CUSTOMER BASE MANAGEMENT AND PROFITABILITY IN INFORMATION TECHNOLOGY INDUSTRIES

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CUSTOMER BASE MANAGEMENT AND PROFITABILITY IN INFORMATION TECHNOLOGY INDUSTRIES♣

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Abstract

The study of information-technology (IT) markets has emerged as an important research theme in the literature. They are governed by a unique set of features and characteristics that may render invalid some of the well-established models and findings in prior research. In these markets, the customer base becomes a critical strategic asset to assessing the firm's current and future competitive position. To optimally manage the customer base and maximize profitability in IT industries, it is crucial to understand the key drivers of customer acquisition and retention, and how they are related to performance outcomes. In this study, we integrate customer relationship management (CRM) and information systems research and provide a comprehensive framework to understand the effects of two defining IT characteristics, network effects and market growth, on a firm's ability to acquire and retain customers, and the links from acquisition and retention to profitability. The proposed framework is empirically tested in the European mobile communications industry using a panel that provides longitudinal information (quarterly data during 1998-2008) for 65 companies in 19 European markets. The results reveal that network size and market growth positively affect customer acquisition and retention, and that these two IT characteristics moderate the impact of price on customer acquisition, but not on retention. They also show that acquisition and retention are two key sources of profitability for IT firms. This research discusses the theoretical and managerial implications of the study findings.

JEL: M21, M15, L96

Key-words: Customer management, Information-Technology markets, Network effects, Market growth, Profitability

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1. INTRODUCTION

Information-technology (IT) markets represent a large and growing portion of the world's economy. They are one of the main sources of economic growth in modern economies (Greenspan, 2000) and provide the basis for the development of a knowledge-centric world. In these markets, the customer base becomes a critical strategic asset to assessing the firm's current and future competitive position (Shankar and Bayus, 2003; McIntyre and Subramaniam, 2009), and the firm's ability to acquire and retain consumers the cornerstone of a customer base management strategy (Reinartz, Thomas, and Kumar, 2005; Thomas, 2001). However, such markets are governed by a unique set of features and characteristics that may render invalid traditional customer relationship management (CRM) models and well-established findings in the customer management literature (Shapiro and Varian, 1998). Thus, understanding the most important drivers of customer acquisition and retention and how they are related to profitability in IT markets becomes of paramount importance for a firm's decision-making processes.

In this research, our focus is on investigating the effects of two distinctive features of IT markets: network effects and market growth (Heide and Weiss, 1995; Shapiro and Varian, 1998; Farrell and Klemperer, 2007). Network effects emerge when the utility of a user increases with the number of other users consuming the good or service (Katz and Shapiro, 1985).[1] In IT industries, products exhibit a high degree of network effects and customer utility is thus significantly influenced by the size of the network of users. According to the resource based view of the firm, the size of the network is a rare and difficult to imitate resource that can be used to gain a competitive advantage (Shankar and Bayus, 2003; McIntyre and Subramaniam, 2009). A large network reduces consumer uncertainty, allows interactions among users and increases the availability and quality of complementary and compatible goods, all of which determines the way in which the customer behaves in the relationship (Frels, Shervani and Srivastava, 2003; Stremersch *et al.*, 2007). A second defining element of IT industries is the

[1] A good can exhibit direct and/or indirect network effects. Direct network effects refer to the increase in consumer utility that occurs when the number of other users consuming the product increases. Indirect network effects occur when the utility of the core product increases with the quality and availability of complementary products. Given our data and the focus of this article, we focus on direct network effects.

high market growth that they exhibit. In the US, these markets have been growing, on average, four times faster than the rest of the economy (Srinivasan, Lilien and Rangaswamy, 2004). A high market growth is expected to influence a firm's ability to acquire and retain consumers. The dynamic evolution of a market affects customer decision making with respect to the relationship and it has been regarded as an important driver of customer behavior (Voss and Voss, 2008). For instance, a rapid sales growth in the product life cycle increases uncertainty and makes behavior less predictable, with customers seeking variety and being less willing to make investments in the relationship.

In this study, our main premise is that the defining characteristics of IT markets and, especially, network effects and high market growth, influence the firm's ability to acquire and retain consumers. Specifically, we argue that they have a direct impact on customer acquisition and retention as well as an indirect effect through their moderating role on the relationship between marketing (pricing) and customer acquisition and retention. In addition, we propose that customer acquisition and retention (i.e. the size and stability of the customer base) are key determinants of profitability. Prior research has provided valuable conceptual and empirical insights into the drivers of customer acquisition and retention (Gustafsson, Johnson and Roos, 2005; Reinartz and Kumar, 2003; Verhoef, 2003), and into the sources of profitability and firm success (Venkatesan and Kumar, 2004). However, despite these recent advances, IT markets are governed by a set of characteristics that may limit the applicability of the previous models and findings (Chen and Hitt, 2007). Specifically, network effects and high market growth have been found to change the nature of competition in markets where they are present and to significantly alter customer behavior (Aaker and Day, 1986; Farrell and Klemperer, 2007; Shankar and Bayus, 2003; Srinivasan, Lilien and Rangaswamy, 2004; Frels, Shervani and Srivastava, 2003). Thus, gaining knowledge about the specific drivers of acquisition and retention in IT industries and of the extent to which acquisition and retention contribute to generate value for IT firms becomes of paramount importance to develop optimal customer base management strategies and to allocate valuable marketing resources to the most profitable strategic options. In this study, we propose to advance prior findings by understanding the role of network effects and market growth on acquisition and retention, and their subsequent impact on profitability.

We have two main research objectives and areas of contribution to the literature. First, by integrating research from CRM and information systems, we aim to develop a comprehensive conceptual framework for customer base management in IT industries that evaluates the direct effect of network size and market growth on customer acquisition and retention, as well as their moderating role in the link between pricing and acquisition and retention. Moreover, this model proposes to link the firm's ability to acquire and retain consumers to profitability in order to investigate the extent to which they contribute to create firm value in this specific context. Second, we want to empirically illustrate the conceptual model with an application to the European mobile communications industry using a longitudinal panel that includes 65 companies in 19 European markets and covers the period 1998 to 2008. By way of preview, we find that a large network size and high market growth enhance customer acquisition and retention, and that they moderate the effect of pricing strategies on the ability of the firm to acquire customers, but not to retain them. Our results also reveal that, after we control for additional sources of performance, acquisition and retention are two critical determinants of a firm's profitability in IT industries.

The rest of the manuscript is organized as follows. In the next section, we review the relevant literature pertaining to CRM and information systems and provide the theoretical foundations to develop the conceptual model and research hypotheses. Subsequently, we discuss the econometric model, the study context, and the data that we use to empirically validate the proposed model, and present the results of the analysis. We conclude with a discussion of the main findings and contributions of the article and identify the limitations of this study and avenues for further research.

