability to introduce new product technologies in an incessant head-to-head rivalry to get or to keep ahead of one another (Giachetti, Lampel, & Li Pira, 2017). This competitive race has culminated at the end of the 2000s with the 'smartphone revolution' triggered by Apple with its iPhone, and the successive diffusion of iPhone-like devices, in large part favored by the introduction of Android by Google, an operating system with characteristics similar to the iPhone's iOS, but licensed for free to handset vendors (Giachetti & Marchi, 2017). The smartphone revolution revitalized an industry that in many countries had reached maturity, opening up new profit opportunities for incumbents and new entrants. Although patents have always played an important role in the mobile phone industry for handset vendors to protect their inventions, patent litigation cases have exploded at the end of the 2000s, reflecting a trend especially for large mobile phone vendors to use patents as a defensive business strategy (Paik & Zhu, 2016). Steve Jobs, the former CEO of Apple, when he announced the first iPhone in January 2007, made a point of this by stating that they had "patented the hell out of it" (Guglielmo, 2012).

We construct our dataset using multiple data sources. We collected information about mobile phone vendors' annual market shares and units sold in the various countries from *Euromonitor International* (2003-2015). We obtained firms' patent data from Questel's *Orbit Intelligence.* Lastly, we used *LexisNexis* to collect country-level litigation data within the mobile phone industry. In the next section, we explain in detail how we used this information to operationalize variables in our analysis.

3.2 Measures

3.2.1 Market entry

A firm's *entry* into a new country was measured with an indicator variable coded as 1 if the firm began operating (i.e., started selling its products) in a given country within a given year, and 0 otherwise. Market entry could be a repeated event, as firms can enter a market, exit from the country, and afterwards re-enter the country (Haveman & Nonnemaker, 2000). After having checked our dataset, we found no firms committing re-entry throughout our observation period.

3.2.2 Patent war intensity

As noted by some authors (Paik & Zhu, 2016), ideally, to measure patent war intensity we would need a composite index weighting multiple factors, like the number of patent infringement lawsuits for all vendors in every country, the royalties paid by infringers when disputes are settled, the amount of penalties infringers had to pay to plaintiffs in each country, as well as legal fees. However, on the one hand some of this information is not readily available, making difficult the computation of composite indices of this type. On the other hand, vendors are unlikely to possess all this knowledge about litigation cases, unless it is publicized. Therefore, based on the observation of Tan (2016) who noted that the level of media coverage can influence the level of public awareness of firms' patent enforcement strategies, and Paik and Zhu (2016) who argued that the level of media coverage of mobile phone conflicts increases as patent wars intensify, we constructed a country-level measure of *patent war intensity* by counting the total number of media articles related to mobile phone lawsuits in each country for a given year. We tracked media articles discussing court cases of mobile phone vendors in a certain country in a given year using *LexisNexis*, a commercially compiled source that searches thousands of newspaper articles published in all major world publications (e.g., The Times, The Guardian, The New York Times, The Wall Street Journal and The Korea Times). More specifically, we counted the total number of articles for each year containing different combinations of "mobile phone" related keywords (e.g., cell phone,

cellular handset, mobile phone, mobile handset, smartphone, etc.), "patent" keywords and various combinations of keywords associated with a "court action" (e.g., infringement, lawsuit, dispute, case, litigation, etc.). Beside these keywords, in order to track mobile phone related court cases in each country, we used multiple combinations of keywords related to a specific country's legal institution (e.g., Chinese court, Chinese judge, court in China, etc.).

3.2.3 Patent stock

The size of a firm's *patent stock,* consistent with the prior studies (Narin, Noma, & Perry, 1987; Paik & Zhu, 2016), was measured by counting the number of mobile phone related patents granted to each firm that were published in each country. Initially, we identified mobile phone related international patent classification (IPC) codes using *Espacenet* (an online service for searching codes related to patents and patent applications provided by the European Patent Office).[5] Next, following the approach used in previous studies (Hall & MacGarvie, 2010; Xie & Miyazaki, 2013), for each firm, together with the IPC codes identified, in *Orbit Intelligence* we performed a search using the mobile phone related multiple keywords (e.g., "cell phone", "mobile phone", "smartphone") that appeared in a patent's title, abstract and claims.[6] Lastly, we carefully checked each patent for accuracy. In order to build our measure of patent stock, we took into consideration the firm's overall patent holdings, at the worldwide level (and thus regardless the countries where these patents were granted to the firm), which was measured as the count of patents granted to a firm at the global level within a five-year period, including the current year (*t-4* to *t*). In fact, as suggested by various authors, recent patents provide the most current information concerning

[5] According to the search we did in *Espacenet* we found the following IPC codes related to the mobile phone technology: A63, B22, B29, C03, C23, G01, G02, G03, G06, G08, G09, G10, G11, H01, H02, H03, H04, and H05.

[6] The empirical results of Xie and Miyazaki (2013) show that using the patent information that includes title, abstract and claims is the most effective strategy of identifying patents through keyword search (for example, the authors argue that considering in the search also information provided in the patent 'description' would bring into the count irrelevant patents, not related to the focal product category).

a firm's chance to defend its products from rivals' patent enforcement strategy in a given product category (Reuer & Lahiri, 2013; Tyler & Caner, 2016).

3.2.4 Technological discontinuity

Authors in the extant literature have noted that over the life cycle of the mobile phone industry there have been mainly two technological discontinuities (Giachetti & Marchi, 2017). The first one was at the beginning of the 1990s when the digital standards were introduced, gradually caused the decline of analog technologies for mobile phones, and became the dominant design with more than 50% of mobile phones sold globally in 1998 working with digital standards. After the digital revolution in the 1990s that favored the transition from analog to digital devices, the other major technological discontinuity started with the launch of the iPhone by Apple in 2007, that, with its revolutionary operating system iOS, custom-built to support multi-touch display and allowing the user to access to thousands of applications, signed the beginning of a new generation of multi-tasking portable devices (Giachetti & Marchi, 2017). Although Apple did not license iOS to other vendors, in 2008 Google introduced Android, an operating system similar to iOS (i.e., with a vast collection of apps) but free to mobile phone vendors since Google did not require any license fees to be payed, unlike other operating systems such as Nokia's Symbian and Microsoft's Windows Mobile. In 2011, only four years since its introduction, Google's Android had become the highest selling smartphone operating system, with nearly 50% of global market share, thanks to its rapid diffusion at the worldwide level. We thus assume that this technological discontinuity was triggered by Apple in 2007, and the 'era of ferment' lasted until Android widely diffused in the market, establishing a new dominant design in the mobile phone industry. Consistent with the extant literature, a dominant design is defined as a product configuration (i.e., Android-based phones in our case) that accounts for over 50-percent of new product sales, and maintains a 50% market share for at least four years (Anderson &

Tushman, 1990). Since in 2012 Android has surpassed 50% market share, and has never felt below that share, we assumed the era of ferment finished in 2012. In sum, throughout our observation period, from 2003 to 2006 the dominant design was digital feature phones (as observed above); from 2007 to 2011 we observed the era of ferment related to the smartphone revolution; and from 2012 to 2015 the dominant design was the new generation of iPhone-like devices based on Android operating system. Therefore, the variable *technological discontinuity* in the mobile phone industry was measured with a dummy variable that takes value of 1 from 2007 to 2011 (i.e., during a technological discontinuity), and value of 0 otherwise (i.e., when a dominant design was establish among vendors).

