Determinants of Retailers' Cross-channel Integration: An Innovation Diffusion Perspective on Omni-channel Retailing

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Abstract

The decision on whether and to what extent they should implement cross-channel integration is a crucial and complex task for multi-channel retailers. Although prior studies have sought to identify key determinants of this decision, most are descriptive or draw on divergent theoretical perspectives. The authors provide a cohesive theoretical model from the perspective of innovation diffusion, including not only technology-related but also organizational and environmental factors. The empirical findings based on the observations in the U.S. retail sector indicate that retailers' information-technology capabilities and private-label provision drive their cross-channel integration. Moderate diversity facilitates cross-channel integration more than does high or low diversity. Firms' financial resources seem to be less important or unimportant at a low level of industry concentration, but may influence retailers' cross-channel integration at a high level of industry concentration.
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Introduction

The rapid pace of technological development, coupled with the continual emergence of new channels (such as kiosks, websites, mobile-phone apps, and social media), empowers consumers with more information and choices than ever before. Consumers use these channels as means of engaging with retailers across multiple touch-points (Aberdeen 2013). There is a real need for retailers to move from a multi-channel to an omni-channel retailing model (Brynjolfsson, Hu, and Rahman 2013; Rigby 2011; Verhoef, Kannan, and Inman 2015). Cross-channel integration, as a retailer's chosen way to implement the omni-channel strategy through combining multiple channels (Cao and Li 2015; Neslin et al. 2006), is attracting increasing attention in literature (Herhausen et al. 2015; Verhoef 2012; Zhang et al. 2010). Cao and Li (2015) define cross-channel

integration as the degree to which a firm coordinates the objectives, design, and deployment of its channels in creating synergies for the firm and offering benefits to its consumers. The degree of coordination can range from complete separation of channels to their full coordination (Cao and Li 2015; Neslin et al. 2006). Each degree of coordination comprises different levels of benefits, outcomes, costs, and risks for retailers and consumers, and each requires the commitment of different levels of resources. Therefore, the determinants of cross-channel integration are an important topic for retailers to consider in deciding whether, if at all, and to what extent they should integrate their channels (Dholakia et al. 2010; Zhang et al. 2010).

Despite increased attention, the theoretical and empirical knowledge of cross-channel integration remains limited and offers few insights to help top managers in retail decide the right level at which to integrate their different channels. Two particular problems exist with the previous literature. First, most studies are descriptive (Berry et al. 2010; Neslin et al. 2006; Zhang et al. 2010). Second, a few empirical studies focus

only on limited factors, such as firm resources (Luo, Fan, and Zhang 2016; Steinfield, Adelaar, and Liu 2005), category of products (Levin, Levin, and Heath 2003; Steinfield, Adelaar, and Liu 2005), customer shopping orientation (Lee and Kim 2010), and intensity of competition (Brynjolfsson, Hu, and Rahman 2009). These studies are based on divergent theoretical perspectives. The resulting lack of a comprehensive theory base makes it difficult to integrate findings from different studies into a coherent body of knowledge. Therefore, it might be interesting to adopt a pertinent theoretical perspective that enables a cohesive theoretical model of the determinants of cross-channel integration to be built.

Although the channel-performance-oriented perspective is widely used in channel decision-making studies (Gensler, Dekimpe, and Skiera 2007; Sharma and Mehrotra 2007), it is poor at explaining the slow development of cross-channel integration in the real world of business. According to this perspective, retailers should accelerate their development of the strategy, since studies provide empirical evidence that cross-channel integration can increase consumer retention rate (Bendoly et al. 2005), consumer satisfaction (Montoya-Weiss, Voss, and Grewal 2003), and consumer loyalty (Van Baal 2014) —and, in turn, improve firm performance (Cao and Li 2015; Oh, Teo, and Sambamurthy 2012). However, a 2011 survey by Edge Research for Sterling Commerce, an IBM company, revealed that while 85% of consumers said they expected a seamless brand experience across all channels, only one in ten retailers felt they excelled at providing this (Stelzer 2011). A 2015 survey by Retail Systems Research also reported that retailers have still not made significant progress in integrating processes across their channels (RSR 2015). Why do these firms hesitate in developing cross-channel integration? Some important factors seem to be ignored by the channel-performance-oriented perspective.

The innovation-diffusion perspective has therefore been suggested as an alternative perspective from which to study the determinants of cross-channel integration, for three key reasons. First, this theory explains the innovation-diffusion structure and its driver. It investigates not only adoption but also use of innovation in an organization (Rogers 1995, 2003). It is relevant to consider cross-channel integration as a process of adopting and implementing innovation. Firms' strategic movement toward cross-channel integration requires retailers to adopt disruptive technologies such as radio-frequency identification (RFID), mobile apps, and centralized data warehousing (Cao 2014; Zhang et al. 2010). Furthermore, when adopted for cross-channel integration, these technologies should be routinized into retailers' operational activities for substantially modifying both customer and retailer behaviors (Berry et al. 2010; Pantano 2014; Zhang et al. 2010). For example, whereas consumers routinely use internet-enabled (and frequently mobile) devices to find information about potential purchases, they will freely choose any channel to buy because retailers' various channels have converged. Retailers are required to deliver a consistent marketing message, to synchronize their information systems across channels, and to redesign their organizational structures to adapt to changes (Verhoef, Kannan, and Inman 2015).

Second, the innovation of diffusion theory suggests that the diffusion of a technology will occur through stages, over time. Each of these stages will involve a decision-making process by the organization (Rogers 1995). As discussed earlier, the adoption and (in particular) implementation of cross-channel integration needs to be studied from an evolutionary perspective (Cao and Li 2015). Cross-channel integration requires retailers to change nearly every aspect of their businesses, including both front-end and back-end operations (Sousa and Voss 2006), supply chains (Piotrowicz and Cuthbertson 2014), and even organizational structures (Zhang et al. 2010). Chaffey (2010) and Zhang et al. (2010) therefore point out that most retailers need to follow a stage-adoption model to adopt and implement cross-channel integration strategy, because firms need to take a gradual approach, reviewing current approaches, benchmarking against competitors, identifying good practice from more advanced adopters, and creating a "roadmap" of future improvements.

Third, the innovation-diffusion perspective is especially relevant to firm-level studies (Giotopoulos et al. 2017), in order to identify the factors that influence firms' adoption and implementation of internet-related technologies such as electronic data interchange (EDI), RFID, e-business, and e-collaboration (Chan, Yee-Loong Chong, and Zhou 2012; Zhu, Kraemer, and Xu 2006). These factors are rooted in the specific technological, organizational, and environmental contexts of an organization (Tornatzky and Fleischer 1990). Compared to the channel-performance-oriented perspective, the innovation-diffusion perspective is more helpful in widening the scope of consideration.

The objective of this study is thus to answer, from an innovation-diffusion perspective, our research question: What are the determinants of cross-channel integration? We investigate this by integrating multiple secondary sources of longitudinal data on 77 publicly traded United States (U.S.) retail firms from 2008 to 2015.

This study makes three contributions to the literature on multi-channel retailing and retail innovation. First, it offers a suitable conceptual model to explain which factors determine firms' level of cross-channel integration given that cross-channel integration is a relatively new trend that is still considered an innovation process in the retail industry. We identify seven factors from three dimensions: (1) technology-related factors; (2) organizational characteristics; and (3) environmental context. We then build arguments for how these factors might determine each firm's decision about cross-channel integration. Second, this study deepens our understanding of decision-making on multi-channel strategy by identifying an alternative perspective on innovation diffusion. This perspective enables us to highlight technology-related factors and to introduce both organizational and environmental factors into the analytical framework. Third, this study extends our understanding of innovation adoption and implementation in retailing. Our findings provide further empirical evidence on the technology-related factors, organizational characteristics, and environmental context that drive the firm's adoption and use of innovation in retailing. In contrast, previous studies primarily offer conceptual frameworks or empirical evidence, focusing only on customer-level factors.