2. CONCEPTUAL FRAMEWORK

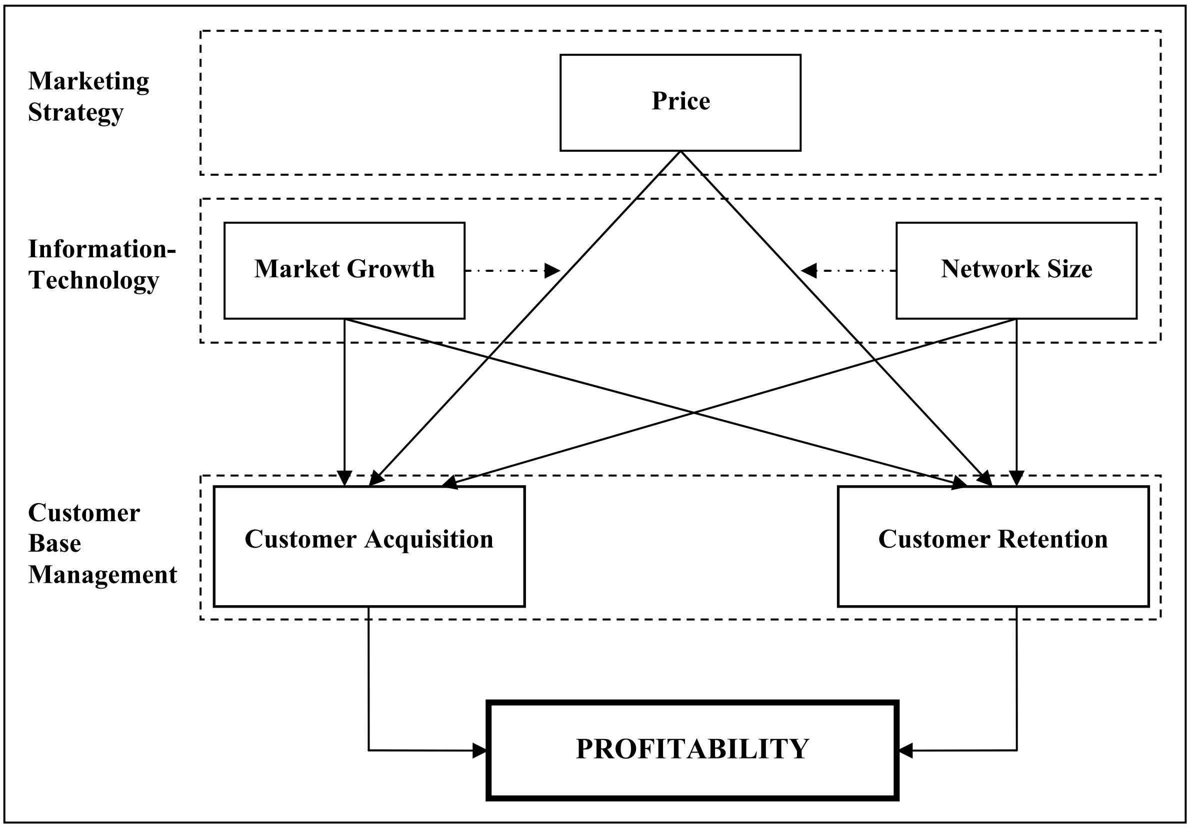
Firm profitability and success in IT industries is determined to a large extent by customer acquisition and retention (Chen and Hitt, 2007). These two constructs summarize the firm's ability to increase the size of the installed base and to protect it from internal and external forces. However, to optimally manage the customer base and maximize profitability in IT industries we must understand the key drivers of customer acquisition and retention and how they are related to financial outcomes. Thus, a primary objective of this study is to provide a comprehensive framework to guide a firm's customer base management strategy that describes and analyzes the linkages between the two IT defining characteristics (network effects and market growth) and customer acquisition and retention, and the impact of a firm's ability to acquire and retain consumers on profitability.

The conceptual framework draws extensively from existing theories on customer relationship management (CRM) and information systems research. Specifically, from CRM literature, we build on conceptual work by Rust, Lemon, and Zeithaml (2004) and Bolton, Lemon and Verhoef (2004), who propose a strategic framework to link marketing inputs with customer perceptions, behavior (acquisition and retention) and financial outcomes (firm profits, customer equity). We also build on empirical evidence investigating the drivers of customer acquisition and retention (Bolton, Lemon, and Bramlett, 2006; Reinartz and Kumar, 2003; Verhoef, 2003). In the area of information systems research, central to our model is the work of Frels, Shervani and Srivastava (2003) and Shapiro and Varian (1998), who argue that networks and market growth are two key drivers of customer behavior and firm profitability in information-intensive industries; and of Chen and Hitt (2007), who state that the firm's success is determined by the size and the stability of its installed base.

We integrate these two research streams and extend the logic to argue that the characteristics of IT industries influence a firm's ability to acquire and retain consumers both directly and indirectly through their moderating effect on the relationship between the firm's pricing strategy and these two constructs. We also argue that customer acquisition and retention will be two key forces affecting a firm's profitability.

Given our data, we focus on two specific aspects that are idiosyncratic to IT industries and that we expect to be intimately linked to acquisition and retention. Specifically, we focus on the impact of network effects (Farrell and Klemperer, 2007; Katz and Shapiro, 1985, 1994; Shankar and Bayus, 2003; Srinivasan, Lilien and Rangaswamy, 2004; Stremersch et al., 2007; Tellis, Yin and Niraj, 2009) and market growth (Aaker and Day, 1986; Christensen, Suarez and Utterback, 1998; Agarwal and Bayus, 2002). The first alters customer behavior by introducing factors beyond the product itself (the user network) into the consumer utility function (Frels, Shervani and Srivastava, 2003). The second influences customer behavior by affecting his/her expectations about the future development of the technology (Aaker and Day, 1986; Brynjolfsson and Kemerer, 1996). Besides their direct effects on acquisition and retention, we claim that these two IT elements will affect the dependent constructs indirectly by moderating the impact of a firm's pricing activity on consumer decisions to initiate and maintain a relationship with a provider. In our framework, we focus on price, a central aspect of the marketing mix for a product/service that is believed to explain a higher amount of variance of the customer purchase and switching decisions than do other marketing-mix variables (Keaveney, 1995; Winer, 1986). A general overview of the conceptual framework is displayed in Figure 1, and we discuss the expected associations between the variables included in the framework next.

FIGURE 1. CUSTOMER BASE MANAGEMENT IN INFORMATION-TECHNOLOGY INDUSTRIES



Network size and customer acquisition and retention

The size of the installed base of a company is an important strategic asset (Shapiro and Varian, 1998), specially in IT industries, in which network effects have been shown to be very important (Varian, Farrell and Shapiro, 2004; Srinivasan, Lilien and Rangaswamy, 2004).[2] Thus, we maintain that the network represents an important component of the consumer utility that is expected to affect a customer's decision to acquire the product/service and maintain the relationship with the vendor.