3.2.5 Control variables

Various country- and firm-level control variables were used in our analysis. In relation to country-level controls, first, we controlled for *GDP growth* rate in a country. The growth of a country's GDP, that is usually accompanied by an increase in a country's global competitiveness, contributes to favorable market conditions for investment opportunities, thereby affecting entry decisions of potential entrants who seek higher returns (Delios & Henisz, 2003). GDP growth was measured as the annual growth rate of a country's gross domestic product (GDP) in US dollars, as reported in the World Bank's World Development Indicator database. Furthermore, we controlled for a country *population growth rate*, since growing populations might be perceived by new entrants as an expansion of their target market (Delios & Henisz, 2003). Population growth rate was computed as the annual growth rate of a country's population, as reported in the World Development Indicator database. Third, we controlled for a country *institutional quality*, since the strength of local institutions of a country is likely to influence a firms' market entry decisions (Peng, 2003). We used Heritage Foundation's Economic Freedom Index as a measure of institutional quality for a given country. Moreover, we controlled for *product diffusion growth* since it might be

perceived by new entrants as a window of opportunity related to consumer demand (Lee & Malerba, 2017). We gathered yearly data on mobile phone subscribers (per 100 people) in a given country from the World Development Indicator database, and then operationalized product diffusion growth rate in a certain country by calculating the rate of change of mobile phone subscribers in a country relative to the previous year. Additionally, we controlled for *industry concentration* in the foreign country, potentially signaling to new entrants the likelihood of retaliation by dominant vendors (Li, 1995; Siegfried & Evans, 1994). We operationalized industry concentration in a country by using the Herfindahl-Hirschman Index. Moreover, we controlled for both *entry rate* (number of firms entering a country in a given year) and *exit rate* (number of firms exiting a country in a given year), as both can be the sign of increasing competitive intensity in the target country (Agarwal & Gort, 1996). Finally, since most mobile phone vendors sign contracts with mobile network operators and consumer electronics stores across countries to sell off their mobile phones in physical outlets, given the limited space that physical outlets have on their shelves, market entry decisions may also be influenced by the growth of store based retailers relative to e-commerce channels in a country. Therefore, we controlled for the *store-based retailing growth rate*, which is calculated as the rate of change in aggregate share of mobile phone store-based retailing channels in a country relative to the previous year. Data on shares of store-based retailers in the mobile phone industry was gathered from *Euromonitor International*.

As for firm-level controls, we included *firm's patent applications* in the target country, since firms who seek protection and want to remain active in patent intensive markets invest in the development of advanced internal IP related resources, and are therefore likely to have a high propensity to file patent applications with the agency that governs patenting initiatives in the country in which they seek protection (Cockburn & MacGarvie, 2011; Salomon, 2006). Firm's patent applications was measured as the total number of patent

applications the firm filed in a given target country patent office in a given year. Finally, we controlled for firms that were involved in *acquisitions* with other firms over our observation period, and compared pre-acquisition to post-acquisition main effect on market entry. We are interested in capturing cases in which, when the acquisition of a rival takes place, the acquirer takes full control of the acquired firm's mobile phone operations, with likely consequences for its market entry strategies. We searched LexisNexis for media articles with information about acquisitions in the mobile phone industry, and in order to control for the post-acquisition effect on market entry, consistent with the extant literature, we used a dummy variable giving it the value 1 for the year of the acquisition onwards, and 0 for the years before the acquisition (Gimeno & Woo, 1996).

4. Analysis and Results

To examine the statistical relationship between the individual predictor variables and firm's market entry moves, consistent with previous market entry studies we used logit regression analysis (King & Tucci, 2002; Rothaermel et al., 2006). The results of Hausman test suggested that using logit fixed-effects regression was preferable than random-effects. Moreover, we standardized and lagged by one year all independent variables before entering them into the logit regression models (Cockburn & MacGarvie, 2011). The Nagelkerke R^2 (Nagelkerke, 1991), denoted R^2_N, in the full model reached a total $R^2_N = 0.71$, indicating that the degree to which our regressors explain the likely of entry is not negligible. Furthermore, we calculated variance inflation factors (VIFs) for all regressions to determine if there was multicollinearity issue in our analysis. Among all regressions, the range of VIF scores was 1.07 to 1.94, thereby less than the recommended threshold of 10 (Chatterjee & Hadi, 2006). Table 1 reports the descriptive statistics of variables included in our analysis.

Please Insert Tables 1 about here

Table 2 presents a set of regressions with market entry as dependent variable. Model 1 in Table 2 includes controls, while in the remaining models we added our key regressors to test Hypotheses 1, 2a and 3a, and their interaction with patent war intensity to test Hypotheses 2b and 3b.

Hypothesis 1 proposed that patent wars in a country would be negatively associated with the firm's likelihood of entry to that country. As shown in the Model 3, the coefficient for patent war intensity is negative and significant (β = -4.86, p < .05), thereby supporting Hypothesis 1.

Please Insert Table 2 about here

Hypothesis 2a states that the stronger the firm's patent stock, the more likely the firm will enter into new countries. As evident in the Model 3, Hypothesis 2a is clearly supported, as patent stock shows a positive and highly significant association with entry (β = 49.47, p < .001).

Hypothesis 3a states that the higher the technological discontinuity, the higher the firm's likelihood of entry into new countries. Hypothesis 3a is supported as shown in the Model 3, with the positive and statistically significant coefficients for technological discontinuity (β = 0.28, p < .05).

Hypothesis 2b proposed that higher patent war intensity in a country will negatively moderate the positive relationship between the firm's patent stock and the firm's likelihood of entry into that country. As can be seen in the Model 3, the coefficient for the interaction between patent war intensity and patent stock is negative and statistically significant (β = -6.98, p < .05), thereby supporting Hypothesis 2b.

Hypothesis 3b states that higher intensity of patent wars in a country will display weaker association between technological discontinuity and firm's likelihood of entry into that country. Model 3 shows that the coefficient for the interaction between patent war

intensity and technological discontinuity is negative and significant (β = -0.85, p < .05), thus supporting Hypothesis 3b.