Theoretical and Hypothesis Development

The diffusion of innovation theory is defined as "the process by which an innovation is communicated through certain channels over time among the members of a social system" (Rogers 2003). It discusses both a set of determinants and a multi-stage diffusion structure for the innovation process (Chan, Yee-Loong Chong, and Zhou 2012; Rogers 2003; Tsai and Hung 2014). If we review the literature on innovation diffusion, we see that the technology, organization, and environment (TOE) framework (Tornatzky and Fleischer 1990) is a prominent model that is relevant to identifying the determinants of innovation diffusion within a firm (Chan, Yee-Loong Chong, and Zhou 2012; Giotopoulos et al. 2017; Hsu, Kraemer, and Dunkle 2006; Zhu, Kraemer, and Xu 2006).

Drawing upon the TOE model and taking into account the unique features of cross-channel integration, the conceptual model underlying this study (see Fig. 1) emphasizes the role of technology-related factors, organization characteristics, and environmental factors in shaping a firm's adoption and implementation of cross-channel integration. The following sections describe the way in which these factors are expected to affect a firm's cross-channel integration based on the existing theoretical and empirical evidence.

Technology-related Factors

Technology-related factors describe the firm's existing technological resources and capabilities, as well as its available resources and its ability to adopt and implement new technologies (Giotopoulos et al. 2017; Tornatzky and Fleischer 1990). In line with the resource-based view, firm resources are defined as all firm-controlled tangible and intangible assets that enable the firm to conceive of and implement strategies to improve its efficiency and effectiveness (Barney 1991; Wernerfelt 1984). Firm capabilities are defined as the way to deploy these resources to enable it to perform better (in a comparable environment) than its direct or potential competitors, and to create value that is perceived as such by consumers (Day 1994; Teece, Pisano, and Shuen 1997). Firms lacking certain resources and capabilities may not be able to adopt innovation and move forward quickly, regardless of their desire to do so (Schoenecker and Cooper 1998). Considering the nature of cross-channel integration (as discussed earlier), three types of firm resources and capabilities are specified within the technological context: information-technology (IT) capabilities, financial resources, and relational resources.

IT Capabilities

IT capabilities are defined as specific hardware and software systems (IT infrastructure) applied in the organization (Bharadwaj 2000), and IT-related organizational processes such as supply-chain management and customer-relationship management (CRM) (Bresnahan, Brynjolfsson, and Hitt 2002). IT capabilities may impact the development of the firm's cross-channel integration for two main reasons: First, for most traditional (store-based) retailers, the internet is the new channel. In the early stages of e-commerce development, some retailers intentionally granted a great deal of independence to their internet channel instead of integrating it into their
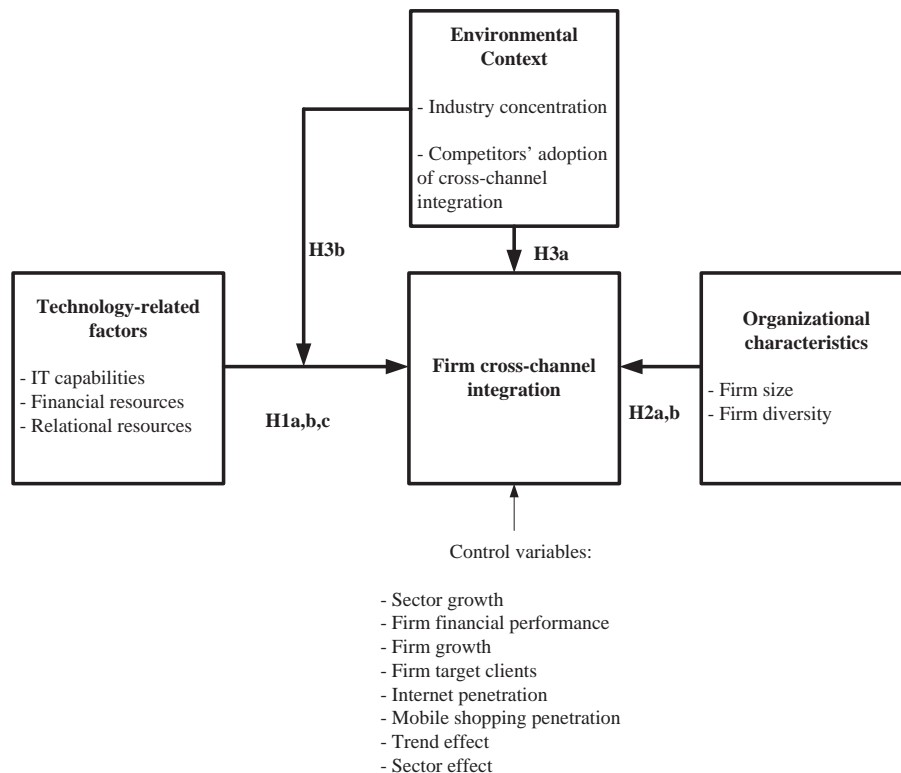

Fig. 1. Theoretical framework of determinants of firms' development of cross-channel integration.

existing channels, in order to attract executive talent and to encourage its growth. Given that the adoption of innovation is likely to be closely related to previous technological accomplishments (Teece 1996), it is only once retailers have accumulated enough experience of online operations that they have tended to consider changing to the integrated multichannel model (Zhang et al. 2010). IT capabilities as foundations of online channel operations that enable and automate online purchase and order-fulfillment processes are therefore expected to impact firms' cross-channel integration (Luo, Fan, and Zhang 2016). Second, retailers should rely on IT systems to transform business, such as cross-channel order fulfillment and CRM (Luo, Fan, and Zhang 2016). Offering a free choice of channel to consumers requires an information system for one channel that gives it the visibility and capability to act on the information system for another channel (Cao 2014). The integrated IT infrastructure enables data across channels to be linked and analyzed in a holistic way. As a result, retailers can obtain a holistic view of their customers by providing a consistent customer experience across channels (Zhang et al. 2010). Thus, we hypothesize that:

H1a. IT capabilities positively impact a firm's cross-channel integration.

Financial Resources

The shift from the silo to integrated cross-channel model is very expensive for retailers, as they must invest in the reconfiguration of architectures, platforms, and systems (Oh, Teo, and Sambamurthy 2012). For example, retailers have to integrate the information systems from different channels in order to provide one channel with the visibility and capability to act on another channel. The integration of information systems needs huge investment (Cao 2014). Although firms may borrow funds for worthwhile projects at competitive rates in an efficient capital market, it may very well be difficult to assess risky projects accurately; as a result, the availability of the flow of funds enhances a firm's ability to engage in active innovation investment (Baysinger and Hoskisson 1989). Moreover, Knight (1967) and Mansfield (1986) have both demonstrated that high costs accompany the development of innovation. Internal financial resources reduce firms' dependence on external capital markets and enable firms to make long-term investments in innovation (Satta et al. 2016).

