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Investigating the Impact of Pace, Rhythm, and Scope of New Product Introduction (NPI) Process on Firm Performance

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Investigating the Impact of Pace, Rhythm, and Scope of New Product Introduction (NPI) Process on Firm Performance

BY

Amalesh Sharma

A Dissertation Submitted in Partial Fulfillment of the Requirements for the Degree

Of

Doctor of Philosophy

In the Robinson College of Business

Of

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ACCEPTANCE

This dissertation was prepared under the direction of the *Amalesh Sharma* Dissertation Committee. It has been approved and accepted by all members of that committee, and it has been accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy in Business Administration in the J. Mack Robinson College of Business of Georgia State University.

Richard Phillips, Dean

DISSERTATION COMMITTEE

Dr. V. Kumar (Chair)

Dr. Alok R. Saboo

Dr. Koray Cosguner

Dr. J. Andrew Petersen (External-Penn State University)

ABSTRACT

Investigating the Impact of Pace, Rhythm, and Scope of New Product
Introduction (NPI) Process on Firm Performance

BY

Amalesh Sharma

April 17, 2017

Committee Chair: *Dr. V. Kumar*

Major Academic Unit: *Marketing*

Many potential benefits of new product introductions (NPI) have been identified in existing
literature, yet there are empirical and theoretical evidence that suggests that such benefits are not
assured. Building on the concepts of time compression diseconomies, absorptive capacity, and
time diversification, we argue that benefits that a firm derives from introducing new products
depend on the process of NPI, which we conceptualize as *how* and *what* products are introduced
by the firm. We propose that pace, rhythm, and the scope are three important characteristics of
the process of NPI that affect firm value. Further, we argue that this effect is moderated by
organizational marketing and technological intensities. We use an unbalanced panel dataset of
the products introduced by public firms between 1991 and 2015 to investigate the proposed
framework in the bio-pharmaceutical industry. We estimate the proposed model using a
multilevel modeling framework, accounting for endogeneity, unobserved heterogeneity, and
heteroscedasticity. The proposed framework and modeling approach provide empirical support
for the role of pace, rhythm and scope of NPI on firm performance, and guide managers on
choosing the right growth strategy to improve new product performance.

Key-words: *new product introduction process, pace, rhythm, scope, event study, firm
performance, endogeneity, unobserved heterogeneity*

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1. Introduction

Developing and introducing new products is the primary source of growth for firms across different industries (e.g., Cohen, Eliashberg, and Ho 1997; Pawels et al. 2003). New products enable firms to enter new markets and penetrate currently served markets, thereby enhancing firm value (e.g. Smith, Collins, and Clark 2005). Indeed, innovative companies enjoy a market premium as investors are willing to bet with their wallets for organizations having potential to introduce innovative products (Dyer, Gregersen, and Christensen 2013). While scholars have emphasized the potential gains from new product introductions (e.g., Bayus, Erickson, and Jacobson 2003; Chandy and Tellis 1998; Chaney, Devinney, and Winer 1991; Nerkar and Roberts 2004), the empirical evidence on the impact of new product introductions on firm performance is decidedly mixed. Several studies indicate that the most new products fail (e.g., Schneider and Hall 2011) and failure rates can be as high as 60% (e.g., Ogawa and Piller 2006), highlighting the risks associated with introducing new products. Further, financial gain from the commercially successful product introductions may not be realized because of substantial development and introduction costs and risk of imitation (Bayus, Jain, and Rao 1997). So, as expected, not all product introductions create value for the firm. Extant research has looked at a variety of factors that may influence the returns on product introductions, including environmental characteristics such as competition, growth, and turbulence (e.g., Moorman and Miner 1997; Yoon and Lilien 1985); firm characteristics such as R&D and marketing resources (Yoon and Lilien 1985); organizational strategic orientations (Atuahene-Gima 1995; Gatignon and Xuereb 1997), and product characteristics such as innovativeness (Chandy and Tellis 1998). We believe that an important factor that has not received sufficient attention in the extant research is the *process* of product introductions, i.e., how and what products are introduced or the pattern of product introduction that relates to introduction of new products over time. Research on the new product introduction process is scarce. While new product scholars acknowledge the importance of studying processes, the primary focus has been to study the new product development process (e.g., Griffin 1997) as opposed to new product introduction processes. Further, from the marketplace, there are mounting evidences that for some products, a firm enjoys positive market

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return, whereas for others, negative return. For example, when Bristol Myers introduced a new product on 31 July, 2000, it enjoyed positive market return (buy & hold abnormal return (BHAR)=0.3701). However, their continued introductions of two new products in the same year resulted in negative market return (BHAR=-0.0499 & BHAR=-0.0455 respectively). These differences in the market return, in addition to the factors already discussed in the extant literature, may be due to the *process* of introducing the products, which need in-depth investigation.

The importance of *process research* is embedded in the initial conceptualization of strategic management by Schendel and Hofer (1979, pg. 11) who opined that "strategic management is a process that deals with developing and utilizing the strategy which is to guide the organization's operations." This definition emphasizes the treatment of strategy as a process rather than a state, which "regrettably has not been realized" (Pettigrew 1992, pg. 5). Process analyses can provide additional insights into a phenomenon which may be lost in cross-sectional research and comparative statics (Pettigrew 1992). Marketing scholars also recognize the importance of studying strategic marketing processes and a need for closer "examination of the temporal sequence" of strategic actions (Varadarajan and Jayachandran 1999, pg. 139).[1] Similarly, Dickson et al. (2001) argue that we should see firm actions as a "moving video rather than a static snapshot." Accordingly, scholars have made calls to bring the process elements centrally into the thinking and methods of strategic analyses (e.g., Rumelt, Schendel, and Teece 1991).

The conceptualization of *process* takes a historical perspective focusing on the sequences of incidents, activities, and actions unfolding over time, which is in line with Van de Ven's (1992) view of process as a sequence of events that describes how things change over time. Theoretical and empirical evidence suggests that firms closely monitor the process of product introductions[2]. Introduction is one of the most critical moments in the life cycle of any new product and for 85% of the pharmaceutical product introductions, the first six months decides their future[3]. Given the complexity and diversity of possible

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[1] For example, Erdem and Keane (1996) and Lewis (2004) looks at the consumer's dynamic decision process under uncertainty. Similarly, Boulding et al. (1993) develop a dynamic process model of service quality.
[2] https://www.pm360online.com/on-track-for-launch-excellence-succeeding-with-the-right-key-performance-indicators/
[3] Mckinsey & Company, June 2012

treatment pathways, most pharmaceutical companies, monitor the planning of their product introductions in order to leverage the benefits. This observation is in line with the research in product life cycle management, which suggests that the timing of product launch is critical and needs to be carefully planned (e.g., Bayus et al. 1997).

