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Research paper

The ambidextrous patterns for managing technological and marketing innovation

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ABSTRACT

Built upon organizational ambidexterity theory, this study provides a new perspective in managing technological and marketing innovation. It distinguishes between simultaneous and sequential patterns of innovation within a firm and takes a longitudinal approach in examining the differential effects of these two ambidextrous patterns of innovation on firm performance. Further, this study investigates the contingent roles of internal product scope and external market dynamism on the above relationships. Using panel data from 158 U.S. firms over 26 years, we find that both simultaneous and sequential patterns are positively associated with firm performance. Further, our findings indicate that a broader product scope strengthens the effect of the simultaneous pattern on firm performance, while weakening that of the sequential pattern on firm performance. When market dynamism increases, the effect of the simultaneous pattern on firm performance is strengthened, while that of the sequential pattern is weakened. Our findings offer managers guidance on the choice of innovation patterns under certain contingencies and how to better manage technological and marketing innovation over time.

1. Introduction

In today's knowledge-intensive economy, developing innovation is a strategic imperative for a firm's long-term survival. In the context of new product development, there are two significant innovation types based on the domain of new knowledge created: technological and marketing innovation (Grimpe, Sofka, Bhargava, & Chatterjee, 2017; OECD, 2005, 2018). Technological innovation involves developing and applying new technologies to improve product functionalities and novel technological advances beyond the current technological trajectory (Garcia & Calantone, 2002; OECD, 2005). Such advancements may drive technological evolution over time and help a firm improve its capacity to assimilate and combine various technology-related knowledge stores to improve firm performance (Song, Droge, Hanvanich, & Calantone, 2005; Sood & Tellis, 2005). In contrast, marketing innovation refers to implementing novel methods to market a product, including changing product packaging, placement, promotion, or pricing of the product (OECD, 2018), which helps a firm accumulate marketing knowledge and capabilities over time to better gauge customer preferences and build substantial customer assets (Moorman & Slotegraaf, 1999).

Since these two types of innovation require different knowledge and firm resources to achieve their goals, managing technological and marketing innovation within a firm has drawn increasing attention from the literature. Yet, the results have been inconsistent (see Table 1 for a literature review). Considerable research has devoted to examining the complementarity between technological and marketing innovation (e.g. (Griffin and Hauser, 1996; Moorman & Slotegraaf, 1999; Song et al., 2005). It also provided empirical support for the synergistic effects between the two types of innovation that can facilitate knowledge exchange between different functional units and enable creative knowledge integration to enhance firm performance (e.g., Nerkar & Roberts, 2004; Song et al., 2005; Zhou & Li, 2012). Despite the potential synergistic effects, recent studies have shown that pursuing a dual innovation strategy between technological and marketing innovation may increase the conflicts between different functional units due to resource constraints and create a high level of complexity in managing these two types of innovation (Calantone & Rubera, 2012; Grimpe et al., 2017).

The inconsistent findings from the prior literature reveal the complexity and challenges in managing technological and marketing innovation within a firm (Danneels, 2008; Grimpe et al., 2017). It calls for more research to study the complex relationships between

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technological and marketing innovation on firm performance, and examine how to balance these two types of innovation activities within a firm for long-term benefits (Grimpe et al., 2017; Rubera, 2015). However, most of the previous studies are cross-sectional and provided limited insights regarding managing the two types of innovation over time.

This study takes a longitudinal approach to study the relationship between technological and marketing innovation to address the above research gaps. Built upon the perspective of organizational ambidexterity, we distinguish between the simultaneous and sequential patterns of innovation and examine their differential impact on firm performance. We then examine the contingent roles of a firm's internal product scope and external market dynamism on the above relationships. This study aims to provide a longitudinal perspective towards managing technological and marketing innovation over time to achieve long-term benefits.

In doing so, our study aims to contribute to the literature in three ways. First, we adopt a new perspective to distinguish between two patterns of innovation—simultaneous and sequential patterns of innovation (Grimpe et al., 2017; Gupta, Smith, & Shalley, 2006; Levinthal & March, 1993; Raisch & Birkinshaw, 2008) and examine their differential effects on firm performance. Most of the previous literature has focused on the simultaneous pattern, and less attention has been given to the sequential pattern that balances technological and marketing innovation through temporal cycling (e.g., Benner & Tushman, 2003; He & Wong, 2004; Tushman & O'Reilly, 1996). The ambidexterity literature has indicated that the two patterns are "very different yet both logical and viable ways" to balance different innovation activities (Gupta et al., 2006, p. 698).

Second, we take a longitudinal approach to study the relationship between technological and marketing innovation over time, aiming at filling the gap in the existing literature that is mostly cross-sectional. The longitudinal approach helps gauge the effects of the two innovation patterns on firm performance over time and provide insights on how to manage a firm's innovation development for long-term benefits. Our findings reveal that the simultaneous and sequential patterns of innovation have their respective benefits and risks, and both can be effective in enhancing firm performance over time through different mechanisms.

Third, our study enriches the extant findings on the relationship between technological and marketing innovation by considering both internal and external contingency factors. Specifically, we investigate whether the impact of the above innovation patterns on firm performance may be contingent upon a firm's internal product scope and external market dynamism. A firm's internal product scope represents the diversity of a firm's product knowledge, and the effect of an innovation pattern can be contingent upon the fit of such a pattern to a firm's underlying product knowledge base (Raisch & Birkinshaw, 2008). Further, we examine market dynamism as an external factor on the above relationship since past literature has indicated that market dynamism in a firm's core industry is a critical boundary condition for being ambidextrous (Gibson & Birkinshaw, 2004).

Using panel data from the U.S. consumer-packaged goods industries (CPG), which included 4607 new product innovation from 158 publicly traded CPG firms over 26 years from 1985 to 2010, we provide empirical support regarding the differential effects of the two innovation patterns on firm performance. Our findings suggest that both simultaneous and sequential patterns can effectively enhance firm performance over time, but their effects vary depending on the level of a firm's internal product scope and external market dynamism. A broader product scope strengthens the effect of the simultaneous pattern on firm performance, while weakening that of the sequential pattern on firm performance. When market dynamism increases, the effect of the simultaneous pattern on firm performance is strengthened, while that of the sequential pattern is weakened. Our findings offer managers guidance on the choice of innovation patterns under certain contingencies and how to better manage technological and marketing innovation over time.

2. Theoretical background

The organizational ambidexterity theory contends that firms who are capable of balancing two contrasting innovation activities (e.g., exploration and exploitation) that accumulate disparate domains of knowledge would attain superior performance than those emphasizing one over the other (Gibson & Birkinshaw, 2004; He & Wong, 2004; Raisch & Birkinshaw, 2008). Balancing two contrasting innovation activities can strengthen a firm's combinative capability to integrate different knowledge for better innovation output to adapt to environmental changes over time (Raisch & Birkinshaw, 2008). Technological and marketing innovation may involve exploitation and exploration within its specific knowledge domain (Kim & Atuahene-Gima, 2010; March,

Table 1
Selected innovation literature on the effects of technology-marketing relationship.