The literature posits that a firm's internal financial resources may have a positive or negative impact on the innovation (Bourgeois 1981; Davis and Stout 1992; Kim, Kim, and Lee 2008; Voss, Sirdeshmukh, and Voss 2008). Given that empirical studies produce mixed findings, Nohria and Gulati (1996) suggest that the relationship between internal financial resources and innovations is curvilinear or inverse U-shaped: Too little slack is as bad for innovation as too much slack. Having too low a level of internal financial resources is bad because this situation discourages any kind of experimentation unless success is assured (Nohria and Gulati 1996). A firm's internal financial resources support innovation because they buffer and counter risks, being available in the event of

uncertainty (Bourgeois 1981; Voss, Sirdeshmukh, and Voss 2008). Equally, too high a level of internal financial resources is also bad, for two reasons. First, this situation might give an illusion of security to the firm and therefore reduce its motivation to adopt innovations, so producing inertia in innovation projects (Davis and Stout 1992; Kim, Kim, and Lee 2008). Second, at the level of innovation implementation, a high level of financial breeds complacency, meaning the firm may pursue more bad than good innovation projects (Nohria and Gulati 1996). As a result, there may be inefficiency of innovation projects (Davis and Stout 1992; Kim, Kim, and Lee 2008).

Retained earnings capture the internal financial resources that a firm decides to maintain both for strategic reasons (in the case of unforeseen eventualities) and for implementation strategies (Bourgeois 1981). Therefore, we expect the following:

H1b. The impact of retained earnings on cross-channel integration is curvilinear and follows an inverse U-shape.

Relational Resources

The cross-channel strategy demands the retailer to integrate and optimize functional activities both inside and outside the organization. Sophisticated multilevel and multi-channel exchanges with consumers and suppliers pose unprecedented challenges to the retailer at the level of relationship management (Cao 2014). The literature suggests the importance of relational resources for innovation from different perspectives: the resource-based view (Barney 2001), the relational view (Dyer and Singh 1998), and the role of alliances and networks in innovation (Sampson 2007). These resources build the firm's vertical-integration capabilities, which are contributable to innovation, especially to systemic innovation (Teece 1996). Given that retailers' provision of private labels demonstrates their vertical-integration capabilities to an extent, we expect that this may influence the degree of firms' cross-channel integration. Furthermore, the introduction of private labels often has a marketing impact on manufacturers or factory brands in the same distribution channel, and shifts channel power toward the retailer (Narasimhan and Wilcox 1998). Geyskens, Gielens, and Dekimpe (2002) suggest that a retailer's channel power influences its multi-channel decisions. Retailers who have stronger channel power are also more likely to follow an integrated multi-channel model (Steinfield, Adelaar, and Liu 2005), because strong capabilities in integrating their supply chains enable them to coordinate procurement, delivery, and inventory management across channels. For example, providing private-label products gives retailers more freedom to align the prices of identical products online and offline, without the constraints related to the producers' pricing strategies. Thus, we hypothesize that:

H1c. The provision of private labels positively impacts a firm's cross-channel integration.

Organizational Characteristics

Organizational characteristics describe measures of the organization such as scope, size, and managerial structure

(Tornatzky and Fleischer 1990). Other than firm resources, organizational characteristics (e.g., firm size or diversity) may be common to many firms and are not considered to be inherently advantageous (Schoenecker and Cooper 1998). However, the literature posits that organizational characteristics may impact the rate and direction of innovation. The match between these organizational attributes and different types/levels of innovation is also important for the innovation-adoption decision, as well as for its implementation and final success (Teece 1996).

Firm Size

Firm size is an important organizational attribute for innovation diffusion (Rogers 1995). In general, the findings on the effect of firm size on the adoption of innovation are contradictory (Schoenecker and Cooper 1998; Warner and Caliskan-Demirag 2011). Larger firms are assumed to be more willing to adopt innovation, as they possess capability advantages in R&D management and product development, as well as having deeper knowledge bases (Schumpeter 1950). Conversely, slow (bureaucratic) decision-making and weak incentives to take risks increase with size, and are argued to have a negative effect on the adoption of innovation (Damanpour 1991; Schoenecker and Cooper 1998; Teece 1996). Smaller firms seem more flexible and market-oriented, and more likely to adopt innovation, especially if they compete in turbulent environments (Bouchard and Basso 2011). Worsening economic conditions in the first decade of the twenty-first century created a turbulent environment for retailers (Berry et al. 2010), and interactive technologies—many of which are internet-enabled—are also reshaping the competitive landscape in retailing. Increased deployment of interactive technologies dramatically changes communication and purchase-related processes (Hoffman and Novak 1996; Yadav and Varadarajan 2005). Since smaller retailers have a heightened perception of the inherent risks in a turbulent environment (Camisón and Villar-López 2010), they may show a stronger motivation for seeking out new solutions to increase their sales, such as cross-channel integration (Cao and Li 2015). Furthermore, the new technology in a cloud- and mobile-enabled, third-party environment and the commercial availability of on-demand supply-chain solutions allow small retailers to implement cross-channel integration without the need for capital-intensive investments (Pantano 2014). Thus, we hypothesize that:

H2a. Smaller retailers develop a higher level of cross-channel integration.

Firm Diversity

The literature posits that firm diversity may have a positive or negative impact on innovation (Schoenecker and Cooper 1998; Teece 1996). The occurrence of positive impact has been argued in two respects (Teece 1996): First, the multidivisional firm has more financial resources to adopt and implement innovation in a given business, even if this leads to negative cash flow, since it can re-allocate cash from another of its businesses that has positive cash flow. Zhang et al. (2010) assert that cross-channel integration may increase sales and consumer retention, which often takes time to materialize; however, given the costs required to support changes in the marketing processes and infrastructures, the concentration of consumer databases, and the reconfiguration of the organization, company profitability may decline in the meantime. If the company operates multiple businesses rather than just the one in which it adopts cross-channel integration, profitability pressure may be reduced. Second, firms with diversified business portfolios can increase their pay-off from uncertain innovations as the new knowledge and experiences resulting from these can be widely commercialized inside the firm. For example, the knowledge and experience acquired from implementing cross-channel integration may also be very useful for the firm's other businesses, since the integration process requires it firm to keep pace with market-oriented digital and interactive technologies (Berry et al. 2010).

The occurrence of negative impact has been argued on the basis that firm diversity increases intra-firm competition and creates slower (more bureaucratic) decision-making due to complicated communication and coordination between business units (Schoenecker and Cooper 1998). Furthermore, implementation of cross-channel integration strategy demands that retailers manage the interdependency of their activities across channels (Neslin et al. 2006; Steinfield, Bouwman, and Adelaar 2002; Stone, Hobbs, and Khaleeli 2002). Higher firm diversity may increase the difficulties of coordination across channels.

Our hypothesis development focuses on how diversity affects the firm's development of cross-channel integration through the previously identified positive and negative mechanisms. We suggest that for low firm diversity, the negative impact on cross-channel integration development is very small because the firm currently needs to focus only on its key current business, but that the firm seeking future growth still expects resource spillover effects. Therefore, positive mechanisms seem to impact the firm's decision on cross-channel integration more greatly in this scenario. However, as the firm's diversity increases, so do the costs of coordination, demands on managers' attention, and risk aversion, so undermining the resource spillover effects. When a firm's diversity increases beyond a certain level, the negative effects may outweigh the positive ones. Thus, we hypothesize that:

H2b. The impact of firm diversity on cross-channel integration is curvilinear and follows an inverse U-shape.

Environmental Context

Environmental context is the arena in which a firm conducts its business—its industry, competitors, and dealings with government (Tornatzky and Fleischer 1990). This study focuses on the strategic choices of competitors to move in the same direction and on industry concentration seeing that these two factors that are the most widely studied and debated in the literature on innovation adoption and diffusion (Abrahamson and Rosenkopf 1993; Pennings and Harianto 1992; Teece 1996). The model introduced in this study additionally controls for other environmental factors (i.e. industry-sector growth, industry-sector effect, internet penetration, mobile shopping penetration, and trend effect) in accounting for a firm's cross-channel integration.