In line with extant strategy research that suggests that the key elements of process research are *how* and *what*, we investigate the characteristics of the NPI process, in terms of *how* and *what* new products are introduced, and their influence on firm value. In particular, we look at the *pace*, *rhythm*, and the product *scope* of a firm's introduction process. These three characteristics delve deeper in to the how and what of product introduction. In particular, *pace* and *rhythm* look into *how* a firm introduces new products and thus capture the temporal patterns associated with NPI, whereas *scope* addresses the *what* element to examine the nature of products introduced by the firm. More specifically, *pace refers to the speed of product introductions, rhythm refers to the regularity of product introductions, and scope refers to the spread of products across different product markets.*

Further, research on organizational learning suggests that firms can enhance their ability to gain from any strategies by building internal knowledge (Lenox and King 2004; March 1991). Given the process of introduction is one of the primary means to increase firm value, the effects of process characteristics on firm performance may be enhanced by the organization's internal knowledge. In line with several marketing studies that have suggested two dimensions of organizational knowledge , marketing and technological, we investigate the moderating effects of these two dimensions – marketing and technological intensities (e.g., Marsh and Stock 2006; Moorman and Miner 1997).

We test our conceptual framework using data on new product introductions in the biopharmaceutical space (a high technology, knowledge intensive context, SIC code 28) between 1991 and 2015. We compile our dataset using data from multiple sources such as Lexis-Nexis, Food & Drug Administration(FDA) database, CRSP, COMPUSTAT, USPTO, and CAPITAL IQ for our sample of 1953 new product introductions (that accounts for 68.88% of the total products introduced during that window) by 73 public firms. Using a random effect regression model that accounts for the unobserved

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heterogeneity, heteroscedasticity and endogeneity of pace, rhythm and scope, we find that pace and scope have a diminishing effect on firm performance whereas rhythm (irregularity) of introduction negatively influence firm performance. Moreover, marketing intensity positively moderates the relationship between pace and firm value whereas technological intensity has a negative effect. Further technological intensity negatively influences the relationship between rhythm (irregularity) of NPI and firm value and positively affects the relationship between scope and firm value.

Our study makes several theoretical and managerial contributions by dwelling deeper into the process of new product introductions and provides a finer understanding of the phenomenon. First, in contrast to extant research on new products, which has largely overlooked the pattern of NPIs, we examine the importance of the process elements of NPIs, in terms of what and how products are introduced. This research adds to the understanding of new product introductions and argues that firms can realize the true potential of their products if they select an introduction strategy that is balanced with respect to the pace, rhythm, and scope of the product introduction process. Thus, we add to the literature on new products by emphasizing additional contingencies that can affect the firm value created through product introductions and add another dimension that can address the mixed findings on impact of new product introduction on firm value (which can be defined as an economic measure reflecting the market value of a firm).

Second, we highlight the values of marketing and technological intensities in the new product introduction process. While the role of marketing in the new product development process is captured in the literature (Im and Workman Jr 2004; Workman Jr 1993), role of the marketing function is surprisingly scarce in the new product introduction literature. Specifically, as marketing being one of the important value generating functions, it should play significant role in understanding the outcomes of new product introduction. Similarly, although technological intensity is found to have significant influence on product innovation and development (e.g., Wu 2012; Zhou and Wu 2010), its impact on new product introduction process, and hence on firm performance, is scarce. We contribute to the literature by exploring the moderating role of marketing and technological intensities.

Several fundamental managerial implications follow from our study as well. Managers should be cognizant of the fact that the returns on products introduced depend among other things, on the process or pattern of new products introduced. Managers need to follow an organic path of balanced growth and acknowledge the clear strategic choices about the prioritization of different dimensions of the NPI process or the integrated strategies by incorporating all three process characteristics together. Similarly, firms hoping to quickly catch up with the competition should be aware of the restrictions this research places in terms of the number of products that can be successfully introduced. These restrictions arise due to the limited organizational capacity to absorb new products and thus benefit from such products. Managers need to be aware of such restrictions before embarking on a growth path.

We organize the rest of the paper as follows: First, we develop our conceptual framework where we provide an overview of our focal constructs, the theoretical background, and develop our hypotheses. Then, we present our data collection and estimation approach. Finally, we present our results and conclude by discussing the implications of our research.

2. Conceptual Framework and Hypothesis Development

We now develop the theoretical framework for our research, including the conceptualization of the process elements of NPI, underlying theoretical mechanisms, and moderators of the relationship between process elements of NPI and firm value.

2.1. Process Elements of New Product Introduction

Mohr (1982) introduced the distinction between *variance* and *process* theories, where variance theories explain the variation in the dependent variable as a result of a set of independent variables, while process theories provide explanations in terms of patterns in events, activities, and choices over time. According to the process school of thought, the impact of any event not only depends on the event characteristics, but also "depends on what precedes it" (Langley 2009), thus arguing for incorporating the temporal patterns in addition to the other variables in the framework (Van de Ven 1992). Intuitively, the process of NPI can be understood in terms of the evolution of the new products for a firm over time.

In a seminal article on what constitutes a theoretical contribution, Whetten (1989, pg. 491) suggests that "*what* and *how* provide a [useful] framework for interpreting patterns," where what refers to factors (variables, constructs, concepts) that should be considered as part of the explanation of the phenomena of interest and how refers to the conceptualizing the relationships between these factors by explicitly delineating patterns. Similarly, Pettigrew (1992, pg. 7) emphasized the importance of "the what and the how" for strategy process research. Scholars have used this framework to empirically investigate variety of events. For example, Marks et al. (2001) studied the *what* and the *how* of team processes to orchestrate goal-directed task work. Similarly, Huckvale and Ould (1994) used it for software process modeling for business re-engineering. Thus, understanding the what and the how provides a useful starting point to investigate the process elements of new product introductions and the constructs related to the two process elements – what and how – should capture the nature of products introduced by the firm and the temporal patterns associated with product introductions. Accordingly, we look at three characteristics – *pace*, *rhythm*, and *scope* – of new product introductions and how these influence firm value (e.g., Vermeulen and Barkema 2002).

2.2. Theoretical Mechanisms

The objective of this section is to outline the theoretical mechanisms to explain why the three NPI process characteristics (pace, rhythm, and scope) influence firm value. The new product literature suggests that developing and introducing new products is critical for performance and survival of firms (Fang 2008; Wind and Mahajan 1997), however, there is mounting evidence that a large portion of new products fail to meet the organizational objectives (e.g., Ogawa and Piller 2006). The values that a firm gets from new products arise through '*learning*' and that learning can stem from two sources: the product itself (e.g., based on its performance in the market), and from the process of introduction (such that learning from one product introduction can be implemented in the subsequent NPIs). While this stream of research has highlighted several factors that could influence the value created (i.e. the learning) by new products, an important factor that has largely been overlooked is the ability of the firms to handle and absorb the complexities associated with the learning and diversify the risks associated with NPIs.