Citation	Theoretical domain	Operationalized technology-marketing relationship	Dependent variable	Main effects	Moderators	Method	Research design
Sounder and Chakrabarti (1978)	R&D-marketing integration	Self-reported R&D-marketing interaction	Innovation project success	+		Survey	Cross-sectional
Song and Parry (1997)	R&D-marketing integration	Self-reported R&D-marketing cooperation	New product performance	+		Survey	Cross-sectional
Calantone and Rubera (2012)	R&D-marketing integration	Self-reported RD&*E*-marketing cooperation	New product performance	–	Type of program; Environmental uncertainty;	Survey	Cross-sectional
Moorman and Slotegraaf (1999)	Capability	Product technology capability × Product marketing capability	Brand quality improvement	+	External information	Quasi-experiment	Cross-sectional
Nerkar and Roberts (2004)	Capability	Technological experience × Product-market experience	Initial sales of new products	+		Empirical	Cross-sectional
Song et al. (2005)	Capability	Technology-related capability × Marketing-related capability	Firm performance (profit margin, sales, ROI)	n.s.	Technological turbulence	Survey	Cross-sectional
King et al. (2008)	Capability	R&D investment × Marketing investment	Abnormal returns	+		Empirical	Cross-sectional
Krishnan et al. (2009)	Capability	R&D intensity × Marketing intensity	ROA	+		Empirical	Cross-sectional
Grimpe et al. (2017)	Capability	R&D investment × Marketing innovative expenditure	Firm sales	–	Firm size; Type of industries	Survey	Cross-sectional
Lee et al. (2019)	Capability	Technological innovation × Marketing innovation	Firm performance (turnover)	+		Survey	Cross-sectional

1991). As such, we view technological and marketing innovation as two types of innovation activities that need to be balanced and aligned within a firm to achieve innovation ambidexterity and long-term benefits (Anzenbacher & Wagner, 2019; Chang & Hughes, 2012; Wu, Wood, Chen, Meyer, & Liu, 2020).

In particular, built upon the theory of organizational ambidexterity, this study distinguishes between two patterns of innovation activities within a firm in managing technological and marketing innovation, namely, the simultaneous and sequential patterns (Gupta et al., 2006; Raisch & Birkinshaw, 2008). A simultaneous pattern involves developing and introducing technological and marketing innovation at the same time. This would allow a firm to simultaneously pursue new knowledge creation in both product technology and market domains to achieve superior firm performance (e.g., Benner & Tushman, 2003; He & Wong, 2004; Tushman & O'Reilly, 1996). In contrast, a sequential pattern involves introducing technological and marketing innovation through temporal cycling (Rothaermel & Deeds, 2004; Siggelkow & Levinthal, 2003) that would result in a co-evolutionary cycle in innovation development (Burgelman, 2002; Rothaermel & Deeds, 2004).

Due to the complexity in managing technological and marketing innovation within a firm (e.g., Grimpe et al., 2017), each pattern of innovation has its advantages. A simultaneous pattern allows a firm to pursue technological and marketing innovation at the same time. It would help a firm advance its knowledge stores in both technological and marketing domains simultaneously, enabling the firm to have the strategic flexibility to adapt to the market environment (Sanchez, 1995; Zhou & Wu, 2010). This kind of strategic flexibility may help to lower the risks of falling into its own "competency trap" (Leonard-Barton, 1992; Levinthal & March, 1993) and give the firm higher dynamic capabilities to reconfigure its organizational resources and processes to address the environmental changes (Eisenhardt & Martin, 2000; Ferraris, Erhardt, & Bresciani, 2019; Teece, Pisano, & Shuen, 1997). However, this pattern of innovation has its limitations. Pursuing a dual strategy in innovation development may increase the organizational conflicts between R&D and marketing investments due to a firm's resource constraints, and make learning across different knowledge domains less efficient and cause a higher level of complexity in managing the two types of innovation simultaneously (Grimpe et al., 2017; Voss & Voss, 2013).

In contrast, a sequential pattern involves cycling through technological and marketing innovation at different periods within a firm. It has the advantage of dedicating a firm's resources to either technological innovation or marketing innovation at a specific time, which would allow the firm to develop specialization at a given time and create new knowledge for that specific domain more effectively (Andriopoulos & Lewis, 2009; Gupta et al., 2006). Such specialization would result in fewer conflicts between different functional units and allow the firm to achieve higher returns due to cost efficiency (Andriopoulos & Lewis, 2009; Voss & Voss, 2013). This kind of specialization in innovation development is considered viable and practical for fostering long-term survival (Benner & Tushman, 2003; Gupta et al., 2006; Wang, Luo, Maksimov, Sun, & Celly, 2019). As such, a sequential pattern can help a firm achieve the balance of two contrasting innovation across different domains over time (Lavie, Kang, & Rosenkopf, 2011).

On the other hand, this pattern of innovation also has its drawbacks. Specializing in either technological or marketing innovation at specific periods creates higher opportunity costs and risks involved when environment changes (e.g., Raisch, Birkinshaw, Probst, & Tushman, 2009). It provides firms with lower strategic flexibility and fewer strategic options to deal with the drastic changes in the environment. It may also slow down the new product's speed to market and harm firm performance when the market environment changes (Gupta et al., 2006; Siggelkow & Levinthal, 2003).

Since these two innovation patterns involve different mechanisms in managing technological and marketing innovation, each pattern may contribute to firm performance differently. In particular, the simultaneous pattern emphasizes balancing the two types of innovation at the same time to give firms more strategic flexibility and lower risks to deal with environmental changes. In comparison, the sequential pattern focuses on specializing in one type of innovation at a specific period and achieving the balance of two types of innovation over periods. Therefore, each pattern of innovation may have differential effects on firm performance over time. Moreover, past research has indicated that the effects of such balancing acts may be contingent upon internal and external factors (Raisch & Birkinshaw, 2008). Built upon past literature, this study focuses on examining the contingent effects of a firm's internal product scope and external market dynamism on the above relationships. Our findings help shed light on the choice of innovation patterns under certain contingencies and balance the two types of innovation over time to achieve optimum firm performance.