Competitors' Adoption of Cross-channel Integration

Strategy is concerned with the future, and innovation is a quest into the unknown (Teece 1996); the strategic context of a firm is always uncertain, although different firms face different degrees of uncertainty (Wernerfelt and Karnani 1987). With regard to environmental uncertainty, multichannel retailers might confront to different sources of uncertainty (Coelho and Easingwood 2003).

On the demand side, the size of the market and the desire of consumers may be uncertain. It is a still severe challenge for retailers to understand changing customer needs and preferences along the customer journey of information search, purchase, and after-sales service through multiple channels offered by retailers (Verhoef, Kannan, and Inman 2015).

On the supply side, uncertainty can arise from external developments in technology. Cross-channel integration demand retailers to adopt new technologies to increase customer and inventory visibility and integrate order fulfillment across channels. The challenge for retailers is that the related technologies have changed tremendously in the last several years.

Competitive uncertainty covers unpredictable circumstances inside competitive firms, but also competitors' nature, behavior, strategies, and aggressiveness. For example, Target Corporation aligned its prices online and offline, as well as price-matching with other top online retailers (including Amazon, Walmart, Best Buy, and Toys "R" Us) during 2013. The launch of this new aggressive pricing policy will inevitably lead to price war and increase turbulence in the market.

Institutional uncertainty is related to the effects of external institutional factors, such as social pressures and government intervention. For example, the model of "Drive" (purchasing online and picking up from a drive-through facility) is most developed in France. One of the incentives for French retailers to adopt this model is attributed to the fact that it is a good way to expand market coverage and provide consumers with convenient services while avoiding regulatory constraints. However, the French government started to guide the development of drive-through services in 2013, through the framework of the Duflot law. This will certainly influence French retailers' decisions to adopt or extend this model.

Faced with such a high level of uncertainty, firms have one strategic option, which is to wait and act only after the uncertainty is removed (Wernerfelt and Karnani 1987). One of the methods that managers use to judge whether the uncertainty has been resolved is to observe whether the dominant design has emerged from the market. A dominant design emerges as the sum of a sequence of decisions across many firms. It is similar to a political election—no single vote creates a winner, but the sum of votes does (Warner and Caliskan-Demirag 2011). This mechanism can also be argued from the institutional-based view, which sees organizations as social (as well as technical) phenomena that adopt patterns of behavior and activity appropriate to their environments (DiMaggio and Powell 1983). Thus, within an organizational field—the broad analog of industry in industrial organization economics—member organizations move toward common structures and processes (a process termed "isomorphism") through a combination of coercion, imitation, and normative expectation (DiMaggio and Powell

1983). While firms act collectively, they do not independently maintain control over the environment: There are typically strong social forces at work within an industry that push members to act in the same fashion. As a result, the common or shared strategy of group members overwhelms the strategy of an individual business (Astley and Fombrun 1983).

In general, the research on innovation diffusion argues that potential adopters commonly want to stay up to par with competitors and choose to adopt an innovation even when its profitability is uncertain out of the fear of the loss of social legitimacy and stakeholder support (Abrahamson and Rosenkopf 1993; Pennings and Harianto 1992). Therefore, we expect that a firm's adoption of cross-channel integration will be influenced by the stage of strategy development among its competitors. According to King, Sen, and Xia (2004), sellers adopt a dual-channel strategy because their competitors do the same and not because they profit financially as a result. Thus:

H3a. Higher levels of cross-channel integration adopted by competitors will positively influence the focal firm's degree of cross-channel integration.

Industry Concentration

In terms of how industry concentration impacts the firm's innovation adoption and implementation, there is no consensus in the literature (Reksulak, Shughart, and Tollison 2008; Teece 1996). Schumpeter (1950) suggests that industry concentration has a positive impact on firms' innovation, as only firms that earn profits in excess of the norm can allocate some of these to innovation. Arrow (1962) argues that organizational inertia, reinforced by the absence of competitive pressure, might reduce incentives to innovate. In other words, he highlights the negative impact of industry concentration on innovation adoption from the perspective of firms' motivation to innovate.

Addressing this debate, Teece (1996) points out that many researchers, particularly industrial-organization economists, have focused too heavily on the direct influence of industry concentration. Studying the isolated effect of industry concentration on firms' innovation may be irrelevant. The effect of industry concentration should be linked with other considerations, such as the accessibility of capital in the market and firms' internal financial resources. If capital markets are open to firms with high-yield innovative projects, Schumpeter's arguments are difficult to develop because firms can go to the market to find the finance they need. However, this kind of capital source (as opposed to internal cash flow) results in additional debts, which increase the cost and risk associated with innovation investment (Hitt et al. 1991). The willingness of firms to accept such costs and risks depends on how motivated they are to innovate. According to Arrow's arguments, industry concentration may impact firms' motivation to innovate: When industry concentration is high, firms have low motivation to innovate; and when industry concentration is low, firms are highly motivated to innovate.

Therefore, Teece's points can be developed as follows. In an industry with low concentration, firms are motivated to innovate; their internal financial resources are lower or even insignificant influences on their innovation adoption because they are able and

willing to borrow funds from the capital market to support these innovative projects. In contrast, in an industry with high concentration, firms have low motivation to innovate. For that reason, their internal financial resources become important because they do not want to take the risk of borrowing funds from the capital market; they must therefore depend on their own financial resources to develop these projects. However, in H1b, we argue that firms' low motivation to innovate produces inefficient use of their internal financial resources for innovative projects, and may weaken or reverse the positive effect of internal financial resources on their innovation implementation (Davis and Stout 1992; Kim, Kim, and Lee 2008; Nohria and Gulati 1996). Overall, we argue that industry concentration plays a negative moderating role in the effect of a firm's internal financial resources on its innovation adoption and implementation.

Previous studies provide empirical evidence of the positive effect of cross-channel integration on firm performance (Cao and Li 2015; Oh, Teo, and Sambamurthy 2012). These research results encourage investment in the capital market. Although Zhang et al. (2010) discuss the possibility that firms may experience profit decline in the short term after the adoption of cross-channel integration, their performance in the future seems promising as this strategy enables retailers to keep pace with changing consumer preferences in innovative ways. The capital market is likely to be open to cross-channel integration projects.

Based on the arguments above, we would expect the interaction between industry concentration and a firm's internal financial resources to affect its development of cross-channel integration. In particular, we hypothesize that:

H3b. In an open capital market, industry concentration negatively moderates the effect of retained earnings on firms' adoption of cross-channel integration.

Methodology

Sample and Data

We focused our investigation of cross-channel integration on U.S.-based retail firms over an eight-year period from 2008 to 2015. The initial sample comprised 91 publicly traded retail firms on the New York Stock Exchange. We dropped nine firms that applied a single-channel strategy for the period under study, and an additional five firms that had information missing. The final sample consisted of 77 retail companies, covering seven retail sectors, according to the Industry Classification Benchmark (ICB): drug retailers (retail-sector code 5333), food retailers and wholesalers (5337), apparel retailers (5371), broadline retailers (5373), home-improvement retailers (5375), specialized consumer services (5377), and specialty retailers (5379). The accounting and financial information was collected from Capital IQ database, supplemented by Securities and Exchange Commission (SEC) 10-K reports (or annual reports) and Factiva. Overall, we obtained a complete data set for 433 firm-year observations. It is therefore an unbalanced panel sample because of missing accounting information on some firm-years.