Introducing new products is a complex activity and firms need to address the several challenges of bringing these products to market. Moreover, firms take substantial risks in developing and introducing new products. Thus, the theoretical mechanisms should account for the complexities and the risks associated with product introductions. Building on concepts of time compression diseconomies (Dierickx and Cool 1989) and absorptive capacity (Cohen and Levinthal 1990), we argue that firms are limited by their abilities to absorb the complexities associated with product introductions and put this knowledge to commercial use. Further, drawing on the notion of time diversification (Jaggia and Thosar 2000), we argue that firms may fail to diversify the risks associated with NPIs adequately, thus preventing them from harnessing the true value associated with their new products. We now provide an overview of the three theoretical mechanisms that we employ to develop our hypotheses.

Time Compression Diseconomies. Dierickx and Cool (1989) developed the notion of time compression diseconomies suggesting that the time required to acquire a skill or resource through learning, experience, or training cannot be endlessly compressed without performance degradation. They use the example of MBA students, who may not accumulate the same knowledge stock in a one-year program as in a two-year program, even if all the other inputs are doubled. The concept of time compression diseconomies has been successfully employed in several empirical investigations, including alliance formation (Day 1995), international expansion (Vermeulen and Barkema 2002), micro dynamics of firm investment (Pacheco-de-Almeida 2010), resource development and competitive strategy (Pacheco-de-Almeida and Zemsky 2007) and human resource management (Wright, Dunford, and Snell 2001), among others to show that the benefits that firms can derive from such activities are constrained in time.

Extending the above arguments in our context, we argue that accelerating product introductions may be counterproductive as firms may not be adequately prepared to develop, introduce, and learn from these products. Introducing new products is resource intensive and may require diverting organizational resources from other organizational activities. Further, firms may have to invest in training and adapt their

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systems, structures, and processes to support new products. Given the resource constraints, firms may not be able to adequately perform these activities under time constraints, leading to sub-optimal decisions.

Absorptive Capacity. The concept of absorptive capacity suggests that firms are bounded in terms of their rationality and cognitive scope (Cohen and Levinthal 1990) and thus are constrained in terms of the amount of information that can be processed and utilized. Cohen and Levinthal (1990) defined absorptive capacity as the ability of the firm to identify, acquire, assimilate, and exploit new knowledge. However, as Zahra and George (2002) argue, speed and scope of learning are important attributes that can influence the organizational absorptive capacity. Specifically, learning cycles cannot be shortened easily without sacrificing the organizational ability to learn from them (e.g., Lane, Koka, and Pathak 2006). Similarly, organizational memory, like human memory, is fragile and subject to decay (Argote 1999), thus long memory cycles may also be counterproductive.

We argue that a similar mechanism is at play for firms introducing new products. While firms can reap some benefits from introducing new products (e.g., increased sales, brand awareness), other benefits that accrue from internalizing the knowledge gained from introducing new products and applying it to future products may be difficult to realize. Introducing too many new products in a short duration can stretch the organizational resources and overwhelm managers, limiting the value-creation potential of the new products. Similarly, a long duration between product introductions can diminish learning potential and lead to the decay of tacit knowledge embedded in the organizational fabric (Lei and Hitt 1995).

Time Diversification. One of the principles that portfolio managers strongly subscribe to is that portfolio risk declines as the investment horizon lengthens (Jaggia and Thosar 2000). The underlying premise is that above average returns tend to offset below average returns over long time horizons (Bernstein and Damodaran 1998). Using the law of large numbers, one can demonstrate that the sampling variance of independent short-term returns approaches zero as the investment horizon approaches infinity (Olsen and Khaki 1998).

Extending the argument to the current context, we argue that firms can diversify the idiosyncratic risks associated with product introductions in the long-run by tapping into the idea of time diversification

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and thereby reduce the risks associated with NPI. Risks in NPI can stem from a variety of sources, including faulty understanding of customer needs, technological challenges, lack of top management support, low market potential, and competitive intensity, among others (e.g., Cooper and Kleinschmidt 1995). Thus, as the number of NPIs in a given time interval increases the risk of NPI failure also increases; by spreading product introductions over a period, firms should be able to diversify such risks and be better prepared to handle NPIs.

The discussion so far suggests that the impact of the product introduction on the firm value depends on the organizational ability to identify, assimilate, and exploit the knowledge gained from product introductions and diversify the risks associated with the same. However, research on organizational learning suggests that firms can enhance their ability to process external know-how by building internal knowledge (Lenox and King 2004; March 1991), indicating that the influence of the NPI process characteristics on firm value may be moderated by the organizational knowledge. In line with several marketing studies that have suggested two dimensions of *organizational knowledge*, *marketing* and *technological*, we investigate the moderating effects of these two dimensions – *marketing* and *technological intensities* (e.g., Autio, Sapienza, and Almeida 2000; Lichtenthaler 2009; Marsh and Stock 2006; Moorman and Miner 1997).

Based on above discussion, we now develop our hypothesis in the next section.

2.3. Hypotheses Development

Pace

Research in the new product domain provides ample evidence suggesting that introducing new products creates value for the firm. The underlying premise behind this observation is that new products provide transitory advantages that allow firms to obtain private (as opposed to public) returns to innovation, i.e., firms can earn relatively high profits compared to the competition (Bayus et al. 1997). New products enable firms to adapt to the changing tastes and preferences of their customers, enter new markets, maintain corporate reputation, and enhance investors' interest, among others (Mullins and Sutherland 1998; Wind and Mahajan 1997). Firms can learn from a new product in two ways: a) from the

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product itself-based on its performance in the market; and b) from the process of introducing the product-learning occurred through the process. Hence, introducing products provides valuable learning that can be subsequently used in other settings. Specially, in the pharmaceutical market, firms learn from products as well as the market for better performance in the future (Hoang and Rothaermel 2005; Nerkar and Roberts 2004). For instance, Roche's Valium was ascertained that its non-trivial side-effects may negatively affect its market valuation. However, its negative side-effects were positively viewed when used in a different therapeutic area. Roche learnt from such product experiences and it led to the creation of a successful new product (Nerkar and Roberts 2004). Similarly in the technological market, Apple Inc. used the learning from the iPod to develop the iPhone and then the iPad (Schmitt, Rodriguez, and Clothey 2009). Thus, new product introductions should enhance firm value.

However, the contribution of new products to firm value is not automatic or fixed, but contingent on a variety of factors, including time to market (Hendricks and Singhal 1997), product attributes (Gatignon and Xuereb 1997), and alignment with customer preferences (Cooper and Kleinschmidt 1987), among others. The new product development (NPD) process literature suggests that developing successful products is an intensive process, requiring functional expertise, close inter-functional collaboration, senior management commitment, and organizational resources (Ernst 2002). Given limited organizational resources, we argue that there are limits to the number of products that a firm can meaningfully develop and introduce in a given period, i.e., the pace of the product introductions.

Time compression diseconomies can emerge during the process of product introduction in two ways. First, firms are constrained by the amount of resources, such as human and financial resources, that they can deploy on developing and introducing new products. Thus, as the number of new products a firm introduces in a given period of time increases, the likelihood of the firm sub-optimally allocating resources to develop and introduce new products should increases.