5. Discussion and Conclusion

In this article, our central hypothesis was that firms are less likely to enter a country in which rivals aggressively fight each other with patent infringement lawsuits, i.e. where patent war intensity is high. We found support for this hypothesis in the global mobile phone industry, in the 2003-2015 observation period. Furthermore, we examined in the same empirical setting how patent war intensity influences the effect on market entry of two characteristics of a firm's internal and external technological environment: the size of a firm's patent stock and a technological discontinuity in the firm's industry, respectively. Consistent with our hypotheses, findings reveal that both characteristics positively affect a firm's likelihood to enter a new country, and that their positive influence is attenuated as patent wars in a country escalates. Together, these hypotheses and findings elucidate how firms manage the tension between entering a new geographic market to (1) exploit their patent portfolio potential and windows of opportunities emerging from radical technological changes, and (2) reducing the risk of being involved in bloody patent infringement lawsuits with rivals in the target country.

A number of implications for theory and practice emerge from our study. First, this study contributes to the literature on patent enforcement strategies (Lanjouw & Schankerman, 2001; Paik & Zhu, 2016; Rudy & Black, 2018) and antecedents of market entry decisions (Bae, 2002; Siegfried & Evans, 1994) by highlighting the role that patent war intensity in a country has in deterring potential entrants. In fact, there is a shortage of studies examining how a firm's entry decision is influenced by the intensity of patent wars in a target country, given the well-known consequences of patent wars for the performance of firms that remain involved in patent infringement lawsuits, it is reasonable to expect a firm to ex-ante behave strategically to mitigate this threat. Examining whether and how firms are likely to avoid

patent wars leads to a more comprehensive understanding of how they can strategize in technology-intensive industries, often the theater of patent battles among firms in multiple countries, with countries greatly differing in terms of patent system and IP protection legislations. As this study shows, an important way in which a firm responds to patent wars in a country is by reducing the likelihood of its entry into that country. These results are not obvious, especially in light of the fact that countries with lower patent wars are often emerging economies with relatively weak IP right protection systems, and the extant literature suggests that since "it can be difficult for firms to protect their knowledge in foreign countries – especially countries with weak intellectual property (IP) protection" (Berry, 2017: 787), this might deter their entry into these countries. Our findings show instead that where patent war intensity is lower (and usually IP rights are weaker), firms are more likely to enter.

Second, by drawing on insights from the literature on strategic management of patents (Artz et al., 2010; He et al., 2006), this study highlights the role of the strength of a firm's patent stock in fostering its entry into a new country, and also shows how patent war intensity in a country can mitigate this positive effect of patent stock on entry. In fact, a static interpretation of the link between the size of a firm patent stock and the likelihood of entry a new country may lead to the somewhat simplistic view that firms can attain omnipotent incentives to entry. Yet, considering the competition that unfolds as patent wars in a country escalates helps one realize that, in reality, the strength of a firm patent stock and patent wars in a country are interdependent and that the firm balances one against the other when taking an entry decision. Without recognizing how firms manage this interdependence, scholars may have underestimated the true difficulties that firms with a strong patent portfolio face when deciding whether to enter or not into a new geographic market.

Third, by bringing insights from the technological change literature into research on patent enforcement strategies and the market entry literature, on the one hand our study

confirms that technological discontinuities represent a window of opportunity for new entrants in a country (Anderson & Tushman, 1990; Murmann & Frenken, 2006; Tushman & Anderson, 1986), on the other hand we also show that the decisions firms take about whether to use the emerging technology as a 'Trojan horse' to get a foothold in a new country has to be evaluated in light of the intensity of patent wars in that country. In this respect, our study contributes to the technological change studies that have examined the role of 'technology windows' as a means for followers to catch-up with incumbents (Anderson & Tushman, 1990; Bergek et al., 2013; Lee & Malerba, 2017; Murmann & Frenken, 2006) by showing how a firm's likelihood to exploit the opportunities offered by radical changes in technology is shaped by the threat of being involved in bloody patent infringement lawsuits.

A potential limitation of this study is the generalizability of the findings. We chose the global mobile phone industry because it allowed us to test our theory in a setting where patent enforcement strategies have been regarded as a tremendous competitive weapon to deter imitation (Paik & Zhu, 2016). Imitation deterrence is highly relevant in this setting, as the mobile phone development process may be very costly and span from few months to years, as in the case of high-end smartphones, even though new technologies equipped in these products are often affected by technological obsolescence. Therefore, first movers often struggle to defend their inventions with legal battles to safeguard returns on investments in the short-run. The corresponding shortcoming may be that our hypotheses are less applicable to settings where products and related technologies have a longer life cycle, because product features are less subject to technological obsolescence, as in the pharmaceutical industry (Polidoro Jr & Toh, 2011), or in industries where patent-enforcement strategies are ineffective or inconvenient, as in the garment industry (Levitt, 1966). Therefore, we hope future research will test and extend our theory in empirical settings with specific peculiarities.

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Table 1
Descriptive Statistics

	Mean	Sd	Min	Max	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Entry	0.122	0.327	0.000	1.000	1.000													
Patent War Intensity	3.979	25.710	0.000	481.000	0.008	1.000												
Patent Stock	552.805	614.121	0.000	2498.000	0.202***	0.020+	1.000											
Technological Discontinuity	0.417	0.493	0.000	1.000	0.178***	-0.039***	0.114***	1.000										
GDP Growth	3.420	3.809	-14.800	18.287	-0.047*	-0.052***	-0.127***	-0.127***	1.000									
Population Growth	0.009	0.017	-0.129	0.162	-0.008	-0.028*	0.003	0.044***	0.142***	1.000								
Institutional Quality	64.675	10.131	36.100	90.100	0.026	0.156***	0.072***	0.030*	-0.244***	0.020+	1.000							
Product Diffusion Growth	0.129	0.208	-0.161	1.551	-0.092***	-0.063***	-0.174***	-0.134***	0.422***	0.024*	-0.367***	1.000						
Industry Concentration	0.300	0.114	0.097	0.775	-0.114***	-0.136***	-0.137***	-0.098***	0.168***	0.071***	-0.246***	0.487***	1.000					
Entry Rate	0.666	0.949	0.000	5.000	0.071***	-0.027*	0.034**	0.199***	-0.029*	-0.022+	-0.104***	-0.025*	-0.096***	1.000				
Exit Rate	0.161	0.400	0.000	2.000	0.151***	0.032**	0.051***	-0.051***	0.009	-0.017	0.046***	-0.066***	-0.159***	0.010	1.000			
Store-Based Retailing Growth Rate	-0.012	0.019	-0.181	0.019	-0.160***	0.005	-0.069***	-0.024*	0.153***	0.160***	-0.034**	0.227***	0.240***	-0.099***	-0.067***	1.000		
Firm Patent Applications	6.088	33.265	0.000	1080.000	0.059**	0.146***	0.032**	-0.014	0.045***	-0.094***	0.037**	-0.035**	-0.114***	0.008	0.068***	-0.005	1.000	
Acquisitions	0.089	0.285	0.000	1.000	0.036+	0.035**	0.181***	-0.114***	-0.081***	-0.044***	0.017	-0.117***	-0.130***	0.030*	0.071***	-0.043***	-0.003	1.000