When confronted with the decision to acquire a product/service from a provider, customers are expected to favor alternatives with large networks, all else being equal. Several arguments

[2] According to Srinivasan, Lilien and Rangaswamy (2004), mobile phone services, the empirical focus of our study, present a high degree of network effects. Specifically, they rate among the highest in a list of 45 goods/services that are believed to be intensive in network effects, and compare favourably with videogames, workstations or CD players, which are common examples when it comes to markets with high network effects.

are relevant to support this assertion. First, a large installed base allows the firm to offer more benefits to potential customers compared with companies with smaller customer bases (Farrell and Klemperer, 2007), which can take the form of reduced uncertainty, compatibility, transfer of technical and non-technical information between members of the network and increased availability and quality of complements. Consistent with diffusion research, the presence of these benefits encourages consumer adoption of the product (Gatignon and Robertson, 1985; Valente, 1995). Farrell and Klemperer (2007) refer to the previous phenomenon as marginal network effects. They suggest that network effects not only increase the utility of the current users of the network, but also enhance others' incentives to adopt it. Overall, network size represents a signal for users that may lead to the beginning of a strong bandwagon.

Second, drawing from information economics, customers frequently use signals to infer unobservable product and service quality (Kirmani and Rao, 2000). In IT industries, the size of the user network is an important quality signal of the product and its current and future complements (Frels, Shervani and Srivastava, 2003). Although some researchers have theoretically argued that superior quality alternatives are frequently pushed aside in these industries (Arthur ,1989; Katz and Shapiro, 1994), Tellis, Yin and Niraj (2009) empirically show that high quality technologies succeed and dominate the markets.

Third, the installed base of a company has important implications on a customer's future expectations about the development of the technology (Shapiro and Varian, 1998). When the user network is large, it represents a guarantee for future development of the product, compatibility with its past versions, and availability and quality of complements.

Customer retention is expected to be positively affected by the size of the network as well. Drawing from economics, several researchers suggest that the presence of strong network effects in IT markets may lead to consumer inertia and lock-in (Katz and Shapiro, 1984; Amit and Zott, 2001; Farrell and Klemperer, 2007). Specifically, a large user network provides important benefits to its members, as noted above, that are not available in alternative options with smaller installed bases. In marketing and psychology, researchers have shown that consumers frequently develop a strong identification with the brand and experience positive feelings of belonging to a community/network (Aaker, 1992; Burnham, Frels and Mahajan, 2003). The larger the customer base, the higher the benefits associated with belonging to a network and the customers' desire to be part of it, leading to increased interdependencies and attachment to the company/brand. As a result of both economic and psychological factors, customers develop switching costs that represent a clear disincentive to explore alternative vendors (Polo and Sese, 2009). In addition, belonging to a large network offers consumers additional opportunities to interact with more users, use the same complements and share knowledge and technical information, which increase the inherent utility that the product/service provides. On the basis of the preceding arguments, we expect network size to positively affect customer acquisition and retention. Stated formally,

$H_{1A.}$ *Network size will have a positive effect on customer acquisition.*

$H_{1B.}$ *Network size will have a positive effect on customer retention.*

Market Growth and customer acquisition and retention

Our second hypothesis pertains to the effect of market growth on customer acquisition and retention. We expect market growth to exert a positive influence on acquisition. In high growth markets, customers quickly follow the lead of the early adopters and adopt the technology from one of the available alternatives in the market (Slater and Narver, 1994). The presence of uncertainty increases the value of information and the expected benefits of considering additional vendors to purchase from (Heide and Weiss, 1995). As a result, the consideration set would be wider and would increase the probability that a given vendor be selected. In addition, a situation of high market growth implies that, at any point in time, there would always be sufficient market resources –enough buyers– for established firms and new entrants. Thus, all else being equal, a period of rapid sales will be positively associated with customer acquisition.

Market growth is also expected to affect customer retention. First, rapid sales attract new competitors and thus increase the number of available alternatives in the market (Aaker and Day, 1986). Customers with more competitive options available are less likely to enter into relational exchanges and exhibit lower retention rates (Voss and Voss, 2008). Second, buyers in dynamic markets are less predictable than in stable markets, seek variety, and are less receptive to long term relationships that may lock them into a specific relationship (Voss and Voss, 2008). Third, high growth markets are characterized by considerable uncertainty and instability (Heide and Weiss, 1995) about the potential user network, the lack of a common standard, compatibility issues and the availability of complementary products (Srinivasan, Lilien and Rangaswamy, 2004). Thus, customers will be reluctant to invest in specific assets and commit a significant amount of resources to a particular technology that may not succeed in the future. Based on the previous reasoning, we formally state the following hypotheses:

***H*$_{2A}$.** *Market growth will have a positive effect on customer acquisition.*

***H*$_{2B}$.** *Market growth will have a negative effect on customer retention.*

Price and customer acquisition and retention

Our third hypothesis pertains to the effect of price on customer acquisition and retention. Price is a central aspect of a firm's marketing strategy and its effects are more direct and immediate than other marketing instruments (Rao, 1984). Over the years, there has been a significant amount of pricing research from several disciplines including microeconomics, psychology and marketing. Conceptually, price is considered an important determinant of customer behavior (Bolton, Lemon and Verhoef, 2004). Empirically, price has been shown to explain a higher amount of variance of the customer purchase decision than other marketing-mix variables (Winer, 1986).

Past price research has provided valuable insights into the effect of this marketing variable on the acquisition of new customers (Guadagni and Little, 1983; Winer, 1986). Based on sound theory and repeated empirical evidence, a generalization emerges that an increase in price leads to a demand reduction (Hanssens, Parsons and Schultz, 2001; Train, McFadden and Ben-Akiva, 1987). That is, a high price makes consumers less willing to purchase the product or service and to initiate a relationship with a given provider. Thus, we expect a high price to have a negative influence on consumer purchase decisions, leading to reduced customer acquisition. The effect of actual prices on consumer retention has been subjected to less inspection and the relationship is considered to be more complex (Bolton and Lemon, 1999). Existing empirical evidence tends to suggest that price negatively influences customer decisions to continue the relationship with the supplier (Keaveney, 1995; Polo and Sese, 2009; Wathne, Biong and Heide, 2001). This is consistent with the argument that absolute prices lead to lower perceptions of price fairness, which in turn increases customer intentions to switch providers (Bolton, Lemon and Verhoef, 2004). It is also consistent with microeconomic consumer theory, which suggests that utility-maximizing consumers react to changes (increases) in price by changing (reducing) their product or service demand. Thus, based on the previous reasoning, we state the following hypotheses:

$H_{3A.}$ *Price will have a negative effect on customer acquisition.*

$H_{3B.}$ *Price size will have a negative effect on customer retention.*

Moderating effect of network size

In addition to investigating the main effect of network size on acquisition and retention, we examine whether this variable moderates the relationship between price and the two focal constructs. When deciding whether to acquire a product or service from a specific vendor, customers assess the value of the offer, where the benefits provided are weighted against the costs that must be incurred (Bolton, 1998). In IT industries, network effects are important (Srinivasan, Lilien and Rangaswamy, 2004), and a significant portion of the customer utility is derived from the network surrounding the product (Frels, Shervani and Srivastava, 2003). By offering increased benefits to potential customers and lowering uncertainty levels, a large installed base would make customers less price sensitive and, thus, we expect price to be less effective at acquiring customers when the size of the network is large. A similar reasoning applies to customer retention. A large installed base allows the firm to offer its clients more benefits, which increase their expectations about future transactions and encourage them to engage in long-term relationships (Farrell and Klemperer, 2007; Garbarino and Johnson, 1999). These benefits generally create switching costs as well, which are believed to lock consumers into the relationship (Amit and Zott, 2001) and make them less price sensitive (Klemperer, 1995). Thus, from the above discussion we expect the relationship between price and customer acquisition and retention to be moderated by the size of the network. More formally,

$\boldsymbol{H_{4A.}}$ *The association between price and customer acquisition will be moderated by network size. The larger the size of the network, the weaker will be the relationship between price and customer acquisition.*

$\boldsymbol{H_{4B.}}$ *The association between price and customer retention will be moderated by network size. The larger the size of the network, the weaker will be the relationship between price and customer retention.*

Moderating effect of market growth

In addition to the direct effect, we expect market growth to moderate the relationship between price and customer acquisition and retention. In IT industries, consumers frequently respond to a rapid pace of technological change by deliberately acquiring new information. However, collecting information about the alternatives is a very costly and time-consuming activity (Heide and Weiss, 1995), and evaluating this information is difficult because it may not be relevant for a long period. Under these circumstances, customers frequently rely on signals to infer unobservable product and service quality (Kirmani and Rao, 2000). Marketing scholars have a long history of recognizing consumers' tendency to use price as an indicator of quality

(Rao and Monroe, 1989), and they suggest that a high price reflects better inputs and, thus, a higher quality. Thus, we expect market growth to make customers less sensitive to changes in the pricing policy of the company. In addition, in these markets, customers face switching costs (Jackson, 1985). These costs frequently give rise to a price pattern known as *bargain-then-rip-off*, under which firms *invest* in increasing the size of the customer base during rapid sales growth periods through aggressive price policies and, once acquired, focus on *harvesting* the customer base through increased prices (Klemperer, 1995). However, these attempts to opportunistically lock consumers into the relationship are negatively valued by consumers (Shapiro and Varian, 1998), who become less sensitive to price changes. Thus, we expect the negative effect of price on customer acquisition to be weakened when market growth is high.

In dynamic markets, customers seeking variety and innovation will be less receptive to engage in long-term relationships (Voss and Voss, 2008) and will thus become more sensitive to variations in the value proposition that the product or service offers. In this context, customer needs are considerably less predictable, and to satisfy their clients, sellers will be forced to offer them greater value (Bolton and Lemon, 1999), leading to a higher price sensitivity by customers. This is consistent with recent arguments suggesting that, in dynamic environments, a customer learning orientation may be ineffective, as it significantly increases the firm's costs and may lead to myopia and missed opportunities (Voss and Voss, 2008). Instead, it is advisable to focus the strategic emphasis on economical (price-related) aspects (Slater and Narver, 1994). On the basis of the previous reasoning, we state the following hypotheses.

$H_{5A.}$ *The association between price and customer acquisition will be moderated by market growth. The higher the growth of the market, the weaker will be the relationship between price and customer acquisition.*

$H_{5B.}$ *The association between price and customer retention will be moderated by market growth. The higher the growth of the market, the stronger will be the relationship between price and customer retention will be.*

Customer acquisition and retention and profitability

The customer base is a key strategic asset that companies must appropriately manage (Shankar and Bayus, 2003). A customer base management strategy is built around two core activities: customer acquisition and customer retention (Rust, Lemon and Zeithaml, 2000). Researchers have conceptually and empirically linked these two constructs to key managerial metrics including customer value and firm performance (Gupta and Zeithaml, 2006; Petersen et al., 2009; Reinartz, Thomas and Kumar, 2005; Rust, Lemon and Zeithaml, 2004). Acquiring and retaining customers is especially relevant in IT markets, where researchers recognize that the size and stability of the customer base are central tenets to a firm success (Chen and Hitt, 2007). Thus, in the conceptual framework, we propose that customer acquisition and retention determine profitability.

Customer acquisition refers to the process of attracting new-to-the-market and competitor-switching customers to buy the products/services from the firm. This is an important part of a customer management strategy because a firm must acquire customers before they can be managed (Blattberg, Getz and Thomas, 2001). Customer acquisition is also important for other reasons. First, a high acquisition rate generally contributes to attract more consumers and can act as a signal to the market that the product/service offered is of high quality and provides more benefits (Srinivasan, Lilien and Rangaswamy, 2004). Second, firms continuously lose consumers that must be replaced with acquisition strategies in order to keep the size of the customer base. Third, customer acquisition increases the number of consumers from which the firm can leverage their potential value in future periods through retention and add-on selling strategies (Rust, Lemon, and Zeithaml, 2004). In IT industries, additional arguments may be relevant. In these contexts, a high customer acquisition rate can provide the firm with an initial advantage that might lead to sustainable increased returns in subsequent periods due to the specific forces that govern these markets (Katz and Shapiro, 1994). This generally leads to a change in the nature of market competition, which results in a strong emphasis on acquisition and in firms competing *ex ante* for *ex post* market power (Farrell and Klemperer, 2007). In addition, in IT industries, where purchase frequencies are low, acquisition strategies are favored as they have a more powerful contribution to firm performance (Blattberg, Getz and Thomas, 2001). Thus, this reasoning suggests that acquisition has a positive impact on profitability.

Customer retention refers to the process of keeping existing customer relationships (Blattberg, Getz and Thomas, 2001). Customer retention is widely recognized as a key component of a customer base management strategy and has received considerable attention in the academic marketing literature (Bolton, Lemon and Verhoef, 2004; Gustafsson, Johnson and Roos, 2005; Verhoef, 2003). In marketing practice, firms increasingly recognize the damaging consequences of customer switching on profitability and firm survival (Ganesh, Arnold and Reynolds, 2000). The benefits that accrue to a firm from retaining its consumers have been well documented in the literature (Reichheld and Teal, 1996; Keaveney, 1995), and researchers have consistently found a positive relationship between customer retention and financial outcomes such as revenue and profitability (Anderson, Fornell and Lehmann, 1994; Rust and Zahorik, 1993). Some researchers have gone even further to suggest that small improvements in retention lead to major profitability gains (Reichheld and Schefter, 2000). Thus, we expect customer retention rates to be positively related to profitability. In addition, we should add some arguments relevant to the context of our study. IT industries are characterized by a high fixed-cost of customer acquisition and a low cost of product delivery (Chen and Hitt, 2007), which increases the negative impact of switching on profitability and makes customer retention a strategic mandate. Also, in these markets, consumer inertia and lock-in confer market power on firms allowing them to *harvest* the customer base and obtain above-normal returns (Farrell and Klemperer, 2007). Thus, on the basis of the preceding arguments, we formally state the following hypotheses,

H_6. *Customer acquisition will have a positive effect on profitability.*

H_7. *Customer retention will have a positive effect on profitability.*

3. METHODOLOGY AND ESTIMATION STRATEGY

In this section, we develop an econometric model that helps to describe and empirically examine the implications of IT characteristics on customer acquisition and retention and on firm profitability. First, we present separately the model components –customer acquisition, customer retention and profitability. Then, we discuss the estimation procedure to estimating the system of equations.