Second, firms that introduce new products at a rapid pace will have little time to evaluate their products, learn from them, assimilate their experiences, and deploy them to commercial ends. Each new product confronts a firm with new experiences in terms of customers, competitors, technology, and other

stakeholders. Thus, it becomes important to learn from these experiences and use them in the future (Teece 2009).

In summary, we argue that although firms can benefit from product introductions as the pace of product introductions increases, firms may not be able to assimilate and learn from these products, thereby reducing the impact of new products on firm value.

>   *H1: As the pace of new product introductions increases, the value created by new product introductions increases at a decreasing rate.*

Rhythm

Rhythm, or the regularity of the NPI process, is the other dimension of *how* a firm introduces new products. Our previous hypothesis suggests that an important objective of introducing new products is to learn from the new experiences in terms of customers, competitors, stake holders, and technology and deploy this knowledge in the future. While firms may learn from introducing new products, their knowledge bases do not remain constant and are influenced by the extent to which they are utilized (Vermeulen and Barkema 2002). Cohen and Levinthal (1994) argue that information overload–caused by introducing products at a rapid pace–reduces the ability of the firm to process and absorb the same.

Similarly, prolonged non-use of stored knowledge leads to decay. Organizational knowledge may be rendered less useful due to technological obsolescence, incomplete transfer of information, loss of data, attrition, or turnovers. Argote, McEvily, and Reagans (2003) and Nelson and Winter (1982) made a similar claim that the organizational ability to learn is derived from a tacit knowledge base that requires continued reinforcement. Extending this argument to our context, we argue that value that firms can realize from introducing new products is not only influenced by the pace of product introductions, but also by the regularity or the rhythm of the process, such that as irregularity increases the value should decrease.

Modern portfolio theory (e.g., Elton and Gruber 1981; Sharpe 2000), which suggests that risk can be mitigated through diversification, makes a similar prediction. In this context, we employ the notion of *time diversification* that suggests that the above average returns tend to offset below average returns over long horizons (Gollier 2002; Kritzman 1994). Extending the notion of time diversification to the process

of new product introduction, we argue that firms that introduce their products in an irregular fashion may fail to diversify their risks over time. By introducing products without diversifying over time, firms may expose themselves to various micro- and macro-economic, which can be mitigated by following a rhythmic introduction strategy. Given the high failure rate and the risks associated with new products, taking undue risks may hurt firm value. In sum, we expect that products introduced irregularly (i.e., at an irregular pattern) contribute less to firm value than products introduced in a regular fashion. Hence, we hypothesize

H2: As the rhythm (irregularity) of new product introductions increases, firm value should decrease.

Scope

The first two hypotheses related to *how* of the NPI process, we now move on to *what* aspect of the NPI process. Given the growth imperative, firms can adopt one of the fundamental growth logics–product expansion (Mishina, Pollock, and Porac 2004). This conceptualization of growth along products and markets is in line with the view held by several other scholars, including Ansoff (1965), Abell (1980), and Penrose (1995), among several others. Accordingly, we argue that firms introduce products geared towards expanding into new product markets, thereby altering the product scope of the firm. Product expansion, which we label *product scope* of the NPI process, entails entering new product markets, i.e., introducing a product in a new domain (Vermeulen and Barkema 2002).

Entering new businesses yields new opportunities to increase firm performance. Further, product diversification can reduce the risk of failure by spreading its risks over additional products (Hitt, Hoskisson, and Ireland 1994). Diversification provides opportunities to achieve economic scale and to spread investments in activities such as R&D, branding, and supply chain management over a broader base. Moreover, such product diversifications provide opportunities to learn from new and diverse ideas and enrich organizational knowledge base (Hitt, Hoskisson, and Kim 1997). Thus, increasing the product scope of the firm should enhance firm value.

However, this relationship between scope and firm performance is more complex than previously portrayed. Entering new businesses changes the scope of operations and may require new knowledge and altered routines, new business practices, changes in the overall strategy of the firm as well as the manner in which the firm competes in the marketplace. Thus, as firms introduce new products in diverse product markets or increase the product scope, it may tax its ability to learn from the diverse experiences and assimilate the same in the organizational fabric. This information overload may lead to suboptimal choices in screening, developing, and introducing new products, limiting the gains obtained from introducing new products. Along these lines, finance scholars have argued that product diversifications do not create value for the shareholders as they can more effectively spread their risks by diversifying their personal portfolios (Martin and Sayrak 2003). Management scholars have also concluded that product diversification stems from agency problem, such that top managers can lower their employment risk through diversification (Goranova et al. 2007). Further, most firms are typically established around a few technological capabilities that demand most of their resources (Terziovski 2010). Thus, spreading across multiple technologies can detract such firms from its core technology and hence may be counterproductive[4]. Hence, we hypothesize

> *H3: The impact of new product introductions on firm value increases at a decreasing rate as the product scope of NPI increases.*

Moderating effect of Marketing and Technological Intensities

The three hypotheses discussed earlier suggest that the impact of the product introduction on the firm value depends on the organizational ability to identify, assimilate, and exploit the knowledge gained from product introductions. However, firms can enhance their ability to absorb new information by developing their internal knowledge intensity (Lenox and King 2004), indicating that the proposed relationships between the NPI process characteristics and firm value may be moderated by the organizational knowledge intensities. Accordingly, we investigate the moderating effects of the two dimensions of

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[4] Although we do not hypothesize the interaction among pace, rhythm, and scope, we account for such interactions in our proposed model.

organizational knowledge– marketing and technological knowledge intensity (e.g., Autio et al. 2000; Li and Calantone 1998).

Marketing Intensity

Marketing intensity refers to organizational knowledge and experience related to the marketing function and related activities carried out by the firm. In line with the absorptive capacity literature that suggests that the organizational knowledge increases its ability to identify, assimilate, and utilize additional information, we argue that firms with high marketing intensity are better placed to identify, assimilate, and commercially exploit the information and knowledge gained from introducing new products relative to other firms. Marketing knowledge intensity constitutes of resources such as knowledge of consumers and their decision processes, distribution network, customer goodwill, and brand equity (Danneels 2002). Marketing intensity increases the efficiency with which firms can absorb external know-how and retain the same and enables firms to identify customer needs and understand the factors that drive consumer choice (Narasimhan, Rajiv, and Dutta 2006). This ability to understand consumer preferences enhances firms' abilities to generate innovative technologies across range of industries (Dutta, Narasimhan, and Rajiv 1999).

Thus, marketing intensity can be especially valuable for firms expanding into new product domains. Expanding into new products domains requires an in-depth understanding of the consumer requirements so as to develop the right products and commercialize them. For example, expanding into new product domains requires a careful mapping of the customer needs and the existing competencies of the firm. Thus, the ability of firms with superior marketing intensity to understand and forecast customer needs and develop innovative products that match consumer preferences and market them can be especially valuable (Krasnikov and Jayachandran 2008).