All variables are lagged by one year, except Entry.
N =2199
+ $p < 0.10$
* $p < 0.05$
** $p < 0.01$
*** $p < 0.001$

Table 2
Logistic Fixed-effects Regression for the Effect of Patent War Intensity, Patent Stock and Technological Discontinuity on Entry

		Model 1 Entry	Model 2 Entry	Model 3 Entry
Independent Variables				
Patent War Intensity	**H1**		-0.210	-4.862*
			(0.435)	(2.241)
Patent Stock	**H2a**		46.625***	49.470***
			(7.384)	(7.351)
Technological Discontinuity	**H3a**		0.351**	0.281*
			(0.114)	(0.121)
Interaction				
Patent War Intensity × Patent Stock	**H2b**			-6.975*
				(3.525)
Patent War Intensity × Technological Discontinuity	**H3b**			-0.845*
				(0.347)
Controls				
GDP Growth		0.003	-0.037	-0.023
		(0.088)	(0.122)	(0.125)
Population Growth		0.089	-0.081	-0.109
		(0.143)	(0.212)	(0.212)
Institutional Quality		1.066*	0.088	0.094
		(0.416)	(0.621)	(0.633)
Product Diffusion Growth		-0.838***	-0.665***	-0.662***
		(0.136)	(0.181)	(0.184)
Industry Concentration		-2.795***	-2.022***	-2.098***
		(0.299)	(0.341)	(0.352)
Entry Rate		0.322***	0.319**	0.354**
		(0.085)	(0.107)	(0.108)
Exit Rate		0.627***	0.777***	0.793***
		(0.085)	(0.109)	(0.110)
Store-Based Retailing Growth Rate		-0.867***	-0.861***	-0.902***
		(0.143)	(0.183)	(0.186)
Firm Patent Applications		1.274+	4.156*	3.829*
		(0.691)	(1.662)	(1.702)
Acquisitions		4.473	3.387	3.349
		(132.747)	(169.836)	(173.367)
N		2199	2199	2199
Log Likelihood		-374.502	-214.774	-208.205
Nagelkerke *R-sq*		0.434	0.699	0.709
Chi-sq		440.227	759.684	772.821
Prob > *Chi-sq*		0.000	0.000	0.000

Estimates are based on standardized variables; standard errors are reported in parentheses.
+ $p < 0.10$,
* $p < 0.05$,
** $p < 0.01$,
*** $p < 0.001$

The Impact of Patent Wars and Strength of Intellectual Property Rights on Firm Performance: Evidence from the Global Mobile Phone Industry

Abstract

Patent wars and strength of intellectual property rights (IPR) in a firm's host country are assuming increasing attention, particularly for high-technology firms seeking to achieve performance efficiency in that country. This study investigates how patent war intensity and strength of IPR in a country affects firm's performance in that country. The results indicate that intensity of patent wars in a country has a negative effect on a firm's performance in that country, whereas strength of IPR in that country has a positive effect on its performance. We also show that firm's performance in a country is affected by the interplay between intensity of patent wars and strength of IPR in that country. Hypotheses are tested using a sample of 85 mobile phone firms that operate from 2003 to 2015 in 46 countries.

1. Introduction

In the competitive commercial world, high technology firms have recognized that the right to exclude others can be taken as an advantage. As a consequence, firms proactively engage in aggressive patent litigation campaigns to protect their inventions against potential infringement that enables them to protect their competitive position (Rudy & Black, 2015). Besides, for defensive purposes, firms strategically use patents as offensive weapons to pose litigation threat against rivals which limits the ability of rivals to innovate, that in turn may adversely affect rivals' performance (Jaffe & Lerner, 2011; Somaya, 2012). As Teece (2000) notes, firms' freedom to operate in a given market is contingent on the risk posed by patent infringement litigation by their rivals in that market. The risk of being sued which limits the competition in a given market, points to the fact that litigations in a country market may have an effect on the performance of not only firms who are involved in litigation but also the ones who are not involved in litigation and who fear the threat of being taken to court for the infringement of a patent. "Firms that are not directly involved in litigation could be affected by escalating patent wars" (Paik & Zhu, 2016: 1).

First, although past research has revealed the impact of patent litigation on the performance of opposing parties in litigations (i.e., plaintiff, defendant) (Rudy & Black, 2015; Schliessler, 2015), to our knowledge there is a scarcity of research examining how the intensity of patent wars among various patent holders and infringers in a country affect the performance of firms regardless of whether or not they are involved in a litigation process in that country. We answer to this question by bridging the literature on patent enforcement strategy (Agarwal, Ganco, & Ziedonis, 2009; Graham & Vishnubhakat, 2013; Lanjouw & Schankerman, 2001; Paik & Zhu, 2016) with the one on patent related antecedents of firm performance (Ceccagnoli, 2009; Cockburn, MacGarvie, & Mueller, 2010; Rudy & Black, 2015; Schliessler, 2015).

Second, although there have been studies showing that protection of intellectual property rights (IPR) positively influences firm innovation (Allred & Park, 2007; Chen & Puttitanun, 2005; Kanwar & Evenson, 2003; Kim, Lee, Park, & Choo, 2012), as Allred and Park (2007) note, no studies so far have examined the influence that IPR have on firm performance. Accordingly, since the degree to which firms' innovations are protected by legal mechanisms affects how firms profit from innovation (Teece, 1986), this paper offers an initial attempt to address this gap by examining how the strength of IPR in a country affects firm's performance in that country, and extends the literature on the relationship between patent wars and firm performance by examining the moderating role of the strength of IPR.

The rest of our paper is organized as follows. We first provide an overview of the theory, deriving two hypotheses that focus on the relationship between patent wars, strength of IPR, and firm performance. We then turn our attention to the role of the strength of IPR in changing the relationship between patent wars and firm performance. Subsequently, we describe our research setting, that is, the mobile phone industry covering 85 mobile phone vendors competing in 46 countries from 2003 to 2015. Then, we discuss research methods and present our findings. Finally, the paper concludes with a discussion of the findings.