Measures

Cross-channel Integration ("CC")

To measure the development of cross-channel integration, we adopted the measurement tool built by (Cao and Li 2015) (see Appendix A) for three reasons: First, this tool captures nearly all aspects of business change during firms' shift toward cross-channel strategies, including front-end/back-end operations (Sousa and Voss 2006) and organizational structure (Zhang et al. 2010). Second, it enables us to operationalize the construct from the evolutionary perspective, which seems to fit well with the reality of firms' development of cross-channel integration (Chaffey 2010; Neslin et al. 2006; Zhang et al. 2010). Third, rather than aggregating the various dimensions, despite their differing degrees of importance (Pentina and Hasty 2009; Steinfield, Adelaar, and Liu 2005), this tool specifies and makes sense of the importance of all dimensions by categorizing them into different stages of development in cross-channel integration.

From each firm's SEC 10-K report in each year, we identified strategic cross-channel integration activities, and built the linkage between them and the indicators listed in Appendix A. Unless otherwise specified, we assumed that all cross-channel strategic activities reported in previous years continued in the year being studied, even if they were not mentioned again in the current annual report. The level of development of cross-channel strategies for each firm-year was thus measured as the highest level of strategic activity for the given year.

We ensured the validity of our measurement using two methods. First, we validated inter-rater reliability by assigning a random proportion of the sample to a second researcher. According to Frey, Botan, and Kreps (2000), two coders should have an overlap of at least 20% in coding materials. Therefore, a second coder examined a random sample of 105 firm-years (21% of the 494 total firm-years). The inter-coder reliability coefficient was .93. Second, we compared our results with other available information, primarily that published by consultancy companies. The levels of cross-channel strategies that we measured were similar to these external findings. For example, Ebeltoft's 2011 research indicated that cross-channel development among apparel retailers lags behind other categories (department stores, DIY retailers, and electrical retailers) (Holder 2012); in our study, the category of apparel retailers also has the lowest cross-channel integration level among the aforementioned four categories.

Independent Variables

The purpose of the empirical study was to investigate whether the level of cross-channel integration is related to a number of independent variables, measured as follows:

• Each firm's IT capabilities ("*IT*") were measured using the measurement tool built by Luo, Fan, and Zhang (2016) (see Appendix B). These capabilities were measured as the total number of major initiatives and projects of IT investment in a firm over the 2008 to 2015 period. The initiatives and projects were considered as major if the company reported them in its annual reports. From every firm's SEC 10-K report in each

year, we identified IT investments from three dimensions: (1) IT infrastructure; (2) enterprise systems; and (3) CRM and business analytics. We measured IT infrastructure related to point-of-sale (POS) systems, networking, and web infrastructure. Enterprise systems represent the initiatives and projects regarding to enterprise-resource-planning systems, supply-chain-management systems, and order-management systems; CRM and business analytics represent major initiatives and projects on data mining, business intelligence, and CRM systems. We used the number of projects accumulated as a measure of each firm's IT capabilities in a given year. In line with Chi, Ravichandran, and Andrevski (2010) and Luo, Fan, and Zhang (2016), we assumed that a firm would continue to use any major IT that had been implemented unless it specified in a later annual report that it had replaced or discontinued it.

- The firm's financial resources ("**Retain**") were measured using the ratio of retained earnings to total assets.
- The retailer's private-label strategy ("**PLabel**") was measured by a nominal variable: Firms selling 100% private labels products in their assortment were coded as 2, firms selling a certain percentage of private label products in their assortment were coded as 1, and firms selling none of private label products in their assortment were coded as 0
- Firm size ("**Size**") was measured by the natural logarithm of the total assets.
- Firm diversity ("**Diversity**") was measured using the entropy index of sales revenue by segment. The segment is defined by each firm. The information regarding the number of segments and the revenue for each segment within a firm was collected from Capital IQ database.

$$\boldsymbol{Diversity} = -\sum_{i=1}^{n} P_i * \ln(P_i)$$

where: P_i is the proportion of revenue belonging to the ith segments of a firm; and n is the number of segments of a firm.

- Competitors' adoption of cross-channel integration ("**Competitor**") was approximated by the median cross-channel integration of the focal firm's competitors[1] in the same sub-sector.
- Industry concentration ("**Concentration**") was measured by the Herfindahl index:

$$\text{Herfindahl index} = \sum_{i=1}^{n} S_i^2$$

where: S_i is the market share of firm i; and n is the number of firms in the same sector according to the four-digit ICB code.

Control Variables

We selected the control variables using two criteria: (1) They had been studied previously in multi-channel retailing and innovation diffusion; and (2) relevant data were available. Thus, we controlled for the effects on cross-channel integration of sector growth (Homburg, Vollmayr, and Hahn 2014), firm financial performance (Oh, Teo, and Sambamurthy 2012), firm growth (Oh, Teo, and Sambamurthy 2012), firm target clients (Jindal et al.

2007), internet penetration (Druehl and Porteus 2010), mobile shopping penetration (Piotrowicz and Cuthbertson 2014; Verhoef, Kannan, and Inman 2015), trend effect (Chan, Yee-Loong Chong, and Zhou 2012), and sector effect (Oh, Teo, and Sambamurthy 2012; Steinfield, Adelaar, and Liu 2005).

Sector growth ("**Sector_growth**") was approximated by the sector's sales growth over the previous three years. Financial performance ("**EPS_growth**") was measured by the natural logarithm of each firm's earnings-per-share growth rate. Firm growth ("**Firm_growth**") was approximated by the growth rate in the previous year's sales. Firm target clients ("**Target**") were approximated by a dummy variable: Retailers targeting young clients were coded as 1, and others were coded as 0. Internet penetration ("**Internet**") was measured by the natural logarithm of the annual number of internet users in the U.S. The variable mobile shopping penetration ("**Mobile**") was measured as the percentage of households in the U.S. that own a mobile phone. The sector effects were measured by the dummy variable using the four-digit ICB code. The time trend ("**Trend**") was controlled as follows: 2009 was given a value of 1; 2010 was given a value of 2; and so forth.

Empirical Results

Descriptive Statistics

Table 1 summarizes the descriptive statistics. The results for the **CC** level indicated that the highest score for any company was 4, the lowest 1, and the mean 2.64. The average score for IT capabilities was 4.99. Furthermore, 33.6% of the sample firms stated in their annual report that they target young customers. Retained earnings represent 31.1% of total assets on average.

Correlation Analysis

Table 2 shows the Pearson correlation between the level of **CC** and the explanatory variables. The **CC** is positively and significantly related to **IT**, **Concentration**, **Competitor**, **Mobile** and **Internet**, but negatively linked to **Retain** and **Sector growth**.

Regression Analysis

The results of the regression test are presented in Table 3. Because we had time-serial panel data, we first ran the Wooldridge test to check whether there was an autocorrelation issue in our data set. The rejection of the null hypothesis indicated that our sample did have an autocorrelation problem. We therefore chose the Newey–West estimator regression models to test our hypothesis (Newey and West 1987). The Newey–West variance estimator was developed by Newey and West in 1987 to overcome autocorrelation and heteroskedasticity in the error terms in the models for the regressions using time-serial data.

The results of Model (1) in Table 3 show that the degree of a firm's **CC** was positively and significantly influenced by the variable **IT**. It suggests that retailers with a stronger IT capability may adopt a higher level of cross-channel integration. This validates H1a.