Customer acquisition model

We model customer acquisition by company i (belonging to market k) in period t ($acquisition_{ikt}$) as a function of the size of its network ($networksize_{ikt}$), the growth rate of the market ($marketgrowth_{kt}$), and price ($price_{ikt}$). According to our conceptual framework, we include interaction terms in the model to examine the moderating effect of IT characteristics on pricing effectiveness ($price_{ikt}$*$networksize_{ikt}$; $price_{ikt}$*$marketgrowth_{ikt}$). To control for additional sources of variation in customer acquisition, we introduce a set of covariates ($covariates_{ikt}$) that include the number of firms competing in the market, the percentage of non-contractual (prepaid) customers in the installed base, and seasonality and year effects. We represent the acquisition model in Equation (1) as follows:

$$acquisiton_{ikt} = \beta_0 + \beta_1 price_{ikt} + \beta_2 networksize_{ikt} + \beta_3 markegrowth_{kt} + \beta_4 price_{ikt} * networksize_{ikt} + \beta_5 price_{ikt} * marketgrowth_{kt} + \beta_6 covariates_{ikt} + \varepsilon_{ikt} \quad (1)$$

Customer retention model

Similar to the previous model, we model customer retention by company i in period t ($retention_{ikt}$) as a function of network size, market growth and price. In addition to the main effects of these variables, we argue that pricing effects on retention are moderated by IT characteristics. To examine whether this is true in our empirical application, we introduce the two interaction terms in the model. We add the same set of covariates as in the acquisition equation to the retention model to control for additional sources of variance in the dependent construct. In Equation (2), we represent the retention model as follows:

$$retention_{ikt} = \beta_0 + \beta_1 price_{ikt} + \beta_2 networksize_{ikt} + \beta_3 markegrowth_{kt} + \\ + \beta_4 price_{ikt}{*}networksize_{ikt} + \beta_5 price_{ikt}{*}marketgrowth_{kt} + \beta_6 covariates_{ikt} + \omega_{ikt} \quad (2)$$

Profitability model

Consistent with the proposed conceptual framework, we relate the firm's ability to acquire and retain customers to performance outcomes. We model performance of firm i in period t ($performance_{ikt}$) as a function of acquisition and retention. As common practice in profitability models suggests, we also control for past realizations of the dependent variable ($performance_{ikt-1}$). We control for additional factors that potentially affect profitability ($covariates_{ikt}$), including the number of firms in the market and time controls.

$$Performance_{ikt} = \beta_0 + \beta_1 performance_{ikt-1} + \beta_2 acquisition_{ikt-1} + \beta_3 retention_{ikt-1} + \\ + \beta_4 covariates_{ikt} + \upsilon_{ikt} \quad (3)$$

Estimation procedure

We estimate equations (1)-(3) as follows. Given the characteristics of our data, we investigate the relationships between the defining IT characteristics– i.e. network size and market growth –, a well-established marketing instrument – i.e. price –, and customer acquisition and retention, as well as the moderating influence of IT characteristics on the linkages between price and acquisition and retention (Equations 1 and 2) using panel data techniques.[3] To examine the drivers of firm profitability and, specifically, the extent to which acquisition and retention contribute to create firm value (Equation 3), we use System GMM estimators (Arellano and Bond, 1991, Arellano and Bover, 1995, Blundell and Bond, 1998).

[3] We conducted fixed effects estimations, as the Hausman test revealed that the fixed effects models were preferred to random effects to estimate acquisition and retention models.

This modeling technique is appropriate for the purposes of this study for the following reasons. First, system GMM allows the introduction of firm-specific effects. This is important in our setting, given that we lack information on certain firm specific effects that might influence performance. Second, it permits endogenous regressors. Finally, it also makes possible the introduction of predetermined, but not strictly exogenous variables, like past realizations of the dependent variable.

4. DATA

Study context

We provide an empirical application of the conceptual framework to the European mobile communication industry. Mobile communications offer an attractive setting to study the direct and moderating influences of IT characteristics, and especially market growth and network effects, on acquisition, retention, and firm profitability. This sector is especially appropriate for our purposes for several reasons. First, the European mobile communications industry has experienced an impressive growth in recent years. The average penetration rate has increased from around 30% at the end of 1998 to slightly over 100% at the end of 2008. Gruber and Verboven (2001a, 2001b) have studied this phenomenon all over the world and conclude that it can be attributed to the setting of one single digital standard (which implies a substantial reduction in costs, with the subsequent effect on prices), and to the introduction of competition in the second generation technology.

Second, IT markets in general, and mobile communications in particular, are paradigmatic examples of network effects (Doganoglu and Grzybowski, 2007; Maicas, Polo and Sese, 2009). Srinivasan, Lilien and Rangaswamy (2004) suggest that mobile communications present a high degree of network effects: they rate among the highest in a list of 45 goods/services that are believed to be intensive in network effects. Previous empirical evidence in mobile communications (Kim and Kwon, 2003; Birke and Swann, 2006) shows clear signs of network effects, even when the networks are perfectly compatible, which is the case of the European context in which the technological standard is the same for all the operators (Gandal, 2002; Fuentelsaz, Maicas and Polo, 2008).

Third, we should also note that the high fixed-cost structure of customer acquisition in the mobile phone industry increases the damaging impact of customer switching. Thus, firms' profitability is expected to depend heavily on a firm's ability to acquire customers and then to retain them in the relationship (Chen and Hitt 2007). These arguments increase the value of research that looks at the determinants of acquisition and retention, and at the sources of profitability in this specific market.

Finally, mobile communications are one of the most important sectors, not only in the communications field, where it contributes to create half of the €1.1 trillion of global telecommunications turnover, but also in the economy as a whole, as the mobile industry becomes a critical part of the private sector that is capable of providing strong economic stimulus (Gsmworld, 2009).

Sample

An externally valid, fuller understanding of the drivers of acquisition and retention and the sources of profitability in IT industries recommends that the model be examined in different countries. We conduct our study in a multi-country sample that consists of 19 European markets[4] and a total of 65 different companies, and collect longitudinal data for the period 1998-2008. The data were collected mainly from the Merrill Lynch Global Wireless Matrix. This publication yields quarterly information that includes the name of the operators, price measures, number of subscribers, number of competing firms in each market and performance measures.

