Competitive Brokerage, Information Technology and Internal Resources

Completed Research Paper

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Abstract

To thrive in the current embedded and electronic competitive environment, organizations must achieve advantageous positions within their networks of competition. We strengthen the understanding of the genesis of network structures by examining the IT-enabled capabilities and internal resource endowment that determine an advantageous position in competition networks, which we term as competitive brokerage. We propose that firms should consider their competitive brokerage position to elaborate a successful e-business strategy. We employ a two-stage Tobit regression on a longitudinal competition network that spans 13 industries and demonstrate that commercial, technical and intangible resources influence competitive brokerage. We find that IT-enabled information management capability strengthens the effects of intangible resources to attain a competitive brokerage position. Our study contributes towards the IT business value, resource base view and competitive dynamics literatures. Overall, our results demonstrate that IT plays a critical role in enabling firms to face multi-market competition in the embedded economy.

Keywords: E-Business, Competitive strategy, Inter-organizational networks, IT-enabled organizational capabilities

Introduction

Hyper-competition, multi-market participation, and information technology (IT) intensity are hallmarks of the current globalized economic milieu. To thrive in this embedded and competitive environment, organizations must achieve advantageous positions within their networks of competition and collaboration. Firms, such as Wal-Mart Stores, Inc., which attain prominent positions in competition networks, often exhibit resource configurations and IT-enabled capabilities that are distinct from those of less successful companies. While there is an increasing understanding of how IT generates value within the boundaries of an organization, Information Systems (IS) researchers have only begun to investigate the effect of IT in the context of networks of competitive actions (e.g. Chi et al. 2010). Moreover, firms should consider how their internal resource endowment and IT-enabled capabilities impact their position in competition networks in order to elaborate successful e-business strategies.

Management scholars have acknowledged the importance of the embedded economy (Burt 2001; Gulati et al. 2000) and have frequently analyzed the influence of structures and patterns of cooperation networks on firm performance and innovation (Ahuja 2000a; Zaheer and Bell 2005). Despite the enlightening contributions of these studies, the extensive focus on the outcomes of prominent network positions (e.g. structural holes and bridging ties) have led researchers to pay scant attention to the IT-enabled capabilities and other internal resources that determine network positions, especially in competition networks. Scholars have recognized the need to further analyze network structures and have called for a more detailed analysis of the determinants of network positioning (Ahuja et al. 2012; Sytch et al. 2012). However, studies that have tried to answer this enquiry have utilized structural approaches, which consider past and surrounding structures as the main determinants of current network structures (Spencer 2003; Sytch et al. 2012; Zaheer and Soda 2009), again overlooking firms' internal resource endowment and related IT-enabled capabilities.

Prior research has primarily studied either coo-petition networks or collaboration networks, while paying scant attention to pure competition networks. Coo-petition networks depict the patterns of both competition and collaboration across the firms. Collaboration networks only reflect the patterns of collaboration between firms. On the other hand, pure competition networks only capture patterns of competition across firms. Even though some scholars have utilized collaboration networks or coo-petition networks to explain the competitive interactions between firms (Gnyawali et al. 2006; Gnyawali and Madhavan 2001; Tsai 2002), the nature of transactions in a network directly influences networks' effects and structures (Afuah 2013; McEvily and Marcus 2005). Thus, the effects of positioning in competition networks cannot be substituted with those in coo-petition or collaboration networks. Furthermore, the IS literature has investigated the role of IT in firm competitive behavior and performance in consort with centrality, structural holes and bridging ties (Chi et al. 2010; Joshi et al. 2010). Nonetheless, it has not analyzed the effects of IT in conjunction with other firms' internal resources in competition environments. Therefore, this study aims to deepen our understanding of the genesis of network structures by examining the IT-enabled capabilities and the internal resource endowment that determine an advantageous position in competition networks, which we term as *competitive brokerage*.

Firms in a competitive brokerage position rest either between paths of other competitors or between disconnected competitors in the network. Competitive brokers have a significant role in the configuration of competition networks or systems. Competitive brokers receive several benefits that may influence their performance and impact the interactions and structures of the whole system. Given that competitive brokers connect distinct competitor communities, they have access to diverse and novel information and knowledge (Burt 1992; Newman 2009). Competitive brokers have the ability to mediate the competitive attacks between different competitor communities. Competitive brokers bridge distinct industries and product categories, so they are able to amalgamate knowledge and technologies to introduce innovations in the competition system. These innovations disrupt the structure of the competition network and change the competitive interactions between firms. Thus, multi-market participation is infeasible in the absence of competitive brokers.

This study examines the relationship between firms' competitive brokerage position and their IT-enabled capabilities and internal resource endowment. We address the research question, *how do IT-enabled information management capability (IMC), commercial, technical and intangible resources and their*

complementarities influence the competitive brokerage position of the firm? To examine this research question, we draw upon literature from the Resource Based View (RBV), IT business value, competitive dynamics and social networks to propose a theoretical model that unveils the determinants of competitive brokerage. Using a multi-industry competition network that spans 13 industries, we test five hypotheses about firms' internal resource endowment and its complementarity with IMC towards attaining a competitive brokerage position. The results show that besides past and surrounding network structures, the internal resource endowment of the firm influences competitive brokerage. Moreover, we find that IMC acts as a complement of intangible resources by positively enhancing the influence of intangible resources on competitive brokerage.