Cohen and Levinthal (1990) suggested that absorptive capacity tends to develop cumulatively and builds on prior related knowledge, thus, superior marketing intensity may enable firms to identify and absorb the information about the new customers and markets and deploy the knowledge thus gained in the future. Along these lines, the ability of such firms to quickly incorporate the available information in the

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organizational knowledge base and act upon it can be valuable during the information overload due to high pace, i.e., firms with high marketing intensity will be better able to process, absorb, and utilize the know-how regarding the market-place needs relative to those with low marketing intensity in case of high pace of product introductions. Further, having more marketing knowledge can equip firms to understand the macro and micro factors better, hence preparing for any shock that may arise due to irregular pattern of NPIs. Moreover, product innovation entails risks along both dimensions: market and technological. Firms with superior marketing intensity can reduce the risks associated with market acceptance of the new products and hence reduce the overall risk associated with the new product. Hence, we hypothesize:

>*H4: Marketing Intensity positively moderates the relationship between (a) pace, and firm value, and (b) product scope, and firm value and negatively moderates the relationship between (c) irregularity of NPI and firm value.*

Technological Intensity

Technological Intensity refers to organizational knowledge and experience related to R&D, product development, and related activities carried out by the firm. Technological intensity constitutes resources such as design and engineering know-how, product and process design equipment, manufacturing facilities, quality control procedures, etc. (Danneels 2002). Firms with high technological intensity have superior skills to transform organizational resources such as R&D into high-quality innovations and hence can derive greater benefits from a given set of technological know-how relative to firms with low technological intensity (Narasimhan et al. 2006). Further, high technological intensity enables a firm to better absorb and deploy the technological advancements in the existing and related technological domains, which may help the firm to identify new trends, experiment with emerging designs, and engage in innovations beyond existing technological boundaries (Zhou and Wu 2010). Such firms will sense the change faster and adjust their product development efforts in line with the new information (Deeds 2001).

Extending this logic in our context, we argue that as the overload due to high pace or irregularity of NPI activities increases, firms with high technological intensity will be better able to make sense of the external information and incorporate the same in their product strategies relative to those with low

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technological intensity. Similarly, superior technological intensity may prevent the information decay that is associated with prolonged non-use of information, further reducing the negative influence of irregular product introductions. This observation is in line with finding that firms routinely invest in R&D to not only develop and introduce new products, but to also develop and maintain their absorptive capacities (Cohen and Levinthal 1990). Further, firms introducing products in diverse product domains require technological resources to transform organizational resources into products that meet or exceed consumer expectations. Technological intensity enables firms to develop new technical insights, combine it with existing technology, and design superior products. This is critical for biopharmaceutical firms as these firms often specialize in a few technologies; and hence superior technological intensity can enhance their ability to utilize existing technological know-how to learn and develop new technologies. Further, as argued earlier firms with superior technological knowledge can reduce the technological risks associated with the new products as technological assessment is easier within the domain of current or related technological competence. Hence, we hypothesize:

H5: Technological Intensity positively moderates the relationship between (a) pace, and firm value (b) product scope, and firm value and negatively moderates the relationship between (c) irregularity of NPI, and firm value.

In sum, we expect a diminishing effect of pace and product scope and negative effect of irregularity of NPI on firm value. Further, regarding the effects of pace and scope, we expect a positive moderation by firm's marketing and technological intensities on firm value. In contrast, for the effect of rhythm (irregularity), we expect negative moderation effects of marketing and technological intensities on firm value. We summarize our conceptual framework in Figure 1.

[Insert Figure 1 about here]

3. Method

3.1. Empirical Context and Methodology

We test our hypothesis on new product introduction process and firm value creation with an empirical examination of new biopharmaceutical products introduced by firms between 1991 and 2015. Success of

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biopharmaceutical firms depends on their ability to introduce new products as it helps firms to manage competition and improve financial value (e.g., Cardinal 2001; Nerkar and Roberts 2004; Schwartzman 1976). Hence, innovation and introduction has been a regular strategy for the pharmaceutical firms (Roberts 1999). Given such importance of new products, a number of scholars have examined biopharmaceutical firms from multiple perspectives. For example, Nerkar and Roberts (2004) look at the technological and product- market experience of NPIs and how these influence firm performance; whereas Gatignon, Weitz, and Bansal (1990) look at the initial market performance of newly introduced pharmaceutical products. Thus, it is clear that biopharmaceutical firms cautiously develop products and pay attention to market and technology that support the new products. While several researchers look at the product development process and subsequent development of technology in the biopharmaceutical industry (Henderson and Cockburn 1994), studies that look at the process of introduction of the product portfolio are rare. Further, biopharmaceutical industry is regulated specially in US and has documented evidence of the new knowledge creation, which further helps to collect information and validate the novelty of the information. Biopharmaceutical firms introduce multiple products to serve different needs, helping us to see the temporal pattern and experience the process of introduction. Finally, limiting the empirical context to one industry i.e., biopharmaceutical, we eliminate the possibilities that cross-industry factors can influence the firm performance (Chandy et al. 2006). Studying one industry helps us to concentrate in the firm-specific NPI strategies and reduces the concerns about internal validity of the measures. Since firms develop organizational memory, routines, and processes over time, an ideal approach to test the above assertions would be to investigate the product introduction patterns of firms since their inception, when they are devoid of such characteristics. However, given the data limitations in case of private firms, we follow the "public" life of the firms.

To test our conceptual framework, we must relate our focal variables – pace, rhythm and scope of NPI – to firm performance. To that end, we need to isolate the value created (or destroyed) solely by a specific product introduction. The best performance measure could have been the individual sales of each product introduced. However, sales information for each product is impossible to get for abundant reasons

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to believe. Hence, as is the norm in such studies (e.g., Girotra, Terwiesch, and Ulrich 2007; Hendricks and Singhal 1997; Sharma and Lacey 2004; Simon and Sullivan 1993), we use an event study approach to compute the abnormal returns associated with each product introduction. An event study is a dominant methodology in the product management literature (specially product development), which relies on the efficient market hypothesis that suggest that price of a security fully reflects all the information available about the firm and market rapidly adjusts to any information updates (Fama 1970). Thus, the changes in the stock price due to an event such as NPI reflects the investors' overall assessment of the value of the event (Brown and Warner 1985).

3.2. Data and Sample

We test our framework using new product introductions between January 1, 1991 and December 31, 2015 by all public biopharmaceutical firms (SIC Code 28). From an initial sample of 126 firms, we exclude firms that have introduced only one product within the time frame (33 firms) and those that have extensive missing information (20 firms), resulting in a final sample of 1952 unique product introduction events by 73 firms or an unbalanced panel of 1952 observations. We collect the information about each product introduction using Food and Drug Administration (FDA) database. In the United States, FDA regulates the biopharmaceutical industry by documenting the phases of life cycle of each product (e.g., Chandy et al. 2006). Additionally, FDA also records and classifies the specification about each product. We validate each product announcement date, active ingredients and classification of the product using news articles from Lexis-Nexis. We analyze each news article for each product introduction announcement for information on announcement date and other product specific information such as name of the product, active ingredients, and purpose of the product. Further, we update any missing or ambiguous information by consulting other sources such as fiercepharma.com, manta.com, etc.