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[1] To avoid causality, we use the previous year's **Competitor** value to predict the current year's **CC** in the regression analysis.

Table 1
Descriptive statistics.

	Mean	S.D.	Min.	Max.
CC	2.755	1.139	1.000	4.000
IT	5.065	1.555	1.000	9.000
Retain	0.317	0.392	−1.106	1.829
PLabel	0.928	0.671	0.000	2.000
Size	8.087	1.485	4.912	12.230
Diversity	0.308	0.412	0.000	1.358
Competitor	2.721	0.954	1.000	4.000
Concentration	0.188	0.175	0.074	0.663
EPS_growth	6.146	0.296	0.000	6.205
Firm_growth	0.039	0.118	−0.339	0.610
Sector_growth	0.040	0.034	−0.022	0.134
Target	0.335	0.472	0.000	1.000
Internet	12.265	0.037	12.223	12.324
Mobile	95.164	1.518	92.600	97.200
Trend	3.910	1.990	1.000	7.000
Observations	433			

Note:

CC: cross-channel integration level was measured using the index built by Cao and Li (2015).

IT: firms' IT capabilities were measured following the method of Luo, Fan, and Zhang (2016).

Size: firm size was measured by the natural logarithm of assets.

PLabel: retailer's private-label strategy was measured by a nominal variable: firms selling 100% private labels products in their assortment were coded as 2, firms selling a certain percentage of private label products in their assortment were coded as 1, and firms selling none of private label products in their assortment were coded as 0.

Diversity: firm diversity was measured using the entropy index of firms' sales revenue by segment.

Competitor: competitors' adoption of cross-channel integration was approximated by the previous year's median cross-channel integration of the focal firm's competitors in the same sub-sector.

Concentration: industry concentration was measured using the Herfindahl index.

Retain: firms' financial resources were measured using the ratio of retained earnings to total assets.

Sector growth: sector growth was approximated by the sector's sales growth over the previous three years.

EPS_growth: financial performance was measured by the natural logarithm of firms' earnings-per-share growth rate.

Firm growth: firm growth was approximated by the previous year's sales growth rate.

Target: target clients were approximated by a dummy variable: Retailers targeting young clients were coded as 1, and others as 0.

Internet: internet penetration was measured by the natural logarithm of the annual number of internet users in the U.S.

Mobile: mobile shopping penetration was measured by the percentage of mobile telephone possession by households in the U.S.

Trend: time trend (2009 was given a value of 1; 2010 was given a value of 2; and so forth).

The positive coefficient of *PLabel* indicates that the provision of private labels can positively influence retailers' adoption of cross-channel integration. Therefore, H1c is valid.

The coefficient of *Diversity* is positively linked to cross-channel integration, whereas the coefficient of *Diversity*² is negative. This empirical finding suggests that the effect of firm diversity on a firm's cross-channel integration is not constant, but is positive at a low level—and negative at a high level—of firm diversity. Therefore, H2b is valid.

The interaction between financial resources and industry concentration (*Concentration * Retain*) is negatively linked to

cross-channel integration. It seems that industry concentration inhibits the impact of financial resources on cross-channel integration. Therefore, H3b is valid.

We also observed that ***Firm_growth*** has a positive effect on ***CC***. It seems that increased sales numbers may motivate retailers to integrate different channels. We did not find any significant impact of financial resources, competitor's move, and firm size on the adoption of cross-channel integration. Thus, H1b, H2a and H3a are not valid.

Robust Test

We noticed that the variation of variable ***CC*** and ***Competitor*** can be affected by some commonly unobserved factors potentially causing endogeneity issue. Due to the lack of appropriate external instruments and ways of identifying restrictions, we adopt the latent instrumental variables method developed by (Lewbel 2012) to deal with the endogeneity in robust tests. The Lewbel method allows the identification of structural parameters in a regression with endogenous issues when the traditional identifying information—such as external instruments or repeated measurements—is absent. In this method, instruments are constructed as functions of the model's data. Identification is achieved through regressors that are not correlated with the product of heteroskedastic errors, which is a feature of many models where error correlations are due to an unobserved common factor. The results of Lewbel method (Model 2 of Table 3) are consistent with the results of the Newey West method (Model 1). Moreover, the underidentification test[2] indicates that models are identified. The Sargan-Hansen overidentifying test[3] shows that the instruments are valid and uncorrelated with the error term.

As Cao and Li (2015) pointed out, most retailers adopt a maturity or stage-of-adoption model to develop their cross-channel integration. The changes between two neighboring stages are gradual, not sudden "leaps." Following the method used by Cao and Li (2015), we treated ***CC*** as an interval variable in the analysis of Models (1) and (2) in Table 3. In Model (3), we ran the ordered logistic regression to verify the findings of Newey regression. The results of this regression are consistent with those obtained in Models (1) and (2), indicating that the conclusions of our empirical findings are valid.

We ran the stepwise regression for the variable selection; the results showed that IT capacities, firm size, private label, diversity, interaction of industry concentration, firm growth, financial resources, and time trend have a significant impact on cross-channel integration. The main findings of our empirical tests remain stable and consistent.

We conducted collinearity diagnostics and found that the variance-inflation-factor (VIF) value of ***Concentration*** is higher than 10. This high VIF is due to the simultaneous introduction of two types of sector-related variables into the regression model: ***Concentration*** and the sector dummy variables. The sector dummies, which correlated with ***Concentration***, therefore, were

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[2] Anderson canon. corr. LM statistic = 281.49, *p*-val < 0.0001.
[3] Sargan statistic (overidentification test of all instruments) = 11.55, *p*-val = 0.95.

Table 2
Pearson correlation.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. CC	1.000													
2. IT	0.358 ***	1.000												
3. Retain	−0.122 **	−0.202 ***	1.000											
4. PLabel	0.053	0.140 ***	0.301 ***	1.000										
5. Size	0.045	−0.035	−0.039	−0.049	1.000									
6. Diversity	−0.058	0.064	0.071	0.051	0.147 ***	1.000								
7. Competitor	0.387 ***	0.234 ***	−0.013	−0.100 **	0.221 ***	−0.051	1.000							
8. Concentration	0.209 ***	0.156 ***	0.104 **	−0.032	0.352 ***	−0.214 ***	0.322 ***	1.000						
9. EPS_growth	−0.007	−0.062	0.034	0.067	0.068	0.036	−0.010	0.034	1.000					
10. Firm_growth	0.120 **	0.043	−0.055	−0.062	0.040	0.072	0.137 ***	−0.054	0.045	1.000				
11. Sector_growth	0.052	−0.011	−0.102 **	−0.110 **	0.017	0.055	0.100 **	−0.215 ***	−0.043	0.197 ***	1.000			
12. Target	0.032	0.011	0.060	0.265 ***	−0.151 ***	0.058	−0.069	−0.120 **	0.030	−0.020	−0.145 ***	1.000		
13. Internet	0.303 ***	0.105 **	0.034	−0.021	0.059	0.051	0.579 ***	0.026	−0.033	0.182 ***	0.332 ***	−0.008	1.000	
14. Mobile	0.355 ***	0.132 ***	0.049	−0.018	0.066 *	0.055	0.722 ***	0.023	−0.045	0.255 ***	0.304 ***	−0.009	0.841 ***	1.000
15. Trend	0.352 ***	0.128 ***	0.046	−0.019	0.067	0.055	0.727 ***	0.027	−0.047	0.235 ***	0.352 ***	−0.010	0.859 ***	0.988 ***

* $p < 0.1$.
** $p < 0.05$.
*** $p < 0.01$.

removed and the regression was rerun without them. This reduced the VIF of **Concentration** to 3.07. We also observed that VIF of the variables **Mobile** and **Trend** was high because mobile penetration increases over the time. The regressions, therefore, were rerun and one of the two variables was retained at a time. We did not find any change in coefficient direction as a result of these tests, which indicates that our findings are robust.