3. Hypotheses

3.1. The effects of the ambidextrous patterns on firm performance

3.1.1. Simultaneous pattern

We predict that the *simultaneous pattern* will have a positive effect on firm performance. First, the simultaneous pattern may enable a firm to achieve synergy between R&D and marketing departments during the new product development process. Specifically, even though simultaneously developing technological and marketing innovation may increase the internal conflicts between R&D and marketing departments, it also allows the R&D and marketing functions to share information and implement cross-functional coordination to create better products that match customer needs and wants (Moorman & Slotegraaf, 1999). A firm will learn to manage the internal conflicts between different functional units over time and achieve higher efficiency in knowledge assimilation across different domains in the long run. Second, the simultaneous pattern has an advantage in accumulating knowledge across different domains for future product innovation (Andriopoulos & Lewis, 2009). The accumulations of new knowledge in technology and marketing domains will help build technology and marketing capabilities more efficiently and strengthen the complementarity between these two crucial firm capabilities in the new product development process (King, Slotegraaf, & Kesner, 2008; Krishnan, Tadepalli, & Park, 2009). Consequently, the firm can attain higher combinative capabilities that can integrate these two types of knowledge stores into creating new products with better market success (Kogut & Zander, 1992; Nerkar & Roberts, 2004). Third, although a firm will encounter more complexity when pursuing both types of innovation simultaneously, such pursuit can provide a firm with more strategic options to deal with changes in the market environment. The strategic flexibility provided by the simultaneous pattern of innovation will outweigh the risks associated with this pattern of innovation and strengthen a firm's dynamic abilities to deal with the rapid changes in the market, which would lead to long term benefits for a firm (Gupta et al., 2006; Rubera, 2015). Thus, we hypothesize that:

H1a. The simultaneous pattern has a positive impact on firm performance

3.1.2. Sequential pattern

We predict that the *sequential pattern* will also have a positive impact on firm performance. First, the sequential pattern of innovation offers a firm an opportunity to develop a specialization in its respective knowledge domain (i.e., technology or marketing) and enhance its absorptive capacities to create new knowledge more effectively (Cohen & Levinthal, 1990; Levinthal & March, 1993). As illustrated, pursuing one type of innovation at a specific period helps a firm accumulate deeper insights within a specific knowledge domain, resulting in more effective learning (Levinthal & March, 1993). Through a combination of deeper knowledge insights across different knowledge domains, the firm

can produce more creative innovation outputs (De Luca & Atuahene-Gima, 2007). Second, the sequential pattern that represents temporal specialization can minimize internal conflicts between R&D and marketing functions (Andriopoulos & Lewis, 2009; Cao, Gedajlovic, & Zhang, 2009) and create a beneficial co-evolutionary cycle in innovation development (Lavie et al., 2011; Rothaermel & Deeds, 2004). While the sequential pattern can potentially slow down the new product's speed to market, we believe it might harm firm performance only in the short term. Past literature has shown that such specialization via temporal cycling would effectively foster long-term survival and enhance firm performance over time (Benner & Tushman, 2003; Gupta et al., 2006). Accordingly, we hypothesize that:

H1b. The sequential pattern has a positive impact on firm performance.

3.2. The contingent roles of product scope and market dynamism

Drawing from organizational ambidexterity—performance literature, we argue that the impact of the above two patterns of innovation on firm performance is subject to internal and external contingencies. Specifically, we examine the moderating roles of a firm's internal product scope and external market dynamism on the above relationships. Past literature has indicated that balancing the two types of innovation depends on a firm's internal resources (Roberts, 1999; Sorescu, Chandy, & Prabhu, 2003). A firm's product scope represents its product-related knowledge that can be utilized to support innovation. It is also a strong indicator of a firm's absorptive capacity to assimilate and combine different knowledge domains to create innovation (Cohen & Levinthal, 1990; Kogut & Zander, 1992; Van Den Bosch, Volberda, & De Boer, 1999).

On the other hand, market dynamism in the industry can serve as an essential boundary condition for being ambidextrous (Gibson & Birkinshaw, 2004; Raisch & Birkinshaw, 2008). The external changes strongly influence the choice of innovation patterns in the marketplace, but the impact of such innovation patterns can also be contingent upon the dynamic changes in the industry. As such, we will examine market dynamism as an external factor that moderates the above relationships.

3.2.1. Product scope

A firm's *product scope* refers to the extent of a firm's product portfolio within an industry (Sorescu et al., 2003). It reflects the number of product markets that a firm needs to manage and the diversity of a firm's product knowledge stores (Roberts, 1999; Sorescu et al., 2003). Although a firm's creation of new products depends on its existing innovation assets and the diversity of its product portfolio (Fang et al., 2011), past literature has indicated that the effects of a firm's product scope on innovation and firm performance remained unclear (Prabhu, Chandy, & Ellis, 2005). We expect a firm's product scope will have differential effects in moderating the relationships between the two patterns of innovation on firm performance.

A broader product scope may help to strengthen the positive effects of the simultaneous pattern on firm performance. Since a firm's innovation creation depends on its existing knowledge stores (Cohen & Levinthal, 1990), greater breadth in its existing knowledge will increase its absorptive capacity to acquire and assimilate new technology and market information gained through the simultaneous pattern of innovation into creating successful innovation. Further, a broader knowledge scope helps to enhance a firm's abilities to combine knowledge in related fields in a more complex and creative way (Bierly & Chakrabarti, 1996; Kogut & Zander, 1992). Even though the simultaneous pattern of innovation may require more efforts of the firm to pursue the two types of innovation simultaneously, a broader knowledge base will help a firm to better integrate the knowledge gained from such innovation activities to create more significant innovation outputs due to higher absorptive capacities (Grant, 1996; Prabhu et al., 2005; Voss & Voss, 2013). Besides, a firm with broader existing knowledge stores is less likely to develop core rigidities and be locked out of emerging technology and market trends (Leonard-Barton, 1992), thereby enhancing a firm's strategic flexibility to adapt to environmental changes in the new product development process. Thus, we hypothesize that:

H2a. A broader product scope strengthens the impact of the simultaneous pattern on firm performance.

In contrast, a broader product scope may weaken the effect of the sequential pattern on firm performance. With a broader product scope, the sequential pattern of innovation may undermine a firm's learning efficiency due to the constant back and forth resulted from the temporal cycling of innovation activities from time to time, thereby making it more challenging to integrate various knowledge across different domains effectively (Siggelkow & Levinthal, 2003). Moreover, a broader knowledge scope may not help a firm lessen the heightened opportunity costs associated with the practice of knowledge specialization required for the sequential pattern. Pursuing the sequential pattern may slow down a new product's speed to market further due to a firm's broader knowledge scope and the lack of knowledge specialization. It may be even more difficult for a firm with a broader knowledge scope to manage the sequential innovation process to cycle across its diverse knowledge domains over time (Prabhu et al., 2005). Hence, we hypothesize that:

H2b. A broader product scope weakens the impact of the sequential pattern on firm performance.