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

Variable measurement

With regard to the three dependent variables of our study, we measure customer acquisition as logarithm of the number of new customers to the firm in a specific period.[5] Customer retention refers to the retention rate of the company (Gupta, Lehmann, and Stuart, 2004; Rust, Lemon, and Zeithaml, 2004), operationalized as 1 minus the churn rate (the proportion of users that defect in a specific period, Neslin et al., 2006). We measure profitability as EBITDA (Earnings Before Interests, Tax, Depreciation and Amortization) divided by Total Revenues of the firm.

With regard to the independent variables in our study, we measure them as follows. We measure network size as the logarithm of the number of subscribers of a firm in each time period.[6] We measure market growth as the percentage variation (increase or decrease) in the population of mobile users in a market between two consecutive periods. Mobile phone prices are very complex and normally involve non-linear tariffs associated with different call types, which makes it difficult to obtain a homogeneous price compared with other markets in which the price for a product or service is perfectly identifiable. Prices in mobile communications usually involve a set of tariffs that differ depending on the receiver of the phone call (on-net vs. off-net calls), its timing, the characteristics of the user, and the specific contract details of the account. Doganoglu and Grzybowski (2007) use all the available information about tariffs to calculate prices in Germany. However, this option is unfeasible in a sample that includes 19 countries. Shy (2002) proposes to operationalize price as the Average Revenue per User (ARpU). However, this measure can be *contaminated* to some extent by the rate of service usage of customers. To avoid the influence of usage, we operationalize price as the Revenue per Minute (RpM), which is defined as the average price that is paid by the users of an operator. Although it is true that an average measure as RpM does not reflect heterogeneity in prices among users in a network, our purpose in this research is to examine the impact of price on

[5] Given our data, we cannot distinguish between customers that are new to the market and customers that switch from competing firms.

[6] The logarithmic transformation is employed to capture potential diminishing returns to network size.

acquisition and retention *between* companies and not *within* a company. Consequently, price variations *within* a firm are not so important in our research as variations *between* companies. The use of this measure also ensures homogeneity and comparability across countries.

We measure the additional covariates that enter the models as follows. We control for rivalry through the number of firms competing in each market. We also control for the percentage of prepaid customers in the customer base of each company. Finally, we measure seasonal and time specific influences using quarter and year time dummies, respectively.

We provide descriptive statistics of the sample and the correlation matrix of the considered variables in Tables A.1 (equations (1) and (2)) and A.2 (equation (3)) in the Appendix.

5. RESULTS

Customer acquisition and retention

We report the coefficient estimates for the acquisition and retention models in Table 1. The hypothesis that the independent variables are jointly equal to zero is rejected for the two models ($\rho < .01$), as can be inferred from an F-test (not shown). Thus, compared with a model with no explanatory variables, the proposed models show significantly better fit. To gain insight into the impact of IT characteristics, price, and the interaction terms on acquisition and retention and test hypotheses 1 to 5, we compare two nested models. First, we estimate a main effects model (A.1 and R.1 for acquisition and retention, respectively) that includes control variables and main effects of the studied variables (allowing us to test H1, H2 and H3). Then, we add the interaction terms of the relevant study variables to test H4 and H5 (A.2 and R.2 for acquisition and retention, respectively).

For acquisition, compared with the main effects model (A.1), the model with the interaction effects (A.2) has a significantly better fit, according to the F test (F = 6.44; $\rho < .01$). For retention, the full model (R.2) performs worse than the simpler model (R.1), suggesting that the interactions do not add explanatory power to the main effects model. All the models present heteroskedasticity and autocorrelation consistent (HAC) estimates.

TABLE 1. RESULT FOR ACQUISITION AND RETENTION EQUATIONS: FIXED EFFECTS (HAC STANDARD ERRORS)

	Acquisition (A.1)	Acquisition (A.2)	Retention (R.1)	Retention (R.2)
Network size (log)	1.029***	1.294***	0.00611*	0.00872**
	(3.81)	(4.03)	(1.77)	(2.11)
Market growth	3.457***	6.439***	0.0129***	0.0181
	(9.14)	(6.92)	(2.67)	(1.51)
Price	-3.541***	10.90*	0.0165	0.105
	(-3.11)	(1.80)	(1.13)	(1.36)
Price*Network size		-1.314**		-0.00996
		(-1.99)		(-1.17)
Price*Market Growth		-11.39***		-0.0198
		(-3.50)		(-0.47)
Prepaid (%)	-0.596	-0.591	-0.0102**	-0.0100**
	(-1.60)	(-1.59)	(-2.15)	(-2.10)
Number of firms	-0.284***	-0.326***	-0.00202*	-0.00224**
	(-3.47)	(-3.94)	(-1.94)	(-2.11)
Second quarter	0.0991	0.0973	0.000663	0.000649
	(1.39)	(1.37)	(0.73)	(0.71)
Third quarter	0.270***	0.266***	-0.000816	-0.000835
	(3.55)	(3.51)	(-0.84)	(-0.86)
Fourth quarter	0.658***	0.669***	-0.000861	-0.000909
	(8.23)	(8.39)	(-0.84)	(-0.89)
Constant	-3.711	-5.949**	0.907***	0.884***
	(-1.52)	(-2.08)	(29.19)	(24.06)
Time dummies	Yes***	Yes***	Yes***	Yes***
N	942	942	942	942
R^2	0.8196	0.8301	0.0985	0.0999
F	38.98***	6.44***	3.45**	0.69

t statistics in parentheses
* $p < .1$, ** $p < .05$, *** $p < .01$

Customer acquisition. Overall, we find strong support for the proposed acquisition model and the effects of the explanatory variables are all in the expected direction and highly significant. In H_{1A} and H_{2A}, we predicted a positive main effect of the two IT studied characteristics, network size and market growth. In line with our expectations, the coefficients measuring the impact of these two variables on acquisition are positive and significant (β = 1.029, $\rho < .01$; β = 3.457, $\rho < .01$, respectively) in model A.1, suggesting that a large network and a high growth of the market leads to increased customer acquisition. We find that price has a negative and significant effect on customer acquisition (β = -3.541, $\rho < .01$). This finding is consistent with prior research and provides support for H_{3A}.

Model A.2 introduces the moderating role of network size and market growth in the relationship between price and customer acquisition. As hypotheses H_{4A} and H_{5A} predict, the results show that network size and market growth moderate the impact of price on customer acquisition. In particular, the larger the size of the network and the higher the growth rate, the weaker the relationship between price and customer acquisition (β = -1.314, $\rho < .05$; β = -11.39, $\rho < .01$, respectively).

With regard to the control variables, we find that the number of firms competing in the market has a negative impact on acquisition (β = -0.326, $\rho < .01$), and that compared with the first quarter of the year, customer acquisition is enhanced in the third and the fourth quarters (β = 0.266, $\rho < .01$; β = 0.669, $\rho < .01$, respectively).