Discussion

The purpose of this research was to develop and empirically test a conceptual model that identifies the determinants of cross-channel integration in a multi-channel retailing context. This conceptual model was based on the innovation-diffusion perspective, including factors in three dimensions: technology-related factors, organizational characteristics, and environmental context. The empirical study of 77 publicly traded U.S. retail firms from 2008 to 2015 generally supported the model we hypothesized. Below, we discuss the obtained results embedded in the TOE context.

Technological Context

The results suggest that retailers with more advanced IT capabilities tend to adopt and implement a higher level of cross-channel integration, and that retailers selling private-label products tend to develop a higher level of cross-channel integration. Firms' retained earnings are not linked to their decisions on channel integration. Compared to firms' IT capabilities and relational resources, their internal financial resources seem less important. One plausible explanation for this is that if firms adopt cross-channel integration projects, their chances of finding investors may increase seeing that such projects are potentially linked to positive future performance and that they enable retailers to keep pace with changing consumer preferences in innovative ways. Firms' willingness to invest and risk borrowing from the capital market will depend on their motivation to innovate. We will return to this point in discussing the factor of industry concentration later in this section.

Organizational Context

Our study suggests that the net effect of firm size is not significant. This finding represents a tension between resource advantages and organizational structure inertia. This result reveals that adoption and implementation of cross-channel integration relies on the availability of firms' resources more strongly than we initially expected, even though new cloud and mobile-enabled technologies enable small retailers to innovate to some extent without capital-intensive investments.

With respect to firm diversity, cross-channel integration is greater for firms with moderate firm diversity than for firms with high or low firm diversity. These results are consistent with our premises that the impact of firm diversity on cross-channel integration involves both positive mechanisms (resource spillover effects) and negative mechanisms (cost of coordination, demands on managers' attention, and risk

Table 3
Regression results.

	(1)	(2)	(3)
	Newey-West regression	Latent IV regression	Ordered logistic regression
IT	0.12 ***	0.12 ***	0.25 ***
	(2.711)	(3.534)	(3.262)
Retain	−0.099	−0.098	0.047
	(−0.317)	(−0.437)	(0.095)
Retain^2	−0.026	−0.026	0.069
	(−0.134)	(−0.174)	(0.231)
PLabel	0.29 **	0.29 ***	0.52 ***
	(2.405)	(3.145)	(2.656)
Size	−0.054	−0.054	−0.14
	(−1.164)	(−1.355)	(−1.546)
Diversity	2.14 ***	2.14 ***	4.23 ***
	(3.680)	(5.013)	(4.381)
Diversity^2	−2.07 ***	−2.07 ***	−4.07 ***
	(−4.298)	(−5.579)	(−4.951)
Competitor	−0.00043	−0.0070	−0.13
	(−0.004)	(−0.054)	(−0.562)
Concentration	3.69	3.70	11.8 *
	(1.332)	(1.304)	(1.765)
Retain * Concentration	−1.94 ***	−1.94 **	−6.17 ***
	(−2.651)	(−2.501)	(−3.242)
EPS_growth	0.035	0.036	0.14
	(0.947)	(0.241)	(0.553)
Firm_growth	0.80 *	0.80 **	1.87 **
	(1.857)	(1.984)	(2.220)
Sector_growth	0.86	0.84	1.28
	(0.390)	(0.454)	(0.316)
Target	−0.0054	−0.0055	−0.072
	(−0.035)	(−0.049)	(−0.294)
Internet	0.74	0.71	0.64
	(0.470)	(0.298)	(0.130)
Mobile	0.25	0.25	0.38
	(1.006)	(1.130)	(0.784)
Trend	−0.018	−0.015	0.15
	(−0.091)	(−0.079)	(0.370)
Sector effects	Controlled	Controlled	Controlled
Constant	−30.5	−30.2	
	(−1.090)	(−0.831)	
cut1			44.3
			(0.590)
cut2			46.0
			(0.612)
cut3			47.1
			(0.627)
R^2	0.3286	0.3643	0.1751
Prob > chi^2	<0.0001	<0.0001	<0.0001

Observations: 433.
t statistics in parentheses.
  * $p < 0.1$.
 ** $p < 0.05$.
*** $p < 0.01$.

aversion), and that the overall impact depends on the combined effect at the various levels of firm diversity.

Environmental Context

It is surprising that the competitors' adoption of cross-channel integration is not linked to the focal firm's decision on channel integration. The research about the relationship between the type of

innovations and innovation diffusion rates may provide some plausible explanations for this result (e.g., Lee, Smith, and Grimm 2003). Literature suggests that the greater the radicality of an innovation, the lower the ability of rivals to learn about the innovation. Consequently, the information flow and adoption behavior are slower and there is less peer pressure. The innovations related to the adoption and implementation of cross-channel integration can be considered radical as retailers should adopt the latest technologies, innovate not only in their front-end but also back-end operations, and revitalize their organizational structure (Cao and Li 2015; Sousa and Voss 2006; Zhang et al. 2010). Some changes introduced by adopters are observable; most of them, however, are not. The causal linkage between these changes may be especially ambiguous. Therefore, the information asymmetry may lead to fewer imitators in the context of cross-channel integration.

Moreover, our findings reveal that the interaction effect on cross-channel integration between a firm's internal financial resources and industry concentration. As discussed earlier, a firm's retained earnings are not directly linked to the decisions on channel integration. However, the role of a firm's internal financial resources in cross-channel integration may vary by industry. In an industry with low concentration, the firm has high motivation to innovate, and it is able and willing to borrow funds from the capital market to support its innovation projects. As a result, the firm's internal financial resources seem unimportant—or at least less important—for the development of its cross-channel integration development. In contrast, if a firm is situated in an industry with high concentration, it has low motivation to innovate and does not want to take the risk of borrowing funds from the capital market. Therefore, its internal financial resources may become important and influence its adoption and implementation of cross-channel integration.

Theoretical Implications

This study advances the research on multi-channel integration in retailing by providing a conceptual model for explaining which factors determine firms' level of cross-channel integration. Although prior research (Brynjolfsson, Hu, and Rahman 2009; Steinfield, Adelaar, and Liu 2005; Zhang et al. 2010) has discussed some potential factors that may influence cross-channel integration from divergent theoretical perspectives, it has not yet provided a comprehensive theoretical base to integrate findings from different studies into a coherent body of knowledge. To address this knowledge gap, we adopted the innovation-diffusion perspective and built a conceptual model by combining six factors from three dimensions: technology-related factors, organizational characteristics, and environmental context. Our empirical results suggest that this model is suitable for explaining retailers' decisions regarding channel integration, especially given that cross-channel integration is a relatively new trend that is still considered an innovation process in the retail industry.

We have deepened our understanding of decision-making on multi-channel strategy by identifying an alternative perspective of innovation diffusion. Most prior studies adopt a channel-performance-oriented method to understand retailers' channel additions (Geyskens, Gielens, and Dekimpe 2002; Homburg, Vollmayr, and Hahn 2014), elimination (Konuş, Neslin, and Verhoef 2014), or

integration (Berry et al. 2010; Neslin et al. 2006; Zhang et al. 2010), focusing on the analysis of the factors related to benefits, costs, and risks at channel and firm levels. However, the evaluation and planning of multi-channel distribution strategies is so complex that it is necessary to broaden the scope of consideration (Achrol and Stern 1988). In response, we proposed taking an innovation-diffusion perspective to understand retailers' channel decisions. This alternative perspective enabled us to highlight technology-related factors, and to introduce organizational and environmental factors into the analytical framework.