3.2.2. Market dynamism

Following the past literature, we define *market dynamism* as the extent to which industry demand changes rapidly and unpredictably (Kohli & Jaworski, 1990). Precisely, we measure market dynamism in a firm's core industry as the rate of change in the annual industry sales following the measure in Boyd, Gove, and Hitt (2005). We expect that the external market dynamism will moderate the effect of the two types of innovation patterns on firm performance.

When market dynamism is high, the simultaneous pattern can help a firm advance its knowledge stores in both technology and marketing knowledge domains concurrently, thereby giving the firm higher strategic flexibility to deal with the drastic changes in the environment. Since customer needs and technologies are constantly changing in a highly dynamic market, such strategic flexibility gained through the simultaneous pursuit of innovation will enable the firm to gain higher dynamic capabilities to reconfigure its organizational resources and routines to address the constant and unpredictable changes in the environment (Eisenhardt & Martin, 2000; Teece et al., 1997). Further, the simultaneous pursuit of technological and marketing innovation will allow the firm to achieve dynamic efficiency to address the market changes. For instance, it can do so through exchanging information between R&D and marketing units more frequently (Voss & Voss, 2013), improving the collaboration between different functional units to create better innovation outputs with higher market success (Calantone & Rubera, 2012). Therefore, we hypothesize that:

H3a. A higher level of market dynamism strengthens the impact of the simultaneous pattern on firm performance.

In contrast, when market dynamism is high, a firm pursuing a sequential pattern may have difficulties dealing with the drastic changes in the environment. Although specialization in either technological or marketing innovation at a time allows a firm to achieve higher learning effectiveness and higher returns when the environment is relatively stable (Voss & Voss, 2013), the firm will have lower strategic flexibility and higher opportunity costs when the market environment changes rapidly (Gupta et al., 2006). In other words, when market demand and technology change rapidly in the environment, specialization in one type of innovation can make it harder for a firm to reconfigure its organizational resources and processes to catch up with the emerging

trends in the environment, thereby heightening the potential risks associated with the sequential pattern of innovation (Grimpe et al., 2017; Siggelkow & Levinthal, 2003). Thus, we hypothesize that:

H3b. A higher level of market dynamism weakens the impact of the sequential pattern on firm performance.

4. Methodology

4.1. Research design

We adopted a panel-data research design and chose the U.S. CPG industries that are underrepresented in industrial management research as our empirical context. CPG industries are a unique business-to-business (B2B) marketplace in which nearly 99% of commercial transactions are from business buyers such as retailers and wholesalers (Shah, 2017). Though the development of innovation in CPG industries is consumer-oriented, the launch and selling of CPG innovation to consumers are through their B2B channel members who rely on CPG firms' innovation introduction patterns to adjust their buying contracts (McKinsey & Company, 2019). Moreover, technological and marketing innovation are the two prevalent types of innovation in the CPG industries, which are often equally shared (Nielsen, 2016). Thus, the CPG industries are an appropriate and strategically imperative context to study the ambidexterity management of technological and marketing innovation that is crucial to the CPG firms' success.

4.2. Data

After matching secondary, archival data from multiple sources, we constructed a longitudinal dataset, including the Product Launch Analytics, COMPUSTAT, and Schonfeld & Associate Reports between 1985 and 2010. Product Launch Analytics is a subscription-based database that collects new product innovation data in the U.S. CPG industries. It documents information related to each CPG product innovation, including the time of introduction, the firm launching it, the product category to which it belongs, and its source of innovativeness (for details, see Sorescu & Spanjol, 2008). COMPUSTAT collects publicly traded firms' financial and operating information, while the Schonfeld & Associate Reports provide supplementary data to compute the control variables.

To construct our sample, we first selected all publicly traded firms from the COMPUSTAT whose primary Standard Industrial Classification (SIC) codes were categorized as the CPG industries by the Product Launch Analytics. We then searched the Product Launch Analytics using the list of firm names identified from the COMPUSTAT database and matched all the innovation records from the Product Launch Analytics with the COMPUSTAT's financial and operating information. For the firms with missing information on R&D and advertising expenses, we obtained the supplementary data from the Schonfeld & Associates Reports. After matching data from the multiple sources and removing observations with missing data, our final sample contains 4607 new product innovation introduced by 158 publicly traded firms over the 26 years from 1985 to 2010.

4.3. Variable measurement

4.3.1. Firm performance

To CPG firms, the biggest financial goal is to increase product sales. Thus, we operationalized *firm performance* as a firm's average product sales over three years (e.g., Krishnan et al., 2009). This measure reduces short-term fluctuations in product sales and captures an innovation pattern's cumulative effect on business partners' repeated purchase behavior in the long run (Ataman, Van Heerde, & Mela, 2010).

4.3.2. Marketing and technological innovation

The Product Launch Analytics classifies a new product into the following innovative categories: packaging, merchandising, positioning, new market, formulation, and technology. We classified innovation in formulation or technology as *technological innovation* because these products' innovativeness stems from changing the technical components (Garcia & Calantone, 2002). For the innovation in packaging, merchandising, positioning, or new market, we categorized them into *marketing innovation* because their innovativeness comes from modifying the marketing mix elements of a product (OECD, 2005, 2018).

4.3.3. Simultaneous and sequential patterns of innovation

According to our definitions, the *simultaneous pattern* represents the simultaneous leverage of both technological and marketing innovation in the same period (Cao et al., 2009). In contrast, *sequential pattern* rotates technological and marketing innovation sequentially, focusing on technological innovation in a period followed by marketing innovation in the next period, or vice versa (Gupta et al., 2006).

Following the ambidexterity literature (Cao et al., 2009; He & Wong, 2004), we measured the *simultaneous pattern* as the product term of the percentage of technological innovation and the percentage of marketing innovation in the same year *t*. Such a measure is optimized if a firm has a high balance of technological and marketing innovation achieved in the same period. We chose year as the time unit t to operationalize the simultaneous pattern because firms make strategic planning for innovation management yearly to decide on resource allocation and leverage to support innovation (Hultink, Griffin, Hart, & Robben, 1997; Rubera & Kirca, 2012; Sorescu & Spanjol, 2008). Yearly strategic planning is also normal for the publicly traded firms that are subject to annual public disclosure and necessitate yearly-planned innovation strategies to meet market expectation (Srinivasan, Pauwels, Silva-Risso, & Hanssens, 2009).

Regarding the *sequential pattern*, we chose the two-year time window to capture the temporal cycling. The *sequential pattern* was measured as the product term of the percentage of marketing (technological) innovation in year *t*-1 and the percentage of technological (marketing) innovation in time *t* to capture the two sequential situations: a firm first introduces marketing innovation followed by technological innovation or first introduces technological innovation followed by marketing innovation. A two-year time period is the shortest period to capture the temporal cycling, which is consistent with the ambidexterity literature that uses the two-year time frame to operationalize the sequential ambidexterity (Venkatraman, Lee, & Iyer, 2007) and aligns with the industry report documenting that CPG firms are usually undergoing two years to pursue a sequential pattern for managing new products (Nielsen, 2016). Appendix A provides the visual representation of the two patterns.