To understand how firms' IT-enabled IMC and internal resource endowment determine firms' competitive brokerage position is relevant for the following reasons. First, by understanding which resources and IT-enabled capabilities configurations are more likely to benefit firms to acquire competitive brokerage positions, firms can integrate the existent knowledge of both structural network properties and the adequate resource and IT-enabled capabilities configurations to achieve competitive brokerage. Second, extant and emergent research has documented the innovation benefits of occupying a brokerage position (Ahuja 2000a; Bao et al. 2012; Tiwana 2008). Hence, it is crucial to comprehend how specific resource and capability configurations lead firms to competitive brokerage, so that managers can decide which resources should be developed. Third, the conflicting perspectives between the resource-based view (RBV) and the network structural properties tradition need to be clarified. While research based on the RBV has suggested that firms' resources and attributes influence the competitive and collaborative interactions between firms (Ang 2008; Chen 1996), the structural properties tradition has stated that competition is not influenced by the attributes of the players, but is rather determined by their relations (Burt 1992). This inconsistency should be clarified.

This paper makes four main contributions. First, this paper provides solid empirical evidence of the complementary role of IMC and introduces the competitive brokerage construct to the IT-firm performance relationship. Second, we enrich the RBV by considering the consequences of the deployment of firms' internal resources in product markets. Third, we clarify the conflicting views between the structural properties tradition and the RBV. We show that in addition to competitive relationships, the internal resource endowment and IMC of the firm determine the acquisition of relevant network positions. Fourth, we contribute to the competitive dynamics literature with the creation of the competitive brokerage construct and the empirical assessment of competitive asymmetry with the introduction of a multi-industry competition network. Overall, our results demonstrate that IT plays a critical role in enabling firms to face multi-market competition in the embedded economy.

Theory and Hypotheses

Competitive Brokerage

Extant literature has documented the value obtained by actors that lie on brokerage or bridging ties (Tiwana 2008). For instance, nodes that lie on paths between other nodes have a considerable influence within a network by virtue of their control of the flow and access to information (Newman 2009). Hence, we define competitive brokerage *as the degree of control of the flow of competitive actions that a firm has at a particular unit of time and importance of this firm in bridging the indirect competitive relationships between other competitors.*

To further clarify the competitive brokerage definition we provide a simplified example of a competitive broker. Consider three companies, A, B and C. Company A dominates in the shampoo market and competes in the bar soap market. Company B participates in the shampoo market and is strong in the detergent market. Company C is a competitive broker and participates with a high market share in all three markets: shampoo, bar soap and detergent. If company A decides to initiate a competitive attack against company C in the shampoo market, company C as a competitive broker, can decide whether it retaliates against company A in the shampoo market or whether it utilizes its bridging ties and launches a competitive attack in the bar soap or detergent markets. Company C can launch an attack on company B in the detergent market, thereby forcing B to initiate a response in the shampoo market and consequently also attack company A. Thus, company C has the capacity to control the flow of competitive attacks between the firms participating in the shampoo, bar soaps and detergent markets.

Even though the competitive brokerage construct relies on bridging ties and uses a similar conceptualization to the notion of structural holes, there are significant differences between the two. First, our brokerage construct incorporates the concepts of asymmetry and link weight, while the structural holes concept ignores these two important structural features (Tiwana 2008). Second, structural holes are often utilized to measure ego networks (Chi et al. 2010), while brokerage is used to study whole or more extensive networks. Thus, our brokerage construct offers a more comprehensive and accurate representation of bridging ties for the study of competition.

Competitive brokers have several advantages compared to firms in less advantageous positions. Competitive brokers are able to reach remote parts of networks, access novel information and exploit it to their advantage (Burt 1992). Hence, competitive brokers are able to develop new understandings, thoughts and actions through the acquisition of information regarding market opportunities in a timelier manner. Another important advantage of competitive brokers is their ability to mediate competitive attacks. As described in the example provided earlier, given that competitive brokers lie on the shortest path between competitors of diverse product categories and industries, they are able to control the flow of competitive attacks between two industries. For instance, if other firm launches a competitive attack, the competitive broker may be able to decide whether to retaliate using its bridging ties or contain the attack in the same network community where it was launched. This competitive attack mediation mechanism brings a significant competitive advantage to firms because it increases the strength and speed of the competitive actions that the firm launches, consequently affecting firm performance. Finally, due to the information advantage of competitive brokers, they may be able to take advantage of their excess resources and diversify their activities (Neffke and Henning 2013). To incorporate such firm behavior, in this study we integrate 13 industries in a single longitudinal competition network, so that the competitive interactions of brokers extend to several industries and bridge multiple resources and information.

Internal Resource Endowment

According to the RBV, a firm is a function of its resource endowment and thus a combination of tangible and intangible resources (Barney 1991). Firm behavior is the result of the pursuit for competitive advantage (Ahuja 2000b). Hence, to attain sustained competitive advantage, organizations attempt to control resources that are rare, valuable and inimitable (Barney and Clark 2007) and to develop capabilities to deploy those resources (Makadok 2001). Considering that competitive brokerage is a competitive positioning indicator and the resources and capabilities of the firm influence the exploitation of perceived market opportunities (Neffke and Henning 2013), competitive brokerage is influenced by the internal resource endowment of the firm. In this study, we examine how three relevant types of resources - commercial, technical and intangible resources, affect competitive brokerage. Furthermore, we analyze how IMC augments the effects of commercial, technical and intangible resources.

Commercial Resources

Commercial resources are defined as supportive or complementary resources that a firm needs to commercialize new and existing products (O'Brien 2003). Commercial resources include the resources that firms invest in marketing activities but exclude brands[1]. These resources enable firms to predict changes in customer preferences and create and maintain durable relationships with customers and other channel members (Song et al. 2005). Commercial resources (e.g. advertising) are vital for firms to compete in the markets; therefore, we study the relationship between competitive brokerage and commercial resources.

Commercial resources enable firms to commercialize new and existing products in the markets through diverse mechanisms. They increase the consumer awareness of products and create differentiation from competitors. Therefore, consumers may be more willing to purchase the firm's products and pay for a premium relative to competing products with identical characteristics (Chu and Keh 2006), thereby strengthening firms' competitive links and improving firms' competitive brokerage. Consumer awareness and differentiation enable firms to penetrate new and existing markets. Firms that invest in commercial resources create barriers to entry for competitors (Kaplan and Norton 2004). Hence, competitors may be

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[1] We thank an anonymous reviewer for this valuable suggestion.

discouraged to enter in markets of firms with abundant commercial resources, such that firms rich in commercial resources are able to strengthen their competitive links, bridge new and existing market improving their competitive positions.