We supplement the product introduction data with security prices information from Center for Research in Security Prices (CRSP), financial information from COMPUSTAT and Capital IQ, and patent related information from United States Patents and Trademark Office (USPTO). We also use

company annual reports to update any missing information and correct for errors and inconsistencies across different databases.

3.3. Measures

Dependent Variable: NPI performance

We use an event study approach to compute the abnormal returns that measures the investors' reaction to the new product introduction announcement (McWilliams and Siegel 1997). Marketing scholars have used event studies to examine the abnormal stock returns associated with several events (e.g., Chen, Ganesan, and Liu 2009; Rao, Chandy, and Prabhu 2008; Srinivasan and Hanssens 2009). Event study methodology is based on the efficient market hypothesis (Fama 1970; Fama et al. 1969), which argues that the price of a security fully reflects all information available about the firm and that the market adjusts rapidly to any new information. Thus, changes in a firm's stock price due to an event, i.e., abnormal stock market returns, reflect investors' estimates of the economic value of that event (Brown and Warner 1985).

As the economic gain of product introduction announcement may not be realized immediately, it is important to consider a longer horizon to capture the value creation by such introductions. To reflect the value created by product introductions, we need a measure that captures the long-term value that new products create; thus we use a stock-market based measure, such as abnormal returns, as these measures are objective in nature and forward-looking, thereby incorporating all information about the future earnings (e.g., Fama 1970). Accordingly, we investigate the financial impact of product introductions by assessing how introducing new products affects the stock price of the firm (Brown and Warner 1985; McWilliams and Siegel 1997).

Consistent with the recent development in finance and marketing, we use buy-and-hold abnormal return (BHAR)[5] to capture the long term financial performance using stock market data for the product

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[5] We also use several other stock market based measures such as cumulative abnormal return (CAR) and Fama-French 4-factor model for different event windows (for example: 3 days, and 5 days) as additional robustness check and we obtain largely consistent results.

introductions(e.g., Ritter 1991; Sorescu, Chandy, and Prabhu 2007). BHAR is an appropriate measure for long term firm performance as it *"preciously measure investor experience"*(Barber and Lyon 1997). In long-run event studies, a characteristics based portfolio matching approach is widely used to estimate BHAR (Lyon, Barber, and Tsai 1999). For T=365 days, BHAR for stock *i* can be defined as

$$BHAR_{it} = \prod_{t=1}^{T}(1 + R_{i,k_i+t}) - \prod_{t=1}^{T}(1 + R_{b,k_i+t}) \tag{1}$$

R_{i,k_i+t} is the day simple return of the *i*th stock, and R_{b,k_i+t} is the corresponding return for the benchmark portfolio, t=1,……,T, *i*=1……,n.

Independent and Moderating Variables

Pace indicates how many new products a firm introduces in a certain amount of time. In order to measure pace, we first compute the average number of products introduced per year, i.e., the numbers of new products introduced divided by the number of days[6] since inception (Vermeulen and Barkema 2002).

Rhythm refers to the regularity in the NPI process. We operationalize rhythm as how ***irregular*** the firm is in introducing new products and measure it as the kurtosis of the first derivative of the number of NPIs over time. Kurtosis effectively measures how peaked (positive kurtosis) or flattened (negative kurtosis) the data distribution is with respect to normal distribution. This variable measures how concentrated in time the change in the number of new products introduced is. Higher the values of rhythm (irregularity), the more concentrated in time the NPIs are.

In order to code "product scope", we need to know the exact therapeutic areas that a specific new product belongs to. We visit the medical literature to find such categories (e.g., antibacterial, antiviral, Diuretics, Enzymes Laxatives and so on) and collect product category level information from NIH drug portal, drugs.com and rxlist.com. In order to compute the *product scope*, we first categorized the products into the therapeutic classes they belong to. We count the number of therapeutic classes that a firm

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[6] Unit of analysis for pace can be in days, month or year. For our proposed model, we use the days. However, we also measure pace with respect to month and year as additional robustness check and we observe identical results.

expands their product portfolio to over time. We operationalize product scope of a firm as the total number of therapeutic classes that a firm operates in at time *t* (e.g., Leenders and Wierenga 2008; Peng, Lee, and Wang 2005). For example, if a firm is introducing products in diabetic class for three consecutive periods (the product scope will be 1 till the third period) and then introduces a product in vitamin class in fourth period, product scope will be 2 in the fourth period.

   Marketing intensity (*MKT*) refers to firms' understanding about the market, its customers and overall external business atmosphere. *Technological intensity* (*TECH)* refers to firm's ability to understand the technical know-how, consumers' changing preference about the technology and trends in technology market. We operationalize *marketing intensity as the* ratio of firm's marketing spend to asset and *technological intensity* as the ratio of firm's R&D spend to total asset (e.g., Mizik and Jacobson 2003).

Control Variables

   We conduct a systematic review of new product literature to identify and account for variables that have been shown to impact the new product performance (see Henard and Szymanski 2001; Montoya-Weiss and Calantone 1994; Sivadas and Dwyer 2000). Specifically, we control for variables related to market, firm, and product. In line with the "product innovation literature" that suggest that performance of new products is influenced by the competition in the industry, we account for the *competition* at product level (e.g., Gatignon and Xuereb 1997; Henard and Szymanski 2001; Li and Calantone 1998). Specifically, we operationalize competition for each new product as the total number of products in the market in the same therapeutic class as the focal product is at the time of introduction.

   Industrial organization and marketing literature place considerable interest on the size of the firm that may affect the new product performance. This is also in line with the population ecology literature that suggests that organizational demography affects firm strategies and performance (e.g., Chandy and Tellis 2000). Specially, a firm with higher size can bring resource advantages, leading to more market power, which can translate into improved new product performance (Gatignon and Xuereb 1997). Accordingly, we control for the *total assets* and total number of *employees* at time *t* for firm *i* to account for the market dominance, performance and the size of the firms. We also control for the *age* of the firm at the time of

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introduction in order to account for the maturity of structures, processes and routines (Anand and Khanna 2000). Further, financial strength of a firm can influence new product performance as profitable firms will have more resources to invest (e.g., Lee et al. 2000). Hence, we control for the profitability and operationalize as the *net-income* of the firm at time *t*. Finally, we control for *book-value-per-share (BVPS)* in order to account for the market value of the firm which may affect new product performance(e.g., Armstrong and Vashishtha 2012; Bell, Filatotchev, and Aguilera 2014).