4.3.4. Product scope

Following Varadarajan's (1986), we used one of the most commonly used measures of diversification—entropy—to measure *product scope*:

$$\sum_{k=1}^{n} p_k ln\left(\frac{1}{p_k}\right)$$

where p_k is the fraction of the firm's products in the k^{th} product category relative to its overall product portfolio. By definition, product scope is an inverse of the concentration distribution of products across different product categories. It measures the diversification of a firm's product portfolio that indicates the breadth of a firm's product knowledge by introducing innovation across multiple product categories. A desirable feature of the entropy measure is the ability to decompose the firm's total diversity into additive elements that define the contribution of diversification at the product category level (see Jacquemin & Berry, 1979). The larger value of the entropy indicates broader product knowledge that could be integrated to improve innovation outputs.

4.3.5. Market dynamism

To measure *market dynamism*, we applied Dess and Beard's (1984) widely used industry-based measure, which is the volatility or standard error of the change rate of annual industry sales in the past five years. The larger value of this standard error signals that a firm faces higher market uncertainty in its primary industry.

4.3.6. Control variables

We included firm- and industry-level variables to control other factors that are commonly known to impact firm sales. We controlled firm size, firm growth, and industry growth for possible economics of scale and scope. We also controlled for each firm's advertising and research & development (R & D) expenses to account for heterogeneity in firms' strategies to increase product sales (Mizik & Jacobson, 2003). Table 2 summarizes the measurements for all variables. Descriptive statistics and correlations for each variable in our data set are summarized in Table 3.

4.4. Model specification and estimation

Since our dataset has a panel structure, we conducted several tests to address the panel-data analysis issues. First, we checked multicollinearity problems among the coefficients of interest. We found variance inflated factors (VIFs) for all the estimates after estimating the full model (i.e., Model 4 in Table 4) ranging from 2.3 to 8.4, with the highest VIF on advertising and lowest VIF on market dynamism. Since all VIFs are lower than the threshold value of 10, multicollinearity was not a concern. Second, we ran the Breusch-Pagan test for heteroskedasticity (Wooldridge, 2010). The insignificant test result indicated that heteroskedasticity is not a big concern in the model (Chi-square = 1.41, $p > .10$). According to the standardized residuals, we also screened for heteroskedasticity using a standardized scatterplot of the predicted dependent variable. The residuals were randomly scattered around 0 and provided a relatively even distribution with a few residuals grouped densely in the lower bound of the predicted values. Thus, we suspected that the potential heteroskedasticity across firms in the lower bound of the predicted values might bias the estimation's standard errors. Following Arellano (2003) and Wooldridge (2010), the use of robust standard errors is the most common and popular method for dealing with issues of across-panel heteroskedasticity, which does not change coefficient estimates, but the test statistics may give us reasonably p values. Accordingly, we specified robust standard errors in our estimation. Third, we need to eliminate the reverse causality concern between our dependent variables and the two patterns. We ran multiple Granger causality tests; none of the F-tests was significant ($p > .05$), suggesting that reverse causality was not a concern. Fourth, we need to address two unobserved heterogeneity. To account for unobserved firm heterogeneity, we applied Hausman's (1978) specification test, which offers results to select between fixed- versus random-effects panel-data model. We found significant results ($p < .05$) that supported a fixed-effects panel-data model, which can address unobserved firm heterogeneity. To address unobserved, time-invariant effects, we included time-specific year dummies in the model.

After addressing these panel-data analysis issues, we eventually applied a fixed-effects panel-data model that specifies robust standard errors, which account for potential heteroskedasticity across firms and within-panel serial correlations. Before estimation, we standardized our variables to create the interaction terms for testing the moderating effects.

Table 2
Variable measurement.

Variables	Measurement	Data source
Dependent Variables		
Firm performance	Average sales of firm *i* across year $t+1$, $t+2$, and $t+3$	COMPUSTAT
Independent Variables		
Simultaneous pattern	The product term of the percentage of technological innovation in year *t* and the percentage of marketing innovation in year *t*	Product Launch Analytics
Sequential pattern	The product term of the percentage of technological (marketing) innovation in year *t*-1 and the percentage of marketing (technological) innovation in year *t*	Product Launch Analytics
Moderator		
Product scope	$\sum_{k=1}^{n} p_k ln\left(\frac{1}{p_k}\right)$, where p_k is the fraction of firm *i*'s new products in the k^{th} product category relative to its overall new product portfolio in year *t*	Product Launch Analytics
Market dynamism	Standard error of rate of change in annual industry sales across past five years	COMPUSTAT
Control Variables		
Firm size	Natural logarithm of total assets of firm *i* in year *t*	COMPUSTAT
Advertising	Advertising spending of firm *i* in year *t*	COMPUSTAT; Schonfeld Reports
R&D	Research & development spending of firm *i* in year *t*	COMPUSTAT; Schonfeld Reports
Firm growth	The difference of firm revenues between year *t* and year *t-1* divided by total revenues in year *t-1*	COMPUSTAT
Industry growth	The difference of total sales between year *t* and year *t*-1 in the industry where firm *i* is in divided by total sales in the industry in year *t-1*	COMPUSTAT

5. Results

We used the stepwise regressions and presented the empirical results in Table 4. Model 0 shows the baseline results with the control variables and moderators; Model 1 shows the main effects, including the moderators and other control variables; Model 2 adds the moderating effects of product scope; Model 3 reveals the moderating effects of market dynamism; Model 4 shows the full results with the moderating effects of both product scope and market dynamism.

5.1. The effects of the simultaneous and sequential patterns on firm performance

Results across Model 1 to Model 4 in Table 4 indicate that the main effects of the simultaneous and sequential patterns on firm performance are positive and significant. Specifically, the full Model 4 shows that both the simultaneous and sequential patterns positively impact firm performance (Simultaneous: $\beta = 0.02$, $p < .05$; Sequential: $\beta = 0.03$, $p < .05$). These significant effects are also held across Model 1 to Model 3, supporting H_{1a} and H_{1b}. Moreover, an insignificant *t*-test result ($p > .10$) of the difference between the coefficients of the main effects implies that the simultaneous and sequential patterns are equally effective to drive firm performance.