However, we posit that the positive effect of commercial resources on competitive brokerage could decline after it reaches a high level. First, firms with abundant commercial resources in a product category have experienced the positive effects of commercial resources, so that they obtain positive feedback between their experiences and competences of utilizing commercial resources in their extant product categories. Firms prefer to refine their commercial resources in their existing product categories rather than exploring new product categories (Levinthal and March 1993), overlooking new opportunities in other products and markets and falling into a "familiarity trap" (Ahuja and Morris Lampert 2001). Hence, the competitive brokerage position of the firm will decrease. Second, navigating in a completely new market or product category is more challenging for firms with strong existing commercial resources due to path dependencies (Sydow et al. 2009). Due to the high investment in existing product categories and markets and the risks associated with new expansion, firms are more likely to decrease their new product development and introductions (Levinthal and March 1993; March 1991). Third, as products become mature in the product cycle, the effectiveness of commercial resources decreases, such that mature products rely on different mechanisms to create consumer awareness. For instance, beyond a relative early stage of the growth cycle of the new product, word-of-mouth becomes the main force driving sales growth and the efficacy of commercial resources considerably declines (Goldenberg et al. 2001; Walsh et al. 2004). Furthermore, once products reach maturity, consumers may consider the opinion of reference group members, such as family or friends, as a more credible source of information than the commercial resources of the company (e.g. print and broadcast media) (Gremler et al. 2001); again decreasing competitive brokerage. Therefore,

> *Hypothesis 1: Commercial resources have an inverted U-shaped relationship with competitive brokerage.*

Technical Resources

Technical resources are defined as firms' resources to create new technology, products and processes (Ahuja 2000b). Technical resources include firms' investment efforts in R&D and do not include R&D outputs such as patents[2]. Technical resources enable firms to respond to changes in the technological environment (Song et al. 2005) and they play a key role in innovation and performance (Zhou and Wu 2010). Prior research has found that technical resources enable firms to ease the integration of new knowledge and technologies (Dewar and Dutton 1986) and enhance products' competitive advantage by improving the relative performance of products (Calantone and Di Benedetto 1988). Considering the important role of technical resources in the firm, we analyze their impact on competitive brokerage.

Firms rich in technical resources (e.g. R&D programs) pursue exploration and differentiation as their main strategies, so that they are able to compete on the basis of innovation and new product development (Lim et al. 2013). Technological resources have a positive relationship with new product introduction (Hitt et al. 1991) and innovative output (Hitt et al. 1996), which increase the competitive range of the firm and thereby its competitive brokerage. We propose that firms with abundant technical resources are able to increase firms' direct competitive reach by entering into or creating new markets. Thus, technical resources have a positive relationship with competitive brokerage.

Moreover, we posit that technical resources facilitate the acquisition of a better competitive brokerage position at an accelerating rate. The accumulation of technical resources enables firms to better assess the value of their existent resources, so that they obtain novel insights to exploit their extant knowledge and skills for innovation (Cohen and Levinthal 1990). The synergy between extant and new technical resources enables firms to make a more effective usage of both new and existing technical resources for new technology and product creation. The experience and feedback generated by abundant technical resources enables managers to make a better assessment of which technical resources should be developed to address environmental challenges. These aspects improve firms' long-term viability in new

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[2] We thank an anonymous reviewer for this valuable suggestion.

and existing environments (Pisano 1990). Hence, in line with previous literature that has analyzed J–shaped relationships (Hagedoorn and Schakenraad 1994; Henderson 1999; Zhou and Wu 2010):

> *Hypothesis 2: Technical resources have a J-shaped relationship with competitive brokerage.*

Intangible Resources

Intangible resources are represented by goods that can be applied in new markers with proportionally smaller increments in costs (Delios and Beamish 2001). Intangible resources (e.g. organizational reputation) provide advantages in firms' current markets and motivate firms to expand, because intangible resources can be used in other markets without depreciating in extant markets (Morck and Yeung 1998). Intangible resources generate competitive advantage based on knowledge (Barney 1991), which improve firm performance. Consistent with these arguments, researchers have found a positive association between intangible resources and market value (Mishra and Gobeli 1998; Morck and Yeung 1998). Thus, in general, the more valuable intangible resources the firm possesses, the better its competitive brokerage position in the market.

Firms with abundant intangible resources are able to transfer them between various markets and product categories such that new products rely on the prestige of existing resources (Morck and Yeung 1998). Thus, valuable intangible resources facilitate consumers' acceptance of new products and assist firms to move into new markets and improve their competitive brokerage position. Firms with valuable intangible resources, such as reputation for high quality products are able to enhance their competitive positioning in new markets (Petrick et al. 1999). Strong intangible resources compel consumers to create a sense of trust and loyalty, which discourages competitors from entering into the focal firms' market. Hence, companies enjoy a superior competitive links and bridges in the markets and increase their competitive brokerage position. Therefore,

> *Hypothesis 3: Intangible resources have a positive linear relationship with competitive brokerage.*

Information Management Capability (IMC)

Extant research has found that firms can leverage IT-enabled capabilities to generate competitive advantage (Chi et al. 2010). For instance, IMC has been proposed as an explanation of the heterogeneity in firm performance and researchers have posited that the relationship between information management capability and firm performance is mediated by three organizational capabilities - customer management capability, performance management capability and process management capability (Mithas et al. 2011). Consistent with prior research, we define information management capability (IMC) as firms' ability to generate, accumulate and disseminate accurate data and information to respond to changing business needs (Mithas et al. 2011).