We also control for product related variables. Since the study is about the impact of the NPI process, it is critical to control for the extent of newness in the product. Accordingly, we control for the *type of innovation* of the new product (e.g., Chandy and Tellis 1998). FDA classifies products based on their newness such as new molecule entity, new active ingredient, new combination etc. We use FDA's classification as well as the press releases for each NPI to code the innovativeness (radical = 0, incremental = 1) of the product as a dummy variable. We account for the numbers of product form to be introduced. In order to control for the value of the innovation of the firms, we also include number of *forward citation*s of firms' patents (Grimpe and Hussinger 2014; Kalaignanam, Shankar, and Varadarajan 2007). Further, any level of information about the product before introduction may inform investors about the potential quality and affect the performance of the product. Hence, we control for *such information about the* expected performance of new product (*EXPP)* that relates to the levels of public attention, and in line with extant literature, we measure *expected performance* as the total number of articles published in news outlets about the specific product within 6 months prior to the introduction (e.g., Pfarrer, Pollock, and Rindova 2010; Pollock and Rindova 2003).

3.4. Model Development

As we discuss earlier, we use an event-study approach to evaluate the influence pace, rhythm and product scope of new product introduction process on firm performance. We begin by laying out the basic regression model that captures the hypothesized effect and then expand on how we augment this model in order to account for a) the endogeneity of pace, rhythm and scope, b)the observed and unobserved

heterogeneity and c) the heteroscedasticity. Because our dependent variable, value created due to new product introduction announcement is a continuous variable, we use a linear specification:

$$BHAR_{it} = \alpha_i + \beta X_{it} + \gamma Z_{it} + \varepsilon_{it} \qquad (2)$$

where $BHAR_{it}$ is the buy-and-hold abnormal return of the firm i at time t; α_i is the intercept of the model; β and γ are the vectors of the regression coefficients; X_{it} is the matrix of independent and moderating variables along with respective interaction effects; Z_{it} is the matrix of control variables; and the error term ε_{it} is considered to be independently and normally distributed.

3.4.1. *Accounting for Endogeneity*

New product introduction is a strategic choice and firms may choose to introduce products based on its expectation from the products and the readiness of the product to be introduced. Specifically, managers may choose *how* and *what* to introduce based on their evaluations of their available product portfolio and a desire to optimize the fit with respect to overall market to get superior returns on the introductions. Thus, pace, rhythm, and product scope of the NPI process may be potentially endogenous. We explicitly test and correct for the endogeneity of our focal variables using the two-step control function approach that is widely used in the marketing literature (e.g., Petrin and Train 2010). In the first stage, we estimate the correction terms by regressing the potentially endogenous variables, pace ($Pace_{it}$), rhythm ($Rhythm_{it}$), and product scope ($Scope_{it}$), on a set of exogenous variables. The knowledge-based view of the firm suggests that knowledge generation, accumulation and application may be the source of superior performance (DeCarolis and Deeds 1999). A firm with higher assets can take advantages of knowledge generation, accumulation and application leading towards product introductions. Hence, we include *total assets* of the firm in our first stage model (Cooper 1984). Managers' decision to introduce products may be dependent on the competition in the market as competition determines whether a specific product will be able to create values for the firm (e.g., Henderson and Mitchell 1997). Accordingly, we account for the competition in the market that may affect pace, rhythm and scope of NPI. Further, firms' decision to introduce new products may be influenced by the financial health of the firms (e.g., Delios and Beamish

1999). Accordingly, we include net-revenues of the firms. Lastly, firms' ability to introduce products depends on size of the firm. Hence, we account for the age and total number of employees respectively in our first stage models.[7]

In addition to the above variables, in line with the exclusion restrictions proposed by Maddala (1983) and Hausman (1978), we include the average industry pace (Ind_pace_t), average industry rhythm (Ind_rhythm_t,) and average industry scope (Ind_scope_t) information respectively in the first stage models that are excluded from our final model.[8] We argue that industry characteristics and market conditions are key determinants of firms' strategic choices, especially for decisions characterized with ambiguity. Given that there is no right level of pace, rhythm and scope , the theory of mimetic isomorphism (DiMaggio and Powell 1983) suggests that firms' faced with this uncertainty tend to imitate other organizations within their industry. This is also in line with the literature on industry recipes that suggests that managers often deal with uncertainty in ways that are characteristic of that industry (Spender 1989). Finally, the literature on dominant logic suggests that over time an industry develops a mindset or "world view" or the conceptualization of ways to do business and make decisions in that business (Bettis and Prahalad 1995). Thus, building on the concepts of isomorphism, industry recipes, and the dominant logic, we argue that average industry pace, average industry rhythm, and average industry scope should influence firms' desired strategies for pace, rhythm and scope of the NPI process. However, such information is unlikely to influence the firm performance due to NPI for several reasons. First, the uncertainty about the right pace, rhythm and scope exists because there is no "right" level of pace, rhythm and scope. Second, the average industry pace, average industry rhythm, and average industry scope information is unlikely to serve the specific needs of the firm. In sum, the average levels of industry pace, rhythm and scope are unlikely to influence the outcomes of any particular firm's NPI.[9] These considerations suggest that our exclusion variables satisfy both the requirements of *relevance* (i.e., they

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[7] Alternate specifications of the first stage model (e.g., only the instrumental variable, with different set of controls) provide similar results.

[8] Although the model can be identified through the nonlinearity of the correction term (Andrews, Ainslie, and Currim 2002), by using the exclusion restriction we reduce our reliance on the functional form for identification (Greene 2003).

[9] For additional justification of such instruments see Germann, Ebbes, and Grewal (2015).

are related to pace, rhythm and scope respectively) and *exogeneity* (i.e., they do not have direct effects on our dependent variable) and, thus, serve as valid exclusion variables. Thus, we specify the first stage equations as:

$$Pace_{it} = \delta^{pace} + \varphi^{pace}(Ind\_pace_t) + \theta^{pace}P_{it} + \eta_{it}^{pace} \tag{3a}$$

$$Rhythm_{it} = \delta^{rhythm} + \varphi^{rhythm}(Ind\_rhythm_t) + \theta^{rhythm}P_{it} + \eta_{it}^{rhythm} \tag{3b}$$

$$Scope_{it} = \delta^{scope} + \varphi^{scope}(Ind\_scope_t) + \theta^{scope}P_{it} + \eta_{it}^{scope} \tag{3c}$$

where, Ind_pace_t, Ind_rhythm_t, and Ind_scope_t represent the industry average pace , average industry rhythm and average industry scope at time *t* respectively; P_{it} reflects a set of exogenous variables; and $\eta_{it}^{pace}, \eta_{it}^{rhythm}$ and η_{it}^{scope} are assumed to be normally distributed. We then use the residuals from the first stage estimation ($\hat{\eta}_{it}^{pace}, \hat{\eta}_{it}^{rhythm}$ and $\hat{\eta}_{it}^{scope}$) as additional control variables in the final model (Equation 2).