5.2. The contingent roles of product scope and market dynamism

5.2.1. Product scope

Results in Table 4 also present evidence in support of the differential moderating effects of product scope. Regarding the simultaneous pattern, both Model 2 and Model 4 reveal that, as product scope increases, the simultaneous pattern has a significant, positive effect on firm performance (Model 2: $\beta = 0.02$, $p < .05$; Model 4: $\beta = 0.02$, $p < .05$). In contrast, Model 2 and 4 show that the interaction term between product scope and the sequential pattern on firm performance becomes significant but negative (Model 2: $\beta = -0.04$, $p < .01$; Model 4: $\beta = -0.03$, $p < .01$). Thus, H_{2a} and H_{2b} are supported. We also conducted a simple slope analysis for the moderating effects. As shown in Table 5, the

Table 3
Descriptive statistics and correlation.

	M	S.D.	1	2	3	4	5	6	7	8	9	10
1. Firm performance	10,687.80	12,790.33	1									
2. Simultaneous pattern	0.22	0.32	0.09	1								
3. Sequential pattern	0.03	0.10	0.08	0.06	1							
4. Product scope	1.34	0.76	0.42	0.13	0.06	1						
5. Market dynamism	0.10	0.10	−0.09	−0.03	−0.01	−0.06	1					
6. Firm size	7.95	2.18	0.58	0.14	0.09	0.53	−0.09	1				
7. Advertising	703.09	1149.44	0.58	0.08	0.03	0.32	−0.05	0.43	1			
8. R&D	379.26	1034.02	0.49	0.10	−0.01	0.11	−0.12	0.33	0.26	1		
9. Firm growth	0.18	2.65	−0.03	0.01	−0.01	−0.06	0.07	−0.15	−0.03	−0.01	1	
10. Industry growth	0.07	0.12	−0.04	0.03	−0.04	−0.07	0.19	−0.10	−0.01	0.01	0.11	1

All values greater than 0.06 (in absolute value) are significantly different from zero at the $p < .05$ level.

Table 4
The effects of simultaneous and sequential patterns on firm performance.

	Model 0	Model 1	Model 2	Model 3	Model 4
	Coef. (sd.)	Coef. (sd.)	Coef. (sd.)	Coef. (sd.)	Coef. (sd.)
Intercept	−0.18 (0.06)**	−0.17 (0.06)**	−0.14 (0.05)**	−0.17 (0.06)**	−0.18 (0.05)***
Main Effects					
Simultaneous pattern		0.02 (0.01)**	0.02 (0.01)*	0.03 (0.01)**	0.02 (0.01)*
Sequential pattern		0.02 (0.01)*	0.04 (0.01)***	0.02 (0.01)*	0.03 (0.01)*
Moderating Effects					
Simultaneous pattern × Product scope			0.02 (0.01)*		0.02 (0.01)*
Sequential pattern × Product scope			−0.04 (0.01)**		−0.03 (0.01)**
Simultaneous pattern × Market dynamism				0.06 (0.03)*	0.06 (0.03)*
Sequential pattern × Market dynamism				−0.08 (0.04)*	−0.08 (0.04)*
Product scope	−0.04 (0.03)	−0.04 (0.03)	−0.05 (0.04)	−0.04 (0.03)	−0.04 (0.03)
Market dynamism	0.03 (0.08)	0.03 (0.08)	0.16 (0.11)	0.04 (0.08)	0.02 (0.08)
Controls					
Firm size	0.54 (0.17)***	0.55 (0.16)***	0.52 (0.17)***	0.61 (0.18)***	0.53 (0.16)***
Advertising	0.45 (0.05)***	0.45 (0.05)***	0.44 (0.06)***	0.47 (0.05)***	0.45 (0.04)***
R&D	0.18 (0.05)***	0.18 (0.05)***	0.20 (0.05)***	0.18 (0.05)***	0.19 (0.05)***
Firm growth	0.16 (0.15)	0.16 (0.14)	0.15 (0.13)	0.15 (0.13)	0.13 (0.14)
Industry growth	−0.00 (0.03)	−0.00 (0.02)	−0.03 (0.02)	−0.01 (0.02)	−0.01 (0.02)
Year dummies	Yes	Yes	Yes	Yes	Yes
Model Statistics					
R^2	0.67	0.75	0.76	0.76	0.77
Adjusted R^2	0.66	0.74	0.75	0.75	0.76
ΔAdjusted R^2		0.08**	0.01*	0.01*	0.01*
Comparison Model		Model 0	Model 1	Model 1	Models 2 & 3

* $p < .05$.
** $p < .01$.
*** $p < .001$.

marginal effect of the simultaneous pattern on firm performance is significant and positive when a firm has higher product scope ($\beta = 0.04$, $p < .01$); instead, the sequential pattern is more effective in a firm with lower product scope ($\beta = 0.11$, $p < .001$).

Table 5
The marginal effects of simultaneous and sequential patterns in terms of [−2,+2] standard deviations to the mean of moderators.

Moderators	Simultaneous pattern	Sequential pattern
	Coef. (sd.)	Coef. (sd.)
High Product Scope (+2 std. dev.)	0.04(0.01)**	−0.02(0.02)
Low Product Scope (−2 std. dev.)	−0.02(0.02)	0.11(0.03)***
High Market Dynamism (+2 std. dev.)	0.15(0.07)*	−0.15(0.10)
Low Market Dynamism (−2 std. dev.)	−0.09(0.06)	0.16(0.07)*

* $p < .05$.
** $p < .01$.
*** $p < .001$.

5.2.2. Market dynamism

Our findings also suggest differential moderating effects of market dynamism. As market dynamism increases, the simultaneous pattern exerts a significant, positive effect on firm performance (Model 3: $\beta = 0.06$, $p < .05$; Model 4: $\beta = 0.06$, $p < .05$). In contrast, the interaction term between market dynamism and the sequential pattern on firm performance is significant and negative (Model 3: $\beta = -0.08$, $p < .05$; Model 4: $\beta = -0.08$, $p < .05$). These results suggest that high market dynamism will amplify the positive effect of the simultaneous pattern on firm performance, while undermining that of the sequential pattern on firm performance. Thus, H_{3a} and H_{3b} are also supported. Likewise, we did the simple slope analysis for the moderating effects of market dynamism. Table 5 reveals that the simultaneous pattern is more effective when market dynamism is higher ($\beta = 0.15$, $p < .05$) whereas the sequential pattern is more effective when market dynamism is lower ($\beta = 0.16$, $p < .05$).

5.3. Robustness check

Our main results measured the simultaneous and sequential patterns at the product category level and averaged across product categories to align with other firm-level variables in model estimation. We believe that new products in the same category are more likely to share similar stacks of technological and marketing knowledge, which can be combined and leveraged to improve firm performance. However, technological and marketing knowledge may be leveraged across product categories (Grimpe et al., 2017; Moorman & Slotegraaf, 1999). For example, Cascade's All-in-1 ActionPacs pod package design, a marketing innovation first introduced in Procter & Gamble's dishwasher detergent category in 2003 (Hartman, 2014), has been applied to its laundry detergent category to make Tide Pod as one of its most successful products (Neff, 2012). Thus, as a robustness check, we also varied the measurement of the simultaneous and sequential patterns from the product category to the firm level. The results are presented in Appendix B. All the results are consistent with the empirical results in Table 4. Hence, we conclude that our results are robust whether the patterns are

measured in the product category or firm level.