2. Theory Background and Hypotheses

2.1 The Influence of Patent Wars on Firm Performance

In competitive environments where imitation is likely, if patent infringement is detected, defending a patent infringement litigation is costly, time consuming, unpredictable and disruptive (Somaya, 2012; Weatherall & Webster, 2014). Particularly when plaintiff firms who are less likely to settle with the alleged infringers, use patents as offensive weapons, as they seek to carve out a stronger patent position in the technology domain (Somaya, 2003, 2012) and exclude direct competitors (i.e., actual infringers) or other competitors (i.e., potential infringers) from technology use or licensing agreements, thereby preventing them

from gaining future market shares (Tansey, Neal, & Carroll, 2005). For that reason, in a country market where patent wars intensify, firms will have reason to fear the cost of defending a potential costly litigation which might be brought to court by their patent holder rivals. Accordingly, this threat of litigation negatively affects firms' incentives to innovate, and firms may be forced to redesign around key patents or terminate the research and development and manufacturing of a product, because they can not afford to risk of being brought into a costly patent infringement lawsuit (Allred & Park, 2007; De Leon & Donoso, 2017; Ménière & Parlane, 2008), that in turn will negatively influence firms' performance. Therefore, we expect that the higher the intensity of patent wars in a firm's host country market, the lower the firm's incentive to innovate due to relatively high threat of patent infringement, thereby affecting negatively the firm's performance. Thus, we posit:

Hypothesis 1: There is a negative relationship between the intensity of patent wars in a firm's host country and the firm's performance in that country.

2.2 The Influence of IPR strength on Firm Performance

IPR protection has been considered a key issue in both domestic and international policy debates, and it shows great variations among countries. In developing countries, which contain weak appropriability regimes and lack the resources to uphold stronger IPR laws, enforcement of IPR is difficult, therefore firms often can not protect their innovations against both domestic and foreign imitation. In contrast, developed economies which have higher IPR laws, tend to have a higher strength of protection for innovation against imitation, and higher commitment of governments to protect these rights (Keupp, Beckenbauer, & Gassmann, 2010; Khoury, Cuervo-Cazurra, & Dau, 2014). These differences in IPR regimes across countries has attracted the attention of scholars who have shown that there is a positive effect of IPR protection on firm innovation (Allred & Park, 2007; Chen & Puttitanun, 2005; Kanwar & Evenson, 2003; Kim et al., 2012).

Countries with weak IPR protection discourage firms to innovate, as such innovations could be easily imitated by others with limited or no resources and without incurring substantial costs (Allred & Park, 2007; Chen & Puttitanun, 2005). However, countries having strong IPR protection with increased penalties for patent violations, enable innovating firms that create novel and industrially applicable products to better exploit their innovation potential, meet the characteristics of the industry and gain competitive advantage. Since, in these countries the environment is supportive of innovation and patents are successfully enforced, firms can guard against imitation and they are rewarded for innovation (Allred & Park, 2007; Ceccagnoli & Rothaermel, 2008).

Innovation is a crucial driver of a firm's performance and its competitive advantage (Banbury & Mitchell, 1995; Porter, 1990; Roberts, 1999). Since the degree to which innovations are protected by legal mechanisms influence how firms rewarded for and profit from innovation (Teece, 1986), we expect firms to achieve better performance in countries with strong IPR. Accordingly, we posit:

Hypothesis 2: There is a positive relationship between the strength of IPR in a firm's host country and the firm's performance in that country.

2.3 The Moderating Effect of IPR Strength

Although intensity of patent wars in a firm's host country negatively influences the firm's performance in that country, we argue that this negative effect will become weaker in countries with strong protection of IPR. We can expect this relationship to become weaker because of fewer information asymmetries in these countries. As Khoury et al. (2014) note, countries with poor institutional environments and institutional voids are the ones with less IPR protection. In these countries, information asymmetries exist and firms' ability to obtain clear information on rivals will be hindered, therefore they can not assess whether intensified patent wars among rivals will pose a threat on them. On the other hand, countries with strong

institutional arrangements are the ones with strong IPR protection that facilitate firms' access to required information on competitors such as their patent application and expiration dates, licensing agreements, litigation issues, revenues and etc. (Frey, 2013). Therefore, in countries with strong IPR protection we should expect firms to efficiently use this information to mitigate the litigation threat from their rivals in countries with high patent wars that deters them from innovating, thereby affecting positively their performance.

Hypothesis 3: The strength of IPR in a firm's host country positively moderates the negative relationship between the patent war intensity and the firm's performance in that country.

3. Methods

3.1 Research Setting and Sample

In order to test our hypotheses, we analyzed data of 85 mobile phone firms that operate in 46 countries from 2003 to 2015. The choice of the mobile phone industry as a setting was considered particularly appropriate for several reasons. First, over the mid 2000s, mobile phone firms have been committing enormous resources in litigation against their rivals to exclude them from using and licensing technology, therefore preventing them from gaining future market shares (Paik & Zhu, 2016; Tansey et al., 2005). A case in point is the patent battle between Apple and Samsung in 2011, which led the US court in 2012 to order Samsung's payment of $1.05 billion damages to Apple for copying Apple's iPhone. This caused Samsung's shares to drop by 7.5 percent in 2012, wiping off more than $12 billion off the its market value (Kim, 2012). The intensified patent wars not only affect the performance of sued firms but also the ones who are not involved in litigation. For instance, following the intensified competition and patent battle between Apple and Samsung in the US, HTC had to cut its sales forecast which caused its profit to decline by 2012 (Culphan, 2012).

Second, mobile phone vendors compete internationally, therefore they are affected by different IPR protection regimes of the countries where they operate. Accordingly, with the time frame in our study from 2003 to 2015, we provide empirical evidence on how the performance of mobile phone vendors regardless of whether or not they were involved in litigation, are affected by the varying levels of patent wars and IPR protection systems of countries in which they operate.

We construct our dataset of mobile phone vendors using information from several data sources. The information about mobile phone vendors' both global- and country-level annual sales and market shares was collected from *Euromonitor International* (2003-2015). We obtained country-level litigation data within the mobile phone industry from *LexisNexis*. Lastly, the information about the strength of the IPR in a given country was collected from *Property Rights Alliance*. In the next section, we explain how we used this information to operationalize the key variables in our analysis.

3.2 Measures

3.2.1 Firm performance

Our dependent variable is the *firm's performance* in a given country. Consistent with the extant literature (Giachetti, Lampel, & Li Pira, 2017), we operationalized firm performance by using the natural logarithm of the number of handset units sold by a firm on a yearly basis in a given country. Firm's unit sales as a measure of firm performance has been broadly used by mobile phone industry authorities such as Mintel International Group Limited and Gartner Dataquest (Giachetti et al., 2017). Data on firm's handset units sold in a given country were collected from Euromonitor International (2003-2015).

3.2.2 Patent war

We operationalized *patent war intensity* in a given country by tracking media articles discussing court cases of mobile phone vendors in a certain country in a given year.