This study extends our understanding of innovation drivers in retailing. Pantano (2014) recommended completing deeper investigations on retail-innovation drivers because most of the existing studies focused exclusively on addressing consumers' acceptance of the most effective novel system. Adoption of the innovation-diffusion perspective enables us to focus on technology-related, organizational, and environmental factors, rather than on customer-level factors alone. Furthermore, Pantano (2014) suggests some important drivers for retailers' innovation, including the number of adopters in the sector (i.e., competitors moving toward the same innovation adoption), amount of investment (i.e., the digital, financial and relational resources engaged in the innovation), type of adopter (i.e., the retail sector), and firm size (i.e., small firms versus large firms), while focusing on the conceptual framework. Our findings provide further empirical evidence for this suggestion.

Managerial Implications

Several of our findings are useful to high-level retail managers. Understanding more about the characteristics of firms that are early adopters of cross-channel integration enables others to emulate those characteristics. Retailers often consider the following factors in making decisions regarding cross-channel integration: the focal firm's IT capabilities, the level of development of goods under a private label in the firm's assortment, firm diversity, and internal financial resources (the importance of which varies by industrial setting). If the capital market is open and industry concentration is low, retailers may adopt and develop cross-channel integration, even without abundant internal financial resources.

To facilitate cross-channel integration, retailers should redefine their strategic business segments to maintain a moderate level of firm diversity. For example, due to the increased focus on internet and digital businesses, in 2011 Barnes & Noble (B&N) evaluated its impact on the identification of operating segments. As a result of this exercise, the company determined that it has three operating segments—B&N Retail, B&N College, and B&N.com—to respond to customers' multi-channel shopping needs.

Limitations and Future Research Directions

As with any research, this study is subject to several limitations, the main one being the potentially important omitted variables that could have affected the results. They include the following:

First, in the block of technology-related factors we measure the firms' relational resources in terms of their provision of privately labeled goods. While a more appropriate measure here might have been channel power—as suggested by El-Ansary and Stern (1972), and Geyskens, Gielens, and Dekimpe (2002)

—we had limited access to information on how the analyzed firms maintained and built relationships with their suppliers, such as the dependency of suppliers on the focal firm to develop the latter's cross-channel integration, incentives from suppliers to encourage the implementation of cross-channel integration, and bargaining power with suppliers. A complementary survey of firm managers could provide new data that would improve the measurement of this variable.

Second, in the block of environmental factors this study focuses on industry concentration and it controls for some environmental factors such as industry-sector growth, industry-sector effect, internet penetration, and mobile penetration in accounting for the firms' cross-channel integration. For the environmental factor of market trend (Chan, Yee-Loong Chong, and Zhou 2012), we introduced a trend term into our model to reduce the impact of this omitted variable on our results. Further analysis using survey data on retail managers' expectations of cross-channel integration on the market could provide more direct insights into the effect of this factor on the model. For the environmental factor of consumer characteristics (Jindal et al. 2007; Konuş, Verhoef, and Neslin 2008), we introduced a variable of firm target clients into our model. We captured, however, only the information regarding the firms' targeting young clients. Further analysis using survey data on more aspects of firms' target clients (e.g., in-store shopping experiences preference, tech-savvy consumers) would shed further light on the matter.

Third, this study uses a context (the retail industry) in which cross-channel integration is a relatively new trend and is considered an innovation process. If an industry embraced omni-channel retailing, the technology-related factors highlighted by the model in the context of innovation diffusion would play a less important role in explaining the level of firms' cross-channel integration. However, marketing-strategy variables (e.g., customer heterogeneity, customers' channel usage, and marketing positioning) might affect firms' cross-channel integration decisions in such situations (Jindal et al. 2007; Konuş, Verhoef, and Neslin 2008; Lee and Kim 2010). Future research could test this proposition by adding more data once they become available.

Fourth, apart from the above-mentioned limitations resulting from omitted variables, our measurement of firms' cross-channel integration can be improved in future studies. We measured cross-channel integration following the method of Cao and Li (2015). We treated the ordinal variable CC as an interval variable in some of the regression analyses. As Cao and Li (2015) point out, most retailers adopt a maturity or stage-of-adoption model to develop cross-channel integration. The changes between two neighboring stages are gradual: They do not represent leaps. Therefore, Cao and Li (2015) also treated CC as an interval variable in their empirical analysis section. The direction of the coefficient in the regression could be used to test the hypothesis. However, the value of this coefficient must be used with caution. Furthermore, this study observed changes in firms' cross-channel integration based only on the activities that firms announced in their annual reports. We have limited access to other information; for example, firms may have replaced or discontinued some activities related to channel integration without disclosing this publicly. A complementary survey of

firm managers could help access more information in order to better measure the variable of cross-channel integration.

Finally, this study is limited to the U.S., where the capital market is open and relatively efficient in funding innovative projects. Given that the nature of the capital market is an important condition for our suggested interaction effects between industry concentration and firm financial liquidity in relation to innovation adoption, it may be interesting to extend our study into other economies, especially in the countries where capital market is less accessible.

Acknowledgments

Appendix A. Measurement Tool for Firms' Cross-channel Integration (Cao and Li 2015)

Level of cross-channel integration	Definition	Dimensions	Items
1	Multi-channel—silo mode: Retailers sell goods or services through more than one channel but independently operate these channels	Presence in different channels	Presence in different channels (website, catalog, kiosk, mobile, social media, call center)
		Different retail-mix policy	Different price policies in different channels
			Different brands in different channels
			Different assortment policies in different channels
			Different service in different channels
2	Multi-channel—minimal integration: Retailers optimize established channels, collaboratively focusing on activities linked to marketing communication with consumers	Integrated marketing communication	Consistent use of the same brand in all channels
			Consistency of marketing message across channels
3	Multi-channel—moderate integration: Retailers optimize established channels collaboratively, focusing on activities linked to the transaction with consumers	Integration of consumer-order fulfillment	Click and pick up in-store
			Click-to-call
			Buy online and return in-store
		Integration of consumer-information access	Access to online inventory and online orders fulfilled by staff in-store
			Allowing online consumers to browse the inventory in-store
			Linkage between store and mobile app (WiFi in-store, locating store by mobile app)
4	Multi-channel—full integration: Retailers optimize established channels collaboratively, focusing on activities linked to consumers' seamless shopping experience	Alignment of fundamentals	Aligned services across channels
			Aligned promotion across channels
			Aligned price across channels
			Aligned loyalty program across channels
			Aligned assortment across channels
		Centralization of back-end system	Integration of merchandise planning systems across channels
			Integration of logistics across channels
			Integration of information systems across channels
			Centralized call-center service across channels
			Integration of database of clients across channels
		Organization transformation	Sharing knowledge across channels
			Recruiting talents with double competences in retail and digital commerce
			Changing organizational structure to adapt to the integration of different channels
			Incentive system linked to both online and offline sales

Appendix B. Measurement Tool for IT Capabilities (Luo, Fan, and Zhang 2016)

Dimensions	Items
IT infrastructure	Point-of-sale
	Web infrastructure
	Networking
Enterprise systems	Enterprise resource planning
	Supply-chain-management systems
	Order-management systems
Business analytics	Data mining
	Business intelligence
	Customer-relationship management

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