We draw on the RBV and the complementarity concept (Powell and Dent-Micallef 1997; Ravichandran and Lertwongsatien 2005) to propose that the utilization of IT to generate IMC improves the competitive brokerage position of the firm. We posit that IMC supports commercial and intangible resources to obtain competitive brokerage. To offer a more granular explanation of the mechanisms through which IMC complements commercial and intangible resources to acquire a competitive brokerage position, we classify IMC into internal information management (IIMC) and external information management capability (EIMC) (Applegate et al. 1987).

IIMC enables firms to synchronize and share resources and information internally. IIMC includes the utilization of synchronization and integration technologies such as e-mail, asset managing tools and groupware. For instance, Pfizer utilizes a platform called "OneSource", which integrates data across the company and enables executives to visualize the drug development pipeline and patents of the company across the globe. This platform allows Pfizer to synchronize, integrate, extract and transform information and other resources across the company. Managers are able to visualize whether there could be synergies or overlaps between the developments of different teams and accelerate drug discovery (Henschen 2010).

EIMC enables firms to use technologies to be in contact with customers, identify their needs and respond to changes in their tastes. Technologies such as blogs, online social networking sites and web analytics enable firms' EIMC. For example, Walgreens (an US-based retailer and pharmacy) developed an iPhone

application that allows customers to enter their prescription numbers, access their previous orders to request a refill and upload order prints and photos. Walgreens uses this app to send SMS to customers and inform them about discounts and promotions. Also, customers can receive notifications when their orders are ready for pick-up (eWEEK 2010). This technology enables Walgreens to reduce the time that customers spend looking for information and to keep constant communication with their customers.

Commercial Resources and IMC

The timely and efficient deployment of EIMC critically affects the impact of commercial resources on competitive brokerage. Firms with strong EIMC are able to direct their commercial resources to their target markets, ensuring that customers receive adequate information in a timelier manner (Kathuria et al. 2014). The diffusion of commercial resources in target markets create a sense of shared meaning in the public (Tippins and Sohi 2003). Thus, consumers may identify with the products and buy them. EIMC complements commercial resources and enables firms to enhance the differentiation of their products, generating and retaining links with consumers and distribution channel members. Firms that conjunctly deploy commercial resources and EIMC have the ability to collaborate with customers and rapidly tackle changes in consumers' needs and markets (Conant et al. 1990; Saldanha et al. 2013) to maintain or improve their competitive brokerage position. For instance, in 2009, Kraft Foods implemented Pluck 4, a social media application server. This technology enabled Kraft Foods to syndicate forums, photos, RSS feeds and video tools. Moreover, it allowed Kraft to create and gather information about their customers' profiles, comments, rating, reviews and blogs; so that the company could be aware of the changes in customers' needs and quickly adjust their commercial resources and products to satisfy their clients (eWeek 2009). Hence,

> *Hypothesis 4: IMC strengthens the relationship of commercial resources with competitive brokerage.*

Technical Resources and IMC

The complement between technical resources and IMC enables firms to synchronize, combine and create technical resources to enhance their competitive brokerage position. As firms accumulate and diversify their technical resources, the complexity to share across the firm and maintain the visibility of these resources considerably increases. Therefore, firms could utilize IIMC to effectively and efficiently manage the flow of technical resources between different business units and departments (Kathuria and Konsynski 2012). For instance, a well-documented example of a firm that utilizes IT to share technical resources across the firm is Merck. Merck deploys a knowledge management system to share findings and experimental procedures across research labs. This constant flow of information between research labs has enabled Merck to improve its drug development and discovery processes by identifying the synergies of technical resources of distinct laboratories (Bierly and Chakrabarti 1996; Ravichandran and Lertwongsatien 2005).

IIMC promotes the intra-firm sharing and organization of technical resources, such that firms are more likely to further combine and explore existing technical resources, encouraging collaboration, new idea generation and innovation. IIMC boosts the synergy of both existing and new technical resources and enables the firm to seamlessly integrate new technical resources. Hence, firms with strong IIMC are more likely to utilize their technical resources to improve and introduce products that respond to the changes in consumer preferences and technology. The continuous improvement and introduction of products will directly enhance the competitive brokerage position of the firms by increasing the opportunities of the firm to bridge distinct markets and increase its competitive reach. Hence,

> *Hypothesis 5: IMC strengthens the relationship of technical resources with competitive brokerage.*

Intangible Resources and IMC

The relationship of intangible resources with competitive brokerage is complemented by IMC through its ability to enable organizations to address environmental, technological and consumer preference changes via the synchronization of intangible resources across the firm. Moreover, the utilization of intangible assets in new markets highly depends on firms' IIMC. IIMC allows firms to improve the internal

availability and visibility of resources, such that distinct business units are aware of the resources developed in the firm as a whole. Through the deployment of IIMC, business units are prone to make use of other business units' intangible resources to exploit their value and reputation. This cross-unit sharing of intangible resources may facilitate the market entrance of new product and market penetration of existing products (Hall 1993), thereby improving firms' competitive brokerage position.

IIMC improves firms' ability to keep an updated stock of intangible resources. Firms can visualize and identify the changes across different business units and design strategies to develop intangible resources that enhance their competitive brokerage position. The strategic bundle between intangible resources and IIMC provides a cost advantage for firms by preventing asset duplication. Given that distinct business units are aware of the intangible resources of the firm as a whole, they may be able to utilize the extant resources instead of engaging in the arduous task of developing new ones. For instance, Johnson and Johnson developed a Social Media Employee Collaboration Platform. This platform enables information and resource sharing across the organization. Furthermore, it also promotes the online interaction of employees through the integration of social media function as those of Facebook, Twitter and YouTube (Soat 2010). Thus,

> *Hypothesis 6: IMC strengthens the relationship of intangible resources with competitive brokerage.*

Methodology

Research Context

To test our theory, we built a longitudinal multi-industry competition network using data from the period 2009 to 2011, sourced from a multinational, multi-market, industrial database[3]. To create the multi-industry longitudinal competition network, we first identified companies and corresponding product categories, brands and products in the United States across 13 industries[4]. The products commercialized in these industries satisfy the most basic daily needs and adult consumers do not face any serious regulatory restrictions to purchase these products. In line with prior literature (Chen 1996), we used United States data to provide a clear geographical boundary definition.