Therefore, we used LexisNexis to construct a measure of patent war intensity based on media articles published in all major world publications (e.g., The Times, The Guardian, The New York Times, The Wall Street Journal and The Korea Times). Consistent with the studies by Tan (2016) who stated that overall level of media coverage can shape the level of public awareness of firms' patent enforcement strategies, and Paik and Zhu (2016) who argued that the level of media coverage of mobile phone conflicts increases as patent wars intensify, we constructed a country-level variable that counted the total number of media articles related to mobile phone lawsuits in each country for a given year. More specifically, we counted the total number of articles for each year containing different combinations of "mobile phone" related keywords (e.g., cell phone, cellular handset, mobile phone, mobile handset, smartphone, etc.), "patent" keywords and various combinations of keywords associated with a court action (e.g., infringement, lawsuit, dispute, case, litigation, etc.). Beside these keywords, in order to track mobile phone related court cases in each country, we used multiple combinations of keywords related to a specific country's legal institution (e.g., Italian court, Italian judge, court in Italy, judiciary of Italy, etc.).

3.2.3 Strength of IPR

We measured the *strength of intellectual property rights* in a firm's host country by using the Intellectual Property Rights Index (IPRI), which has been published annually by the Property Rights Alliance from 2007 onwards. IPRI index which is formed by taking the average of three sub-component indexes: (1) *Protection of Intellectual Property Rights*, (2) *Strength of Patent Rights* and (3) *Copyright Protection,* evaluates the strength of IP protection in a given country (Paik & Zhu, 2016). This index ranges from 0 to 10, with 10 reflecting the strongest level of IPR in a given country and 0 reflecting the weakest level of IPR in a country.

3.2.4 Control variables

Mobile phone vendors' performance may be affected by many other factors, therefore we controlled for both country- and firm-level characteristics in our analysis. First, with respect to country-level controls, we included the *total market share of firms from developed countries.* Firms from developed countries as compared to their rivals from developing countries have stronger ownership advantages in the fields such as branding and advertising and technology. Moreover, host countries' governments tend to favour the establishment of resource-rich firms from developed countries to bring more advanced technology to the country, and customers more often choose products by firms from developed economies due to their established brand image (Aulakh, Rotate, & Teegen, 2000; Cuervo-Cazurra & Genc, 2008). Accordingly, firms from developed countries are better positioned against their rivals from emerging economies (Cuervo-Cazurra & Genc, 2008). We measured the total market share of developed firms in a given country by summing the market share of firms who have developed country of origin. Although, developed country firms are at an advantage relative to the rivals from developing countries, developing country firms know better how to operate in countries with challenging institutional environments and they have cost advantages over rivals from developed countries. Therefore, we controlled for the *total number of firms from developing countries* in a given country (Aulakh et al., 2000; Cuervo-Cazurra & Genc, 2008). Third, since country markets with larger sizes offer increased opportunities for firms to benefit from stronger bargaining position against customers and suppliers, and help firms to reach cost effectiveness and increase profits (Kang & Jiang, 2012; Kogut, 1985), we controlled for *market size* in a given country. We measured market size by taking the natural logarithm of total handset units sold by all vendors in a given country in a given year. Yearly data on mobile phone market size in various countries was obtained from *Euromonitor International*. Furthermore, since in high growing markets it is easier for firms to acquire and retain customers and earn profits (Gatignon & Xuereb, 1997), we controlled for *market*

growth in a given country by calculating the annual change of aggregate units sold by all handset vendors in a country. Additionally, we controlled for *market share instability*, as instability in shares is a sign of active competition and rivalry, which is likely to influence firms' performance (Sakakibara & Porter, 2001). We measured market share instability in a given country by taking the sum of the absolute value of the annual percentage changes in market shares of all competitiors in that country. We also controlled for the *ratio of non-store based retailing to store based retailing* which is measured by taking the ratio of the shares of non-store based retailers to store based retailers in a given country in a given year. We can expect that the higher the ratio of non-store based retailing to store based retailing in a country, the higher the customers' propensity to buy products through e-commerce channels (e.g., third party retailers, Amazon.com, Aliexpress.com, etc.), thereby resulting in lower bargaining power of physical stores (e.g., telecom carriers' retail chains, consumer electronics physical stores, etc.). A higher ratio means easier for e-commerce firms to penetrate the country market, influencing negatively incumbent firms' performance in that country. Data on shares of non-store based and store based retailers in the mobile phone industry was gathered from *Euromonitor International*.

As for firm-level controls, since in the extant literature acquisitions have been found to influence firm's performance in a given market (Tuch & O'Sullivan, 2007), we controlled for firms that were involved in *acquisitions* with other firms over our observation period. After having searched LexisNexis for media articles discussing acquisitions in the mobile phone industry, we generated a dummy variable giving it the value 1 for the year of the acquisition onwards, and 0 for the years before the acquisition. Moreover, we controlled for firms that compete with their host country rivals in more than one distinct geographic market, namely firm's degree of *multimarket contact (MMC)* with its host country rivals. Majority of studies on multimarket competition showed that the degree of firm's MMC with its host

country rivals is positively associated with firm's performance in that country market (Yu & Cannella, 2013). Therefore, consistent with the extant literature (Yu, Subramaniam, & Cannella, 2009), we measured firm's level of MMC with its host country rivals with an indicator that captures the degree of MMC between a focal firm and its competitors in a given country. Finally, we included *global firm size* to assess whether larger firms at the global level are also the ones who are more likely to achieve better sales performance in a given country. Global firm size was measured by taking the natural logarithm of a firm's sales at the worldwide level.

4. Analysis and Results

Taking into account multiple firms, multiple years and multiple countries structure of our database, we used panel data techniques to test our hypotheses. A Hausman test indicated that the use of fixed-effects regression was preferable over random-effects. Accordingly, we use robust fixed-effects regression to test our hypotheses in order to control for heteroscedasticity and time-series dependence in the data (Cameron & Trivedi, 2009). All variables were lagged by one year except firm performance, to make rational assumptions about the fact that firm performance is not a contemporaneous but a subsequent response to varying levels of patent wars and IPR protection. Additionally, we standardized independent variables to allow for comparison of their coefficients and, thus, evaluate the relative magnitude of predictors' effect on firm performance. Furthermore, we calculated variance inflation factors (VIFs) to determine whether there was multicollinearity in the analysis. The average VIF scores were all below 1.78, and no individual VIF was greater than 3.4, thereby all were lower than the recommended threshold of 10 (Chatterjee & Hadi, 2006). Table 1 reports the descriptive statistics of the variables.

Please Insert Table 1 about here

4.1 Patent War Intensity and Strength of IPR on Firm Performance

Table 2 reports the results of our hypotheses on firm performance. In Table 2, Model 1 is an examination of the effects of control variables on firm performance. In Model 2, we added the main effect of patent war intensity, and in Model 3, the main effect of the strength of IPR. Finally, in Model 4 –the *full model*- we included all controls, main effects and the two-way interaction effects between patent war intensity and strength of IPR.