6. Discussion

This study takes a longitudinal perspective to study the relationship between technological and marketing innovation over time. In particular, we differentiate between two ambidextrous patterns of innovation, simultaneous and sequential patterns, and examine their differential effects on firm performance. Then, we examine the contingent roles of a firm's internal product scope and external market dynamism on the relationship between the two innovation patterns on firm performance. Our findings suggest that both innovation patterns have positive effects on firm performance over time. A broader product scope or a higher level of market dynamism would strengthen the effect of the simultaneous pattern on firm performance while weakening that of the sequential pattern on firm performance. Our study offers some important implications for both theory and practice.

6.1. Theoretical implications

Our findings offer implications to the existing innovation management literature. We adopt the ambidexterity view to study the relationship between technological and marketing innovation and distinguish between two patterns of innovation activities within a firm, i.e., simultaneous and sequential patterns of innovation. Such distinction extends the prior innovation literature that suggested a simultaneous strategy as an optimal approach to enhance firm performance (e.g., King et al., 2008; Krishnan et al., 2009; Lee, Lee, & Garrett, 2019) but revealed the challenges involved in the simultaneous strategy, such as conflicts of R&D-marketing integration and the complexity in resource allocation (Calantone & Rubera, 2012; Grimpe et al., 2017). Instead, we introduce the sequential pattern and provide clarification of the differences between these two patterns.

Second, we take a longitudinal approach to identify both patterns and examine their differential effects on firm performance. Specifically, we contribute to innovation literature by investigating the sequential pattern that cannot be detected by previous cross-sectional studies (e.g., Grimpe et al., 2017). Our empirical findings suggest that both simultaneous and sequential patterns are equally effective in enhancing firm performance over time. These findings imply that the temporal cycling of the sequential pattern can successfully minimize the conflicts of R&D-marketing integration (Calantone & Rubera, 2012) and the complexity of resource allocation, which is often induced when the firm engages the simultaneous pattern in innovation development (Grimpe et al., 2017). It also implies another advantage of the sequential pattern—the effectiveness of learning (Levinthal & March, 1993), rewarding the firm with more in-depth knowledge to produce better innovation outcomes (Grant, 1996). Such advantages of the sequential pattern can compensate for its drawbacks like low strategic flexibility and less control of market risk (Siggelkow & Levinthal, 2003), making it equivalent to the simultaneous pattern on firm performance enhancement.

On the other hand, the simultaneous pattern's positive finding is consistent with extant innovation literature (see Table 1). Specifically, the simultaneous pattern can maximize the complementarity of technological and marketing innovation through learning efficiency, which accumulates across-domain knowledge simultaneously for more creative knowledge integration (Levinthal & March, 1993). It also equips a firm with high strategic flexibility (Zhou & Wu, 2010) and better control of market risk (Cao et al., 2009), which might cancel out the negative influence brought by its downside of inducing high internal conflicts (Calantone & Rubera, 2012), thereby enhancing firm performance.

Third, the contingent effects of internal product scope and external market dynamism on the relationship between the two patterns of innovation and firm performance are revealing. Our results indicate that the marginal effect of the simultaneous pattern on firm performance is significant and positive for a firm with a broader product scope, while the sequential pattern is more effective for a firm with a narrower product scope (See Table 5). These results imply the choice of pattern based on a firm's breadth of product knowledge that indicates its combinative capabilities (Van Den Bosch et al., 1999). When a firm is engaged in a simultaneous pattern, a broader product scope helps increase a firm's ability to assimilate new knowledge gained through innovation efforts and combine different knowledge domains more creatively (Nerkar & Roberts, 2004), resulting in more creative innovation outputs. In contrast, when a firm with a narrower product scope is deficient in product knowledge for highly creative knowledge integration, the sequential pattern allows it to accumulate in-depth product knowledge within one specific domain (e.g., technology or marketing) to fuel its future innovation efforts (Raisch et al., 2009).

Moreover, our findings suggest that when there is a higher level of market dynamism, the simultaneous pattern is more effective for improving firm performance, whereas the sequential pattern is more effective under a lower level of market dynamism (see Table 5). In a dynamic market, the shared mindset on coping with dynamism will attenuate the internal conflicts induced by the simultaneous pattern (Song & Parry, 1997). The simultaneous pattern becomes superior via a balanced set of technological and marketing knowledge ready for integration to address changing market needs (Voss & Voss, 2013). In a stable market, the sequential pattern becomes a more effective strategy by initiating a more in-depth analysis of specific domain knowledge to produce outputs that better please the customers (Zhou, Yim, & Tse, 2005). The market's stability can also mitigate its negativity caused by low strategic flexibility and less market risk control.

6.2. Managerial implications

Our findings can provide several implications for managers regarding better managing technological and marketing innovation over time. First, firms can choose either a simultaneous or a sequential pattern as a practical approach to implement a "dual" strategy of technological and marketing innovation to maximize firm performance. Though this study has a limitation in empirically testing the differences between these two patterns, managers should be alert that one of the distinguishing features between these two patterns is whether they increase or decrease internal conflicts induced, which can be well-managed depending on the firm's internal structure. For instance, the recent ambidexterity research illustrates that firms that involve units to operate separately for either type of innovation or have the managerial capability to allow organizational members to engage in dual capacities for both types of innovation internally can resolve internal conflicts (Venugopal, Krishnan, Upadhyayula, & Kumar, 2020; Wu et al., 2020). Thus, these firms had better implement the simultaneous pattern. On the other hand, for firms whose internal structure is less capable of resolving internal conflicts (Kang & Snell, 2009), the sequential pattern would be a more appropriate option.

Second, managers should be mindful of the choice of innovation pattern under different contingencies. In particular, when a firm has a broad product scope, a simultaneous pattern would be preferred since it can help a firm to take advantage of its broad knowledge base to enhance knowledge assimilation and integration to create more successful innovation. For instance, Tide Pod that involves technological innovation (e.g., dissolvable technology) and marketing innovation (e.g., 3-in-1 package design), has succeeded by borrowing product knowledge from the dishwashing detergent product category (e.g., Cascade's Pod Dishwash Powder) to maximize its success (Neff, 2012). On the other hand, for firms with a relatively narrow product scope, a sequential pattern could be better since it allows firms to develop a higher level of specialization in their specific knowledge domain for higher innovation returns. For example, Bausch & Lomb has maximized performance by sequentially utilizing its limited eyecare product knowledge on developing technological innovation (e.g., Soflens monthly disposable contact lens) then followed by marketing innovation

(e.g., iConnect model hunt promotional campaign targeted at the youth for affordable Soflens monthly disposable contact lens) (Bureau, 2011).