To study the multi-industry competitive relations, we disaggregated the market data in product category, firm, market share and industry. Then we used the data obtained from the database to build a bipartite network (Latapy et al. 2008). To depict the competitive relations between firms, we linked companies and product categories. Compared to other methods used in the competitive dynamics literature (McNamara et al. 2003; Upson et al. 2012), this approach creates a more refined representation of competition. We added weights to the links to represent competitive asymmetry.

To evaluate the firm-to-firm competitive relations, we used a one mode projection to transform the bipartite network to a firm-to-firm competition network (Newman 2009). To ensure the accuracy of the number of links and clustering of the firms, we reflected the bipartite network into a weighted directed network (a one mode network with value on its directed links) (Padrón et al. 2011).

In this competition network, the directed and weighted links depict the concept of competition asymmetry (Desarbo et al. 2006). Each competitive relationship has two directed links (A→B and B→A) and the weight of each link represent the total number of products that each firm uses to compete against each other across the 13 industries. We followed the same process to create yearly networks and their corresponding matrices from 2009 to 2011. The competition networks have an average of 988 companies and 37,994 competitive links.

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[3] For the sake of brevity the methodology section has been condensed. Please contact the corresponding author for further details about the data, its sources and methodology.

[4] The 13 industries include: beauty and personal care, alcoholic drinks, apparel, appliances, consumer electronics, consumer food service, consumer health and wellness, beverages, pet care, tissue and hygiene, home and garden, toys and tobacco.

Our longitudinal multi-industry competition network contains both publicly listed and non-listed companies. Following the conventions of previous literature (Schilling and Phelps 2007), we focus on the 297 publicly listed companies in the United States that are included in the network. We obtained the corresponding financial data from Compustat and Thomson Reuters Eikon.

IMC Data

To alleviate concerns about common method bias in IT usage and IMC surveys (Joshi et al. 2010), we collected secondary data of firms' IMC. Following prior IS research (Chi et al. 2010; Joshi et al. 2010), we searched six main computer journals (Computerworld, Networkworld, eWeek, eWeek Security Watch, Infoworld, and InformationWeek) for data about information management initiatives of the firms from 2008 to 2010. Using structured content analysis we extracted the information management initiatives of the firms in our data set. We excluded duplicated and non-relevant news. We obtained 672 relevant news reports, which were then classified according to the technologies used for IIMC and EIMC. Then, we counted the number of IIMC and EIMC enabling technologies by year for each company. We presumed that technologies used before a certain period will continue to be used unless they were later reported as discontinued or upgraded. To check the reliability of the classification we used the Perreault and Leigh index (Perreault and Leigh 1989) and obtained a value of 0.80, which exceeds the 0.7 benchmark value.

Measurement

Table 1. Description of Major Variables					
Variable	Definition	Measure	References	Mean	S.D.
Competitive Brokerage	Degree of control of the flow of competitive actions that a firm has at a particular unit of time and importance of this firm in bridging the indirect competitive relationships between other competitors.	Quantification of number of times that intermediary nodes act as bridges or brokers in a competition network.	(Opsahl et al. 2010)	4,690.7	19433.6
Commercial Resources	Supportive or complementary resources that a firm needs to commercialize new and existing products.	Logarithm of advertising expenses.	(Delios and Beamish 2001; Dierickx and Cool 1989; O'Brien 2003)	4.490	1.810
Technical Resources	Firms' resources to create new technology, products and processes.	Logarithm of R&D expenses.	(Ahuja 2000b; Calantone and Di Benedetto 1988).	3.134	2.726
Intangible Resources	Goods that can be applied in new markers with proportionally smaller increments in costs.	Logarithm of intangible assets.	(Chang et al. 2013; Delios and Beamish 2001)	5.580	1.840
Information Management Capability	Firms' ability to generate, accumulate and disseminate accurate data and information to respond to changing business needs.	Predicted factor scores from count based measures of information management initiatives.	(Chi et al. 2010; Mithas et al. 2011)	-0.17	0.41

Table 1. Description of Major Variables

Dependent Variables

We developed the measure for our dependent variable, competitive brokerage, using the multi-industry longitudinal competition network. This measurement relies on the concept of intermediary nodes and quantifies the number of times that intermediary nodes acts as bridges or brokers. Competitive brokerage is measured as : $C_b^{w\alpha}(i) = \frac{g_{jk}^{w\alpha}(i)}{g_{jk}^{w\alpha}}$, where $g_{jk}^{w\alpha}(i)$ is the number of weighted shortest paths that go through firm i and $g_{jk}^{w\alpha}$ is the number of weighted shortest paths between two nodes (Opsahl et al. 2010)[5]. For this study, we set the tuning parameter α to 0.5[6].

Independent Variables

The independent and control variables were lagged one year in relation to the dependent variable. The logarithm of R&D expenses was used as a proxy for technical resources (Calantone and Di Benedetto 1988). Consistent with previous research that indicates that advertising expenses represent the stock of accumulated commercial assets (Delios and Beamish 2001; Dierickx and Cool 1989), we measured commercial resources as the logarithm of advertising expenses. We measured the logarithm of intangible assets to measure intangible resources (Chang et al. 2013; Delios and Beamish 2001). Table 1 provides a description of the major variables, along with their measures, references, means and standard deviations.