Please Insert Table 2 about here

Hypothesis 1 states that as the intensity of patent wars in a firm's host country increases, the firm's performance in that country will decrease. As can be observed from Table 2, in Model 4 the relationship between the patent war intensity and the firm performance is negative and highly significant (β = -0.84, p < .001), thereby supporting Hypothesis 1.

Hypothesis 2 states that the stronger the IPR in a firm's host country will have a positive effect on the firm's performance in that country. Hypothesis 2 is supported as shown in Model 4 with the positive and statistically significant coefficient for the strength of IPR (β = 0.25, p < .01).

With Hypothesis 3, we predict that the strength of IPR in a firm's host country positively moderates the negative relationship between the patent war intensity and the firm's performance in that country. As shown in Model 4, the coefficient of the interaction between patent war intensity and strength of IPR is positive and highly significant (β = 0.62, p < .001), thus supporting Hypothesis 3. Figure 1 which shows the plot of interaction between patent wars and strength of IPR confirms that the negative effect of patent war intensity on firm performance is weaker in countries with strong IPR.

Please Insert Figure 1 about here

4.2 Robustness Tests

Since it takes time for firms to recognize potential threats and harms from patent infringement cases in their host country, and firms before making an assessment of their incentives to innovate, which consequently influences their performance, need to take into consideration the evolution of litigations in their host country, we checked whether our results are robust in Table 2, Model 5 by measuring patent war intensity in a given country by taking the total number of media articles discussing mobile phone court cases in that country for the past two years. Model 5 shows that results are consistent with the ones in Model 4.

We also wanted to check whether our results are robust also with an alternative index to the one used in our analysis. Various indexes have been used by scholars to measure the level of IPR protection in a given country (Liu & La Croix, 2015; Park, 2008; Seyoum, 1996). As Liu and La Croix (2015) note, Ginarte and Park's index provides a good measure of the overall strength of patent protection for a given country. The index which was first developed by Ginarte and Park (1997) was extended by Park (2018) that covers 122 countries at five years intervals from 1960 to 2015. The index is comprised of five general dimensions that influence the extent and strength of national patent laws. Following the approach used in previous studies (Ang, 2010), we linearly interpolated missing data between years. The analysis using the Ginarte and Park's index is shown in Model 6 (Table 2). As can be seen in Model 6, results remain consistent with the ones in Model 4.

5. Discussion and Conclusion

This paper empirically shows how intensity of patent wars and strength of IPR in a country affect performance of firms in that country. Although studies by Rudy and Black (2015) and Schliessler (2015) have focused on how patent litigations between opposing parties affect their performance, our paper makes the first attempt to exploit how patent war intensity at the country-level influences firms' performance regardless of whether or not firms are involved in a litigation process, as firms that are not directly involved in litigation may also be affected by

intensified patent wars. Furthermore, even though majority of studies in economics and management have found a positive impact of IPR strength on firms' innovative activities (Allred & Park, 2007; Chen & Puttitanun, 2005; Kanwar & Evenson, 2003; Kim et al., 2012), to our knowledge as Allred and Park (2007) highlight, no studies have yet demonstrated its direct impact on firms' performance. In light of this gap in the extant literature, this study provides the first empirical evidence of how heterogeneity in IPR regimes across countries influences firm performance. In addressing these gaps, we bridge the literatures on patent enforcement strategy and IPR with the one on the associated antecedents of firm performance.

First, we find that as patent wars in a firm's host country intensify, high litigation threat on the firm that reduces its incentive to innovate, negatively affects its performance in that country. Second, our findings suggest that the stronger the IPR in a firm's host country, the more the firm will be rewarded for and profit from innovation, thereby increasing its performance in that country. Our findings also show that strong IPR in a firm's host country weakens the negative effect of patent wars on firm's performance in that country.

Our research suggests that managers should be mindful of the broader consequences and potential negative impact of escalated patent wars in their host country on their performance. Besides, firms when planning to enter new countries with high intensity of patent wars and low IPR protection not to rely on experience gained when structuring their innovative activities in countries that have high intensity of patent wars and strong IPR protection.

Having shown the crucial role that countries with different levels of patent wars and IPR protection play in enhancing or hindering firm performance, to extend our findings research can turn its attention to fuller exploration of how firms' performance are affected by escalating patent wars in different industrial settings. Future research could also examine how

firms' performance are affected by distribution of host country rivals with different origins (i.e., developed or developing country origin), size classes and goals.

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Table 1
Descriptive Statistics

	Mean	Sd	Min	Max	1	2	3	4	5	6	7	8	9	10	11	12
Firm Performance	6.133	1.991	-1.204	11.267	1.000											
Patent War Intensity	5.673	32.505	0.000	481.000	0.156***	1.000										
Strength of IPR	6.372	1.459	3.000	8.558	-0.097***	0.204***	1.000									
Market Share of Developed Country Firms	48.837	15.462	3.700	87.000	-0.155***	-0.033+	0.256***	1.000								
Number of Developing Country Firms	5.188	2.989	1.000	17.000	0.206***	0.023	-0.239***	-0.531***	1.000							
Market Size	9.381	1.330	6.893	12.984	0.595***	0.242***	-0.178***	-0.315***	0.538***	1.000						
Market Growth	0.066	0.147	-0.456	0.871	0.121***	-0.005	-0.174***	0.053**	0.053**	0.122***	1.000					
Market Share Instability	0.035	0.048	0.000	0.474	0.049**	-0.035*	-0.026	-0.081***	-0.054**	0.051**	0.026	1.000				
Non-Store Based Retailing to Store Based Retailing Ratio	0.140	0.166	0.000	1.433	-0.139***	0.005	0.401***	-0.079***	0.108***	-0.141***	-0.130***	-0.149***	1.000			
Acquisitions	0.100	0.300	0.000	1.000	-0.035*	0.019	-0.010	-0.157***	0.080***	0.020	-0.083***	-0.002	0.037*	1.000		
Multimarket Contact	26.765	13.430	0.000	44.000	0.026	-0.058***	0.019	0.141***	-0.505***	-0.406***	0.021	0.002	-0.073***	-0.108***	1.000	
Global Firm Size	10.407	1.896	-0.357	12.853	0.375***	0.004	-0.012	0.013	-0.174***	-0.099***	0.025	0.024	-0.063***	-0.064***	0.714***	1.000