Customer retention. Consistent with H_{1B}, we find a positive and significant effect of network size on customer retention (β = 0.006, $\rho < .1$). That is, the larger the size of the network, the higher the number of retained customers. In H_{2B}, we argued that market growth would have a negative effect on a firm's ability to retain its current customers. The estimation results reveal that market growth has a positive and significant impact on customer retention (β = 0.013, $\rho < .01$). Thus, we do not find support for H_{2B}. In H_{3B}, we predicted a negative effect of price on retention. However, we observe a positive and non-significant estimated coefficient (β

= 0.016, $\rho > .1$), suggesting that price has no effect on customer retention. We thus do not find support for H_{3B}. As we already noted, the model with the interaction terms (R.2) performs worse than the main effects model (R.1), and we find non-significant coefficients for the two moderating effects (β = -0.0090, $\rho > .1$; β = 0.0068, $\rho > .1$, respectively), which does not provide support for H_{4B} and H_{5B}. With regard to the control variables, we obtain negative and significant coefficients for the percentage of prepaid customers and for the number of firms competing in the market (β = -0.010, $\rho < .05$; β = -0.002, $\rho < .1$), suggesting that a large number of prepaid customers and a more competitive market reduce the ability of the firm to retain its current customers.

Firm profitability

In Table 2, we show the System GMM estimation results for the profitability model. The model presents heteroskedasticity and autocorrelation consistent (HAC) estimates. In H_6 and H_7, we argued that a firm's ability to acquire and retain customers is a key determinant of profitability in IT markets. After controlling for additional sources of variance in profits, we observe a positive and highly significant effect of acquisition and retention on profitability (β = 0.005, $\rho < .01$; β = 0.453, $\rho < .05$, respectively), providing strong support to H_6 and H_7. The results also show that past profitability has a positive effect on current performance (β = 0.680, $\rho < .01$), and that profitability decreases with the number of firms competing in the market (β = -0.011, $\rho < .05$).

TABLE 2. RESULTS FOR FIRM PROFITABILITY EQUATION: SYSTEM GMM (HAC STANDARD ERRORS)

	Margin
Lagged margin	0.680^{***}
	(25.91)
Lagged acquisition	0.00540^{***}
	(3.23)
Lagged retention	0.453^{**}
	(2.12)
Number of firms	-0.0117^{**}
	(-2.56)
Times dummies	Yes***
	(0.69)
Constant	-0.351^{*}
	(-1.74)
N	1,240
AR(1)	-3.76^{***}
AR(2)	1.12
Hansen statistic	4.17

t statistics in parentheses

* $p < .1$, ** $p < .05$, *** $p < .01$

6. DISCUSSION

In IT industries, the customer base becomes a critical strategic asset to assessing the firm's current and future competitive position. One of the greatest challenges that IT academics and practitioners face is to optimally manage the size (acquisition) and stability (retention) of the customer base in order to maximize profitability. While prior research has provided valuable insight into managing customer relations, traditional models might not be appropriate to systematically manage this strategic asset in an IT context, as the characteristics that govern IT markets may render invalid some of the well-established findings in CRM research. In this study, we integrate CRM and information systems research to develop a conceptual framework that aims to increase our understanding of the key drivers of customer acquisition and retention in IT industries and how they are related to financial outcomes. We empirically test the framework in the European mobile communications industry using a multi-country sample that includes 65 companies in 19 countries (Table 3 offers a summary of the hypothesis testing results), which allows us to provide a more externally valid test of the conceptual framework. The study findings enable us to contribute to existing research in several critical ways and provide interesting insights for managers.

TABLE 3. SUMMARY OF HYPOTHESIS TESTS

Hypothesis	*Description*	*Hypothesis test*	*Significance*
H1A	Network size → higher customer acquisition	Supported	$p < 0.01$
H1B	Network size → higher customer retention	Supported	$p < 0.01$
H2A	Market growth → higher customer acquisition	Supported	$p < 0.01$
H2B	Market growth → higher customer retention	Not Supported	--
H3A	Price → lower customer acquisition	Supported	$p < 0.10$
H3B	Price → lower customer retention	Not Supported	--
H4A	The larger the size of the network, the weaker the relationship between price and customer acquisition	Supported	$p < 0.05$
H4B	The larger the size of the network, the weaker the relationship between price and customer retention	Not Supported	--
H5A	The higher the growth of the market, the weaker the relationship between price and customer acquisition	Supported	$p < 0.01$
H5B	The higher the growth of the market, the stronger the relationship between price and customer retention	Not Supported	--
H6	Customer acquisition → higher profitability	Supported	$p < 0.01$
H7	Customer retention → higher profitability	Supported	$p < 0.05$

The study results reveal that the two defining IT characteristics that we consider, network effects and market growth, play a critical role in attracting customers to the firm and keeping them in the relationship. Consistent with network theories, the size of the user network enhances the attractiveness of the product itself by making it more useful and providing additional benefits that increase the value proposition (Frels, Shervani, and Srivastava, 2003). We find that this source of utility is highly valued by prospective customers, who are concerned about the survival of the technology and about the availability and quality of its complements. The additional benefits provided by a large network are also an effective means to retain a firm's customers, as this increased utility prevents them from switching to alternative vendors. In the presence of a high market growth, the firm's ability to acquire and retain consumers increases. In terms of customer acquisition, this is consistent with our initial expectations that a high market growth rate leads to a contagion effect among consumers that increases the likelihood of adopting the technology from one of the available alternatives. The finding of a positive effect of market growth on retention is more remarkable. On the basis of general diffusion theories, high growth rates correspond with greater uncertainty about the product/service's utility (Heide and Weiss, 1995). This might prevent customers from committing a significant amount of resources to the relationship, as we hypothesized, but also may make them more reluctant to switch providers that might not provide the same level of service (increase retention rates). This finding is also consistent with recent empirical evidence on diffusion, which shows that early adopters, corresponding with high growth stages of the lifecycle, have a lower probability to disadopt and abandon the relationship than later adopters (Prins, Verhoef, and Franses, 2009).

The results pertaining to the effects of price are noteworthy. CRM research emphasizes that pricing strategies have a powerful impact on customer decisions to enter into and to continue in a relationship with a firm (Bolton, Lemon, and Verhoef, 2004). In the mobile communications industry, we find that price plays a critical role in customer decisions to initially purchase a product, but once the customer initiates the relationship, price does not have an impact on customer decisions to continue it. Although according to microeconomic consumer theory this result might seem counterintuitive, theories from CRM and information systems research might help explain why this happens. In relationship marketing, there are convincing conceptual arguments indicating that loyal and continuing customers are less price sensitive (Reichheld and Teal, 1996) and, thus, that price plays a minor role in customer repurchase decisions. In IT markets, customer inertia and lock-in research provides solid arguments and empirical evidence to explain customer irresponsiveness to price after the customer-firm relationship has been established, as the cost of discontinuing a relationship frequently outweighs the potential economic gains associated with switching to cheaper alternatives (Shapiro and Varian, 1998; Amit and Zott, 2001; Chen and Hitt, 2007).