Table 2. Factor Loadings for Information Management Capability									
	2010			2009			2008		
	Factor		Uniqueness	Factor		Uniqueness	Factor		Uniqueness
Variable	1	2		1	2		1	2	
IIMC	0.85		0.28	0.94		0.11	0.85		0.28
EIMC	0.85		0.28	0.94		0.11	0.85		0.28
Eigenvalue	1.44	0.56		1.77	0.23		1.44	0.56	
Variance proportion	0.72	0.28		0.89	0.11		0.72	0.28	

Table 2. Factor Loadings for Information Management Capability

Following prior literature (Chi et al. 2010), we performed cross-sectional factor analysis using the two dimensions of IMC (IIMC and EIMC) to investigate whether firms differ in the deployment of technologies for IIMC and EIMC. Table 2 illustrates that only one factor has an eigenvalue greater than one; therefore, most of the variance is explained by a single factor. The scree plots also showed that most of the variance is explained by a single factor. Hence, in this study we use IMC as a single construct. We used the predicted factor scores in the subsequent regression analysis.

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[5] For a detailed understanding of the brokerage concept and its measurement in social networks, please refer to (Opsahl et al. 2010).

[6] The parameter α has two benchmark values, 0 and 1. If α =1, only the weights of the links will be considered to find the shortest path and calculate betweenness centrality. If α =0, only the length and number of links will be considered to calculate the measurement. Therefore, we set α =0.5. When α =0.5, the calculation takes into account and gives the same importance to the number of links, weight and length of the links to calculate the measure.

Table 3. Standardized Coefficient Estimates: Regression Analysis for Competitive Brokerage Position					
Competitive Brokerage (DV)					
	Model 1 (Control)		Model 2		Model 3	
	δ	t-value	δ	t-value	δ	t-value
Links	11,269.28***	(149.76)	11,199.05***	(364.51)	11,232.01***	(394.10)
Firm size	1,437.44***	(17.16)	1,060.78***	(32.88)	1,014.18***	(37.82)
Firm age	234.91**	(3.22)	114.23***	(6.61)	107.33***	(7.38)
Firm performance	2,893.99***	(39.64)	2,750.26***	(101.16)	2,749.02***	(109.87)
Industry capital intensity	0.62	(0.02)	-53.24***	(-4.74)	-44.74***	(-4.36)
CBP (residuals)	15,334.94***	(376.15)	15,312.59***	(1,082.43)	15,311.24***	(1,202.39)
Commercial resources			188.62**	(3.23)	87.22**	(2.72)
Technical resources			79.28*	(2.40)	192.57***	(3.49)
Intangible resources			272.18***	(7.78)	229.47***	(8.29)
Technical resources^2			618.84***	(16.17)	735.04***	(18.23)
Commercial resources^2			-170.02**	(-2.92)	-123.13*	(-2.04)
IMC					-26.66	(-1.24)
Intangible resources X IMC					52.27*	(2.42)
Commercial resources X IMC					93.65†	(1.92)
Commercial resources^2 X IMC					-97.15†	(-1.75)
Technical resources X IMC					17.56	(0.50)
Technical resources^2 X IMC					-213.77***	(-3.99)
N	562		562		562	
Log likelihood	-1580.07		-1406.23		-1400.68	
t statistics in parentheses						
*** p<0.001, ** p<0.01, * p<0.05, †p<0.10						

Table 3. Standardized Coefficient Estimates: Regression Analysis for Competitive Brokerage Position

Control Variables

Given that our sample contains firms from 13 different industries, we included both firm level and industry level control variables. Firm age is the number of years since the foundation of the firm. Links represents the logarithm of the number of outgoing competitive links. The logarithm of the number of employees accounts for firm size. We adapted the weighted market share measurement from Bharadwaj et al. (1999) (Weighted market share=MsiPi, where Msi is a firm's market share in each of its industries "I" and Pi is the proportion of the firm's sales in the industry) to account for firm performance. We captured the industry level capital intensity measure from Hambrick (1983), Capital intensity=Net book value of plant and equipment/Revenues.

Hypotheses Testing

Our dataset is unbalanced because there are a different number of firms each year, due to M&A or firms abandoning the markets. We used a random effects model to analyze the data. We assumed that each firm has its own systematic baseline and that each intercept "is the result of a random deviation from some mean intercept" (Chellappa and Saraf 2010). Since we are interested on analyzing the distribution for each firm, a random effects model is suitable.

The dependent variable (competitive brokerage) is truncated to the left (zero) because not every firm holds a competitive brokerage position and some firms are located in the outskirts of the competition network. Hence, to analyze the data for hypothesis 1 to 6 (DV: Competitive brokerage, see Table 2), a two-stage random effects Tobit model was used (Wooldridge 2002). Previous studies argue that network positioning is influenced by past and surrounding network structures (Zaheer and Soda 2009). We built a first-stage regression using variables identified in previous literature that likely affect the past competitive brokerage position (CBP). The variables used in the first-stage regression were competitive links, firm size, technical resources and firm performance; these variables were lagged one year in relation with the dependent variable. Then, the residual values of the first-stage model were used as an instrument in the second-stage regression (Hadani and Schuler 2013). To deal with possible multicollinearity between the square and interaction terms, we mean centered each measurement that is part of an interaction term and created the interactions by multiplying the corresponding mean centered variables (Aiken and West 1991).