Firms should also continuously track external market dynamism to modify their choice of patterns. The simultaneous pattern is a better choice to cope with high market dynamism; in contrast, the sequential pattern becomes salient in a stable market. Firms with agile internal structure and operation processes can further flexibly switch their choice of pattern based on their assessment of market dynamism.

7. Limitations and future research

There are several limitations to this study that would provide directions for future research. In this study, due to limitations in collecting sales data for each product category, we operationalized the two innovation patterns for a firm in each product category and averaged across all product categories to link each innovation pattern to the firm-level sales data in estimation. The use of such averages is reasonable because synergistic learning effects often exist across product categories (Schilling, Vidal, Ployhart, & Marangoni, 2003; Voss & Voss, 2013). However, linking each pattern to sales data at the product category level or the product level can be pursued in future studies.

Second, this study selected CPG industries as our research context, which is a unique industrial context where most of the CPG firms are manufacturers of consumer products and their sales are mostly derived from their downstream buyers such as retailers and wholesalers who often account for the CPG's innovation management to adjust their purchase contracts (Nielsen, 2016). Future research can be extended to other high-tech industries such as electronic manufacturers, where technological and marketing innovation are more prevalent to generalize the findings from our study.

Third, this study's longitudinal design would make it challenging to measure firms' internal characteristics, such as internal conflicts, learning effectiveness, and strategic flexibility, which are essential to understanding the different mechanisms between the two innovation patterns. Future research may consider using a survey-based method to examine each innovation pattern's drivers and outcomes in more detail and enrich our study findings related to innovation management over time.

Lastly, although the results reveal that the additions of the moderating effects are significant in improving the explanatory power between models, the small increases of R-square suggest that product scope and market dynamism might play limited roles in adjusting the phenomenon of the ambidextrous patterns. While such small increases of R-square (2%) are consistent with the related studies on ambidexterity management of innovation (0.8% to 1.8% increases of R-square in He & Wong, 2004 and Nerkar & Roberts, 2004), future research may conduct a thorough and deeper investigation of the adjusting effects of the moderators on the ambidextrous patterns.

Appendix A

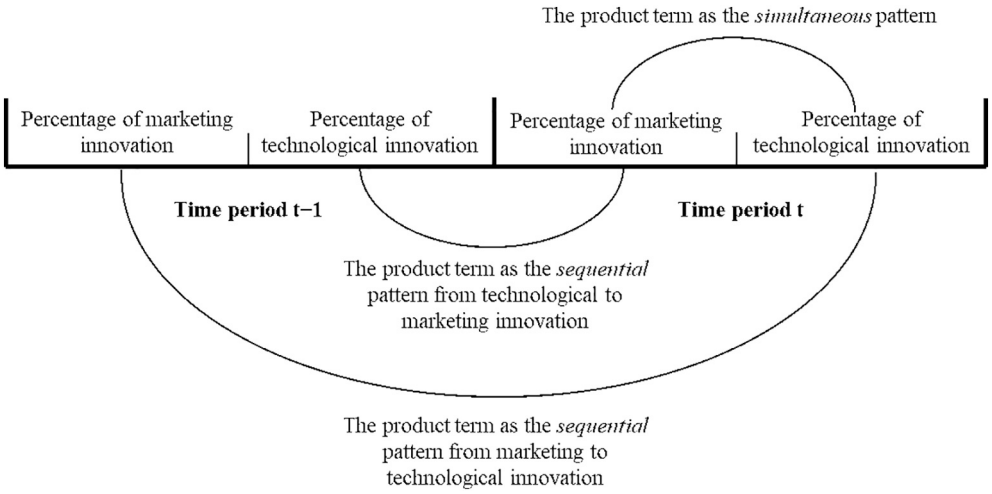

Fig. A1. Measurement of simultaneous and sequential patterns.

Appendix B. Robustness check

	Model 0	Model 5	Model 6	Model 7	Model 8
	Coef.(sd.)	Coef.(sd.)	Coef.(sd.)	Coef.(sd.)	Coef.(sd.)
Intercept	−0.18(0.06)**	−0.13(0.05)**	−0.14(0.07)*	−0.12(0.05)*	−0.14(0.05)**
Main Effects					
Simultaneous pattern		0.03(0.01)**	0.02(0.01)*	0.03(0.01)*	0.02(0.01)*
Sequential pattern		0.02(0.01)*	0.04(0.01)**	0.02(0.01)*	0.03(0.01)*
Moderating Effects					
Simultaneous pattern × Product scope			0.02(0.01)*		0.02(0.01)*
Sequential pattern × Product scope			−0.03(0.01)*		−0.03(0.01)*
Simultaneous pattern × Market dynamism				0.09(0.05)*	0.05(0.03)*
Sequential pattern × Market dynamism				−0.04(0.02)*	−0.08(0.04)*
Product scope	−0.04(0.03)	−0.06(0.04)*	−0.06(0.04)	−0.05(0.04)	−0.06(0.04)
Market dynamism	0.03(0.08)	0.09(0.08)	0.18(0.13)	0.19(0.12)	0.08(0.08)
Controls					

(*continued on next page*)

(*continued*)

	Model 0	Model 5	Model 6	Model 7	Model 8
	Coef.(sd.)	Coef.(sd.)	Coef.(sd.)	Coef.(sd.)	Coef.(sd.)
Firm size	0.54(0.17)***	0.63(0.19)***	0.63(0.19)***	0.61(0.21)**	0.63(0.19)***
Advertising	0.45(0.05)***	0.45(0.07)***	0.47(0.07)***	0.48(0.07)***	0.46(0.07)***
R&D	0.18(0.05)***	0.26(0.03)***	0.26(0.03)***	0.20(0.06)***	0.26(0.03)***
Firm growth	0.16(0.15)	0.22(0.13)*	0.19(0.13)	0.18(0.13)	0.19(0.13)
Industry growth	−0.00(0.03)	0.05(0.06)	0.02(0.03)	0.01(0.02)	0.05(0.06)
Year dummies	Yes	Yes	Yes	Yes	Yes
Model Statistics					
R^2	0.67	0.74	0.75	0.75	0.75
Adjusted R^2	0.66	0.73	0.74	0.74	0.75
ΔAdjusted R^2		0.07**	0.01*	0.01*	0.01*
Comparison Model		Model 0	Model 5	Model 5	Models 6 & 7

* $p < .05$.
** $p < .01$.
*** $p < .001$.

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