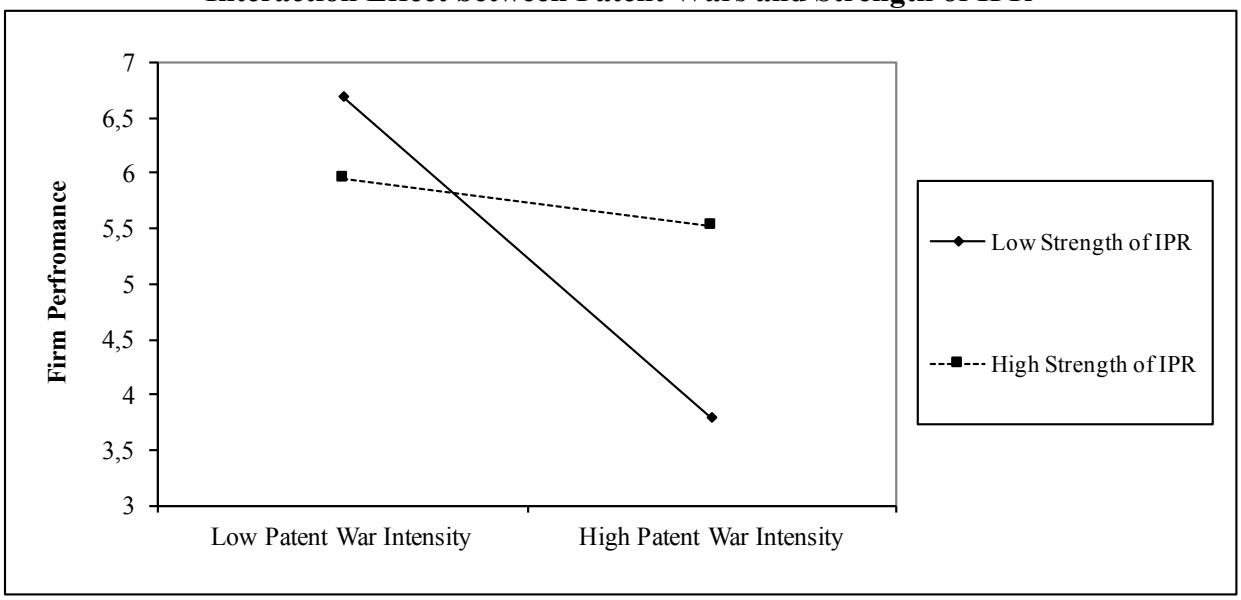
All variables are lagged by one year, except Firm Performance.
N =3414
+ $p < 0.10$
* $p < 0.05$
** $p < 0.01$
*** $p < 0.001$

Table 2
Robust Fixed-effects Regression for the Impact of Patent Wars and Strength of Intellectual Property Rights on Firm Performance

		Model 1 Firm Performance	Model 2 Firm Performance	Model 3 Firm Performance	Model 4 Firm Performance	Model 5[a] Firm Performance	Model 6[b] Firm Performance
Constant		5.607***	5.607***	5.609***	5.487***	5.493***	5.573***
		(0.030)	(0.030)	(0.030)	(0.047)	(0.058)	(0.034)
Independent Variables							
Patent War Intensity	**H1**		-0.022+		-0.838***	-0.724*	-0.369***
			(0.011)		(0.242)	(0.300)	(0.108)
Strength of IPR	**H2**			0.168+	0.247**	0.219*	0.227+
				(0.088)	(0.094)	(0.094)	(0.122)
Interaction							
Patent War Intensity × Strength of IPR	**H3**				0.616***	0.522*	0.235**
					(0.182)	(0.227)	(0.073)
Controls							
Market Share of Developed Country Firms		0.144**	0.147**	0.143**	0.136**	0.138**	0.140**
		(0.045)	(0.045)	(0.045)	(0.045)	(0.046)	(0.046)
Number of Developing Country Firms		-0.114*	-0.108*	-0.122*	-0.105*	-0.105*	-0.101*
		(0.047)	(0.047)	(0.047)	(0.047)	(0.047)	(0.048)
Market Size		0.604***	0.606***	0.572***	0.584***	0.595***	0.529***
		(0.124)	(0.125)	(0.124)	(0.124)	(0.124)	(0.131)
Market Growth		0.029	0.030	0.036	0.026	0.033	0.032
		(0.027)	(0.027)	(0.027)	(0.027)	(0.027)	(0.028)
Market Share Instability		-0.112	-0.116	-0.067	-0.115	-0.118	-0.107
		(0.245)	(0.245)	(0.245)	(0.249)	(0.249)	(0.247)
Non-Store Based Retailing to Store Based Retailing Ratio		-0.118**	-0.118**	-0.115**	-0.113**	-0.113**	-0.115**
		(0.040)	(0.040)	(0.040)	(0.040)	(0.040)	(0.040)
Acquisitions		0.062*	0.063*	0.062*	0.062*	0.064*	0.062*
		(0.026)	(0.026)	(0.026)	(0.026)	(0.026)	(0.026)
Multimarket Contact		0.014	0.021	0.026	0.040	0.040	0.046
		(0.074)	(0.074)	(0.075)	(0.075)	(0.075)	(0.076)
Global Firm Size		1.736***	1.737***	1.734***	1.742***	1.740***	1.740***
		(0.104)	(0.104)	(0.104)	(0.104)	(0.104)	(0.106)
N		3414	3414	3414	3414	3414	3354
Within R-sq		0.423	0.424	0.424	0.431	0.429	0.430

[a] Patent War Intensity is measured by taking the total number of media articles related to mobile phone lawsuits in each country for the past two years.
[b] Strength of IPR in a given country is measured by using Ginarte and Park's Index instead of using Property Right Alliance's Intellectual Property Rights Index.
Estimates are based on standardized variables; standard errors are reported in parentheses.
+ $p < 0.10$,
* $p < 0.05$,
** $p < 0.01$,
*** $p < 0.001$

Figure 1
Interaction Effect between Patent Wars and Strength of IPR



Estratto per riassunto della tesi di dottorato

Studente: Ergun Onoz matricola: 956248

Dottorato: Management

Ciclo: XXXI

Titolo della tesi: *Three Essays on Competition in the Global Mobile Phone Industry*

Abstract:

This dissertation that includes three quantitative essays on competition in the global mobile phone industry contributes to the field of competitive dynamics by examining strategic decisions and performance outcomes of 85 mobile phone vendors that operate in 46 countries from 2003 to 2015. In the first essay, we made an attempt to shed light on how institutional quality of an MNE's host country affect the observability of actions of the MNE's rivals in that country, that in turn affects the ability of the MNE to conduct an MMC strategy. The second essay contributes to the literature on patent enforcement strategies and antecedents of market entry decisions by highlighting the crucial role that escalating patent wars in a country play in deterring potential entrants. Third essay makes the first attempt to empirically show how escalating patent wars and IPR protection in a firm's host country influence its performance in that country.

Firma dello studente