Figure 1. Main effects
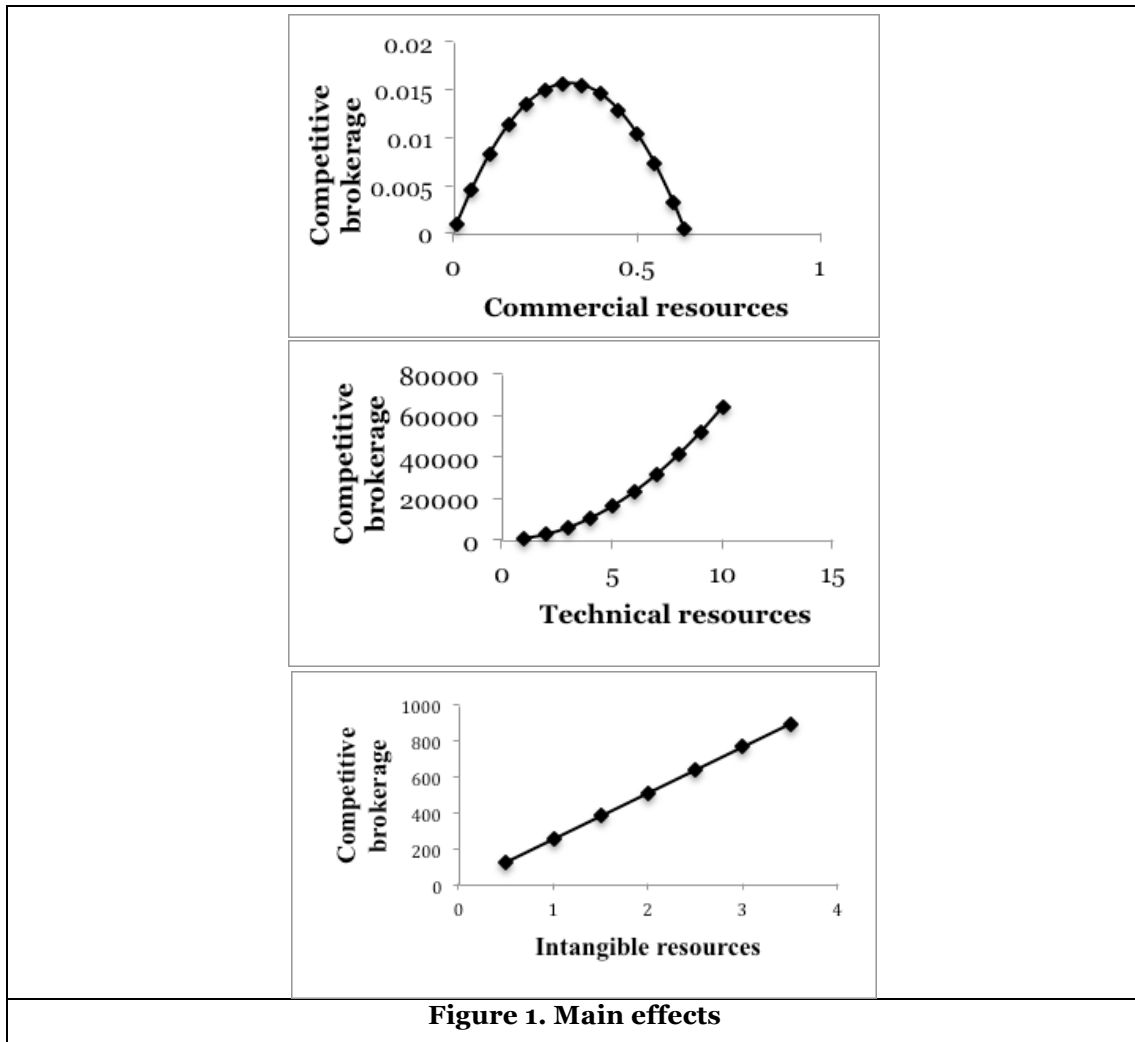
Hypothesis 1 considers the relationship between commercial resources (CR) and CBP. As Model 3 in Table 3 shows, CR positively relates to CBP (b=87.22, p<0.01), whereas CR^2 (b= -123.13, p<0.05) negatively affects CBP. Therefore, CR has an inverted U-shaped relationship with CBP in support of hypothesis 1. In Hypothesis 2, we consider the effect of technological resources (TR) on CBP. As we show in Table 3, Model 3, both TR (b=192.57, p<0.001) and TR^2 (b=735.04, p<0.001) affect CBP. We find a J-shaped curved relationship between TR and CBP, in support of Hypothesis 2. We find support for Hypothesis 3 (b=272.18, p<0.001) which proposes that intangible resources will be positively associated with CBP. Figure 1 shows a graphical depiction of these results.

Hypothesis 4 suggests that IMC strengthens the relationship between commercial resources and the competitive brokerage position of the firm. As shown in Table 3, the interactions between commercial resources and information management capability (b= 93.65, p<0.10) and commercial resources^2 and information management capability (b= -97.15, p<0.10) are significant. Therefore, Hypothesis 4 is supported. In Hypothesis 5, we assess the effects of IMC on TR. As Model 3 shows, the first order interaction between TR and IMC (b=17.56, p>0.10) is not significant, while the second-order interaction negatively relates to CBP (b= -213.77, p<0.001). Thus, Hypothesis 5 is not supported. Hypothesis 6 predicts that IMC strengthens the positive linear effects of intangible resources on competitive brokerage position. Our model shows that the interaction term between IMC and intangible resources (b=52.27, p<0.05) is significant. Thus, Hypothesis 6 is supported. In addition, consistent with previous literature (Spencer 2003; Zaheer and Soda 2009), we found that previous network structures influence current network structures. In these models, the largest variance inflation factor, which is a multicollinearity indicator, is associated with the squared term of commercial resources and has a value of 6.25, which is below the usual benchmark of 10.