We also investigate whether any interrelationships exist between the two considered IT characteristics and price. We find that network size and market growth moderate the influence of price on customer acquisition, but not on retention. This result may be of interest to the CRM literature. Price is generally believed to be an important determinant of behavior and to explain a higher amount of variance of customer decision making than other marketing-mix variables (Winer, 1986). Our results show that the effectiveness of price for attracting customers to the firm is contingent on the size of the network and on the growth rate of the market, such that a large installed network and a high growth rate make consumers less price sensitive. This result has important implications for a firm's customer base management strategy. In addition to increasing the likelihood of acquiring new customers, having a large installed base allows the firm to set higher prices than competing suppliers while still being an attractive alternative from which to purchase from.

Finally, this study provides key insights into the linkages between a customer base management strategy –the firm's ability to acquire and retain consumers– and profitability. After controlling for other sources of performance (past profitability, competition), our results provide strong support for the notion that customer acquisition and retention play a central role in creating profits for IT companies. These findings are in line with CRM theories emphasizing the importance of acquisition and retention to increase firm profitability and value (Gupta, Lehmann, and Stuart, 2004; Kumar and Shah, 2009), and with information systems research, which acknowledges the importance of the size and stability of the customer base (Chen and Hitt, 2007).

We hope the framework developed in this research to advance both the conceptual understanding of the drivers of acquisition and retention in IT industries and the assessment and measurement of the value that they create for organizations. On the basis of this framework, firms should adopt the perspective that the customer base is a critical strategic asset that must be cultivated and leveraged to maximize profitability and gain competitive advantage. Only by understanding the determinants of acquisition and retention a firm can identify the issues that must be addressed in order to optimally manage the customer base. The empirical application in multiple countries that we carry out in this study provides further support for the proposed framework and shows that IT characteristics influence a firm's ability to acquire and retain consumers, which, in turn, determine profitability and firm success.

7. LIMITATIONS AND FURTHER RESEARCH

Some limitations of this study should be noted, which suggest possible directions for future research. First, we restrict the analysis of the direct and moderating influence of IT characteristics on customer base management and profitability to two particular factors, namely, network effects and market growth. While they have been widely acknowledged to define and be significantly present in these markets and the study results reveal their significant effects on a firm's ability to acquire and retain consumers and to achieve better performance outcomes, we should also recognize that other factors inherent to IT markets have not been considered in this research. For instance, switching costs have been found to be significantly present in the studied market (Polo and Sese, 2009) and to alter customer behavior (Burnham, Frels, and Mahajan, 2003). A promising avenue for further research would be to integrate switching costs in the proposed model and investigate their direct and moderating influence on customer acquisition and retention. We could expect similar results, as network effects and switching costs have similar consequences on IT markets (Farrell and Klemperer, 2007).

Second, we decided to test the proposed model in one particular IT industry, the mobile communications market. While the mobile phone industry is considered a paradigmatic example of IT industries and it offers a very attractive setting to empirically validate the conceptual framework (e.g., it presents a high degree of network effects (Srinivasan, Lilien, and

Rangaswamy, 2004) and it has experienced an impressive growth), we should implement caution in generalizing our study findings to other IT contexts. Additional research therefore might test the proposed framework in other IT industries to examine whether network size and market growth play such a critical role in managing the customer base and obtaining enhanced performance outcomes.

Third, customer retention is measured as the percentage of customers that are kept between two consecutive time periods. Given the interest of companies to report high retention rates and large customer bases, it has been acknowledged that retention rates might sometimes be overrated. This might explain, at least partially, the low variation in this measure over time for the considered sample of companies. Unfortunately, we do not have access to internal company data to check whether the reported retention rates differ from the real ones. Obtaining a sample of customers from each company and collecting information at the customer-level might provide additional insights into the firm’s real retention rates and its sources of variation over time. However, given the multi-country nature and the 10-year time horizon of this study, combining firm and customer-level data seems to be extremely difficult. Future research might focus on smaller samples of companies and combine these two sources of data to gain additional insights into this topic.

Fourth, in our model, we identify network effects with network size. By doing so, we assume that all network users contribute the same to the utility function of each customer. Although network size has been frequently and successfully used to asses network effects in prior research (Brynjolfsson and Kemerer, 1996), we are neglecting network intensity (McIntyre and Subramaniam, 2009), that is, the possibility that network effects may be localized (Birke and Swann, 2006; Maicas, Polo and Sese, 2009). This would mean that, instead of the total size of the network, the utility function can be affected differently by the different groups of users that take part of the network. Thus, future research should control for the effects on acquisition and retention decisions of the heterogeneous nature of the density of the network.

Finally, in our model, we only consider price as a marketing tactic. While price is one of the most salient instruments in the marketing mix to stimulate customer behavior (Bolton, Lemon and Verhoef, 2004) and explains more variance of the customer purchase decision than do other marketing-mix variables (Winer, 1986), other marketing actions may also play an important role in acquiring and retaining customers. Thus, an interesting extension of this research would be to investigate the role of other marketing tactics such as advertising and/or direct marketing and examine the extent to which IT characteristics moderate their impact on a firm's ability to acquire and retain customers.

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APPENDIX A.

TABLE A.1. DESCRIPTIVE STATISTICS AND CORRELATIONS (R&A MODEL)

Variable	Obs	Mean	Std. Dev.	Min	Max	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Acquisition (log) (1)	942	4,956	1,248	0,693	7,771	1,000									
Retention (2)	942	0,944	0,018	0,838	0,983	0,092	1,000								
Price (3)	942	0,191	0,065	0,062	0,485	0,093	0,205	1,000							
Network size (log) (4)	942	8,817	0,911	6,597	10,556	0,625	0,097	-0,057	1,000						
Market growth (5)	942	0,147	0,159	-0,132	1,030	0,308	0,072	0,463	-0,066	1,000					
Prepaid (%) (6)	942	0,410	0,185	0,000	0,965	-0,224	-0,009	-0,197	-0,123	-0,238	1,000				
Number of firms (7)	942	3,650	0,736	2	5	0,061	-0,184	0,070	0,201	-0,089	-0,079	1,000			
Second quarter (8)	942	0,261	0,439	0	1	-0,089	0,011	-0,039	-0,026	-0,002	0,043	-0,022	1,000		
Third quarter (9)	942	0,240	0,427	0	1	-0,007	-0,013	0,064	0,000	-0,032	-0,006	0,024	-0,334	1,000	
Fourth quarter (10)	942	0,251	0,434	0	1	0,196	-0,013	0,008	0,028	-0,023	-0,059	0,022	-0,344	-0,325	1,000

TABLE A.2. DESCRIPTIVE STATISTICS AND CORRELATIONS (PROFITABILITY MODEL)

Variable	Obs	Mean	Std. Dev.	Min	Max	(1)	(2)	(3)	(4)
Margin (1)	1.260	0,327	0,201	-3,571	0,571	1,000			
Acquisition (log) (2)	1.302	4,956	1,262	0,693	8,020	-0,002	1,000		
Retention (3)	1.302	0,946	0,019	0,838	0,983	0,168	0,109	1,000	
Number of firms (4)	1.302	3,556	0,735	2	5	-0,140	0,096	-0,203	1,000

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