Discussion

Our theoretical framework and empirical results answer our research question about the influence of IT-enabled information management capability and internal resource endowment on competitive brokerage. We augment research in IT business value, evolution of network structures and competitive dynamics by exploring the internal resource endowment and IMC that determine the attainment of a competitive brokerage position in competition networks. We develop a longitudinal multi-industry competition network to represent multi-industry competition and competitive asymmetry. We find that commercial resources have an inverted U-shaped relationship with competitive brokerage, while technical resources have a J-shaped relationship with competitive brokerage. We also find that intangible resources have a positive relationship with competitive brokerage. Finally, we find that the IT-enabled IMC strengthens the positive relationships of commercial and intangible resources with competitive brokerage. Contrary to our expectations, we found that the interaction between technical resources and IMC is not significant. We explain this result as follows. IMC enables firms to share and synchronize technical resources internally and even though different departments or business units may be aware of the existence if technical resources across the company, they may lack of the capabilities required to utilize those technical resources. Hence, companies may need to develop not only IMC but also other capabilities such as technological capabilities (Afuah 2002; Zhou and Wu 2010) to fully utilize technical resources, making the complementary relationship between technical resources and IMC non-significant. Our findings have significant implications for managers and researchers.

Research Contributions

Research on the determinants of positioning in competition networks has been nascent; however, most studies have focused on collaboration networks. For instance, Zaheer and Soda (2009) proposed that structural holes in collaboration networks are the result of structural constraints and network opportunities. This study uses a structural approach and underlines the role of network structure as an antecedent of structural holes. Sytch et al. (2012) posited that proximate existent network structures and the evolving global network structure provide the incentives and opportunities to firms to form bridging ties in collaboration networks. Although these studies analyze collaboration networks in different contexts, they both utilize structural approaches that do not consider the resource endowment of the firm as a determinant of competitive positioning. Our study extends this line of research and contributes to the evolution of network structures and social networks literature by proposing and empirically demonstrating that in addition to past and surrounding network structures, the internal resource

endowment of the firm impacts positioning in competition networks. This finding also reconciles the gaps between RBV and the structural properties tradition.

This study contributes to the competitive dynamics literature with the introduction of the competitive brokerage construct. Compared to other studies in the competitive dynamics literature (e.g. Chellappa et al. 2010; Chen 1996; Chen et al. 2007; Chen et al. 1992; Gnyawali and Madhavan 2001; Upson et al. 2012), we go beyond the industry classification boundary and take into account that a single firm can compete in several industries at the same time. We integrate all the competitive relationships of firms across diverse industries in a single competition network and calculate the multi-industry competitive positioning of firms (competitive brokerage). The competitive brokerage construct represents an alternative to objectively evaluate and compare the market positioning of the firm relative to its competitors. Furthermore, the design of our double link competition network augments empirical research to evaluate competitive asymmetry (Carpenter et al. 1988; Desarbo et al. 2006).

We enrich IS literature by posing that IT-enabled IMC complements the internal resource endowment of the firm to achieve a competitive brokerage position. Previous literature has addressed the complementarities between IT and other firm resources (Kathuria et al. 2014; Powell and Dent-Micallef 1997; Ravichandran and Lertwongsatien 2005). Nonetheless, scholars have paid scant attention to how IT and its complementary relationship with other firm resources influences positioning in competition networks. This study represents an early attempt to integrate IT and its relationship with other firm resources as an antecedent of network positioning. Our results suggest that IMC has a distinct effect on each type of firm resources. While IMC enhances the effects of intangible and commercial resources in competitive brokerage, it does not influence the linear effects of technical resources. Therefore, scholars and managers should analyze the complementarity of IMC contingent on the type of resources that they interact with.

Managerial Implications

Considering that the amount of resources that firms can develop is limited, firms should carefully select their resource endowment. Firms should develop a rich stock of technical resources, so that they are able to respond to technological changes, create new products and utilize the synergy between new and extant technical resources (Cohen and Levinthal 1990; Lim et al. 2013). Since technical resources have an increasingly positive relationship with competitive brokerage, firms with abundant technical resources will be able to reach a competitive brokerage position faster compared to firms with lesser stocks of technological resources. Moreover, firms should be cautious with their investments in commercial resources. While new technologies such as social networks and search engines represent further advertising options for firms, managers should be aware that after the effects of commercial resources reach a high level, their effectiveness to obtain a competitive brokerage decreases. Therefore, companies should closely monitor their investment in commercial resources. Intangible resources provide relevant advantages for the acquisition of a competitive brokerage position, hence firm should keep a rich stock of intangible resources (Mishra and Gobeli 1998). Differing from other resources, intangible resource do not depreciate, so they can be transferred or simultaneously utilized across different business units or markets (Morck and Yeung 1998). Therefore, intangible assets motivate firms to expand and improve their competitive brokerage position.

Our study represents an early attempt to analyze the relationship between IT-enabled capabilities and positioning in competition networks. Managers should be aware that firms are embedded in both competition and collaboration networks and that their positioning in these networks can significantly affect firm performance. Hence, they should ensure that their IT systems support the firms' network structure (Schultze and Orlikowski 2004) and enhance the information advantages and competitive attack mediation mechanisms of competitive brokerage, so that they can elaborate a successful e-business strategy. In addition, our results suggest that managers should consider how IT-enabled capabilities interact with other internal resources. Managers should ensure that there is a strategic bundle between intangible resources and IMC, such that different business units are aware of the intangible resources available in the firm as a whole and utilize the existing intangible resources to expand in new markets. Finally, due to information and knowledge acquisition advantages and the competitive attacks mediation mechanisms that competitive brokerage provides to firms, acquiring a competitive brokerage position in

competition networks should be one of the strategic priorities of the firms, especially in electronic environments such as e-business.

Conclusion and Future Research

This study has some limitations, which provide several opportunities for future research. First, in this study we consider the information advantages of competitive brokerage; however, we cannot exclude the possibility that firms may obtain information and knowledge through different sources of spillovers such as personal relationships. Future research may collect such data to enrich our understanding. Second, characteristics of competitive actions such as intensity can be included in the model to study the diffusion of competitive actions and improve our understanding of multi-industry competition. Third, we conceptually differentiated between IIMC and EIMC. However, we were not able to empirically differentiate these two IT-enabled capabilities. Therefore, future research could benefit from collecting subjective measures of IT-enabled capabilities to disentangle the impacts of these two capabilities.

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