3.4.2. *Unobserved Heterogeneity and Heteroscedasticity*

As firms introduce multiple products over time, it is critical to consider the product portfolio in order to design effective introduction strategies. Thus, unlike prior studies (e.g., Katila and Ahuja 2002; Langerak, Hultink, and Robben 2004; Pauwels et al. 2004; Smith et al. 2005) that treat NPIs by the same firm as independent events, we use panel data methods that allow us to look at the introduction of the product portfolio and account for the dependencies across the NPIs by the same firm. Further, our use of panel-data methods allow us to use a random effects specification to capture unobserved heterogeneity as firms may vary in terms of introduction strategies and avoiding such heterogeneity may bias the results (Rabe-Hesketh, Skrondal, and Pickles 2005; Srinivasan, Kekre, and Mukhopadhyay 1994).

The standard approach that has been followed thus far in the marketing literature is to estimate Equation 2 using ordinary least squares (OLS) regression (e.g., Rao et al. 2008). The OLS model, however, assumes homoskedasticity and no-autocorrelation in the data. Neglecting these features of the data can lead to statistics that do not follow their assumed distribution and lead to inefficient parameter estimates and inconsistent test statistics and hence erroneous conclusions (e.g., Corhay and Rad 1996). In

the context of our study, accounting for the potential heteroscedasticity is of special interest for several reasons such as: a) as firms learn from their NPIs, the error in their introduction strategies become smaller over time; b) matured firms may be well equipped to handle the shock from introductions, leading to smaller error at *t* as well as in the subsequent periods; and c) skewness in distribution along with model misspecification (e.g., some important variables are omitted from the model) (e.g., Hustvedt and Bernard 2008; Kalirajan 1989). We account for the potential heteroscedasticity by allowing heteroscedasticity consistent standard errors in our model (e.g., Long and Ervin 2000; Verhoef, Franses, and Hoekstra 2001; White 1980). We specify the complete model as:

$$
\begin{aligned}
\text{BHAR}_{it} = {}& \alpha_i + \beta^{pace} Pace_{it} + \beta^{sq\_pace} Pace_{it}^2 + \beta^{rhythm} Rhythm_{it} + \beta^{scope} Scope_{it} + \\
& \beta^{sq\_scope} Scope_{it}^2 + \beta^{pace\_rhythm}(Pace_{it} \times Rhythm_{it}) + \beta^{rhythm\_scope}(Rhythm_{it} \times Scope_{it}) + \\
& \beta^{pace\_scope}(Pace_{it} \times Scope_{it}) + \beta^{mkt} MKT_{it} + \beta^{pace\_mkt}(Pace_{it} \times MKT_{it}) + \\
& \beta^{rhythm\_mkt}(Rhythm_{it} \times MKT_{it}) + \beta^{scope\_mkt}(Scope_{it} \times MKT_{it}) + \beta^{tech} TECH_{it} + \\
& \beta^{pace\_tech}(Pace_{it} \times TECH_{it}) + \beta^{rhythm\_tech}(Rhythm_{it} \times TECH_{it}) + \beta^{scope\_tech}(Scope_{it} \times \\
& TECH_{it}) + \sum_{j=1}^{J} \partial_j Control_j + \pi^{pace} \hat{\eta}_{it}^{pace} + \pi^{scope} \hat{\eta}_{it}^{scope} + \pi^{rhythm} \hat{\eta}_{it}^{rhythm} + \varepsilon_{it}
\end{aligned}
$$

(4)

where $Pace_{it}, Rhythm_{it}\ and\ Scope_{it}$ refer to pace, rhythm and scope of firm *i* at time *t*; MKT_{it} and $TECH_{it}$ refers to marketing and technological intensities respectively of firm *i* at time *t*; $\pi^{pace}, \pi^{scope}\ and\ \pi^{rhythm}$ are the coefficients for the correction terms; ∂_j represents the estimate for the *j*th control variable. We use SAS and Stata statistical software to estimate the models using maximum likelihood estimation procedure.

4. Results

We provide the descriptive statistics and pairwise correlation in Table 1 and present the results of first-stage regression models (Equations 3a-3c) used to obtain the correction terms in Table 2. We find evidence for the unobserved heterogeneity in our data (variance of random effect parameter, $\sigma^2 = 0.20, p < 0.01$). Results of first stage equations, although important for accounting the potential endogeneity, also merit attention as they provide insights into organizational strategies. Hence, we discuss

in brief the results of these models. In line with our expectation, average industry pace (β=0.025, p<0.01), average industry rhythm (irregularity) (β=8213.14, p<0.01) and average industry scope (β=0.282, p<0.01) are positively related to pace, rhythm (irregularity) and scope respectively[10]. We find evidence that total asset positively influences pace (β=8.56, p<0.01) and scope (β=1.8, p<0.01) and negatively influences the irregularity of NPI (β=-10.3, p<0.01). As age increases, firms' irregular introduction (β=0.009, p<0.01) as well as scope of NPI increases significantly (β=0.079, p<0.01). Further, higher number of employees help a firm to increase the irregularity of NPI (β=1.05, p<0.01). Finally we find that net-income of a firm negatively influence the pace (β=-2.24, p<0.01) as well as scope of NPI (β=-0.003, p<0.01).

[Insert Tables 1, 2 and 3 about here]

We now present the results of the hypothesized model that accounts for the endogeneity in our focal variables, unobserved heterogeneity, and heteroscedasticity (Equation 4) in Table 3. As results suggest, we find evidence of endogeneity for our focal variables: rhythm, and scope, as the correction terms for them are significant ($\pi^{rhythm} = 3.34, p < 0.01$; $\pi^{scope} = 0.022, p < 0.05$). However, we do not find significant endogeneity effect for pace ($\pi^{pace} = -47.48, p < 0.1$). As proposed in H1, we find evidence that as pace increases, firm performance increases at a decreasing rate ($\beta^{pace} = 89.37, p < 0.01$; $\beta^{sq\_pace} = -1148.55, p < 0.01$). In contrast, we find that irregularity of introduction is negatively related to firm performance ($\beta^{rhythm} = -2.94, p < 0.01$), supporting H2. Finally, results show that the product scope of NPI has a sharp diminishing effect on firm performance ($\beta^{scope} = 0.012, n.s.$; $\beta^{sq\_scope} = -0.0008, p < 0.01$), which supports our hypothesis H3.

As regards to our moderating effects (see Table 3 and Figure 2), we find support for H4a, marketing intensity of firms positively moderates the relationship between pace of NPI and firm performance($\beta^{pace\_mkt} = 265.31, p < 0.05$). We do not find any significant role of marketing intensity in moderating the relationship between rhythm and firm value ($\beta^{rhythm\_mkt} = 0.403, n.s.$) and scope

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[10] We test for the validity of the instruments empirically. Correlation between BHAR and average industry pace (ϱ=0.09, p<0.01); BHAR and average industry rhythm (irregularity) (ϱ=0.12, p<0.01); and BHAR and average industry scope (ϱ=0.08, p<0.01) as well as Sargan test confirms our understanding that instruments are valid.

and firm value ($\beta^{scope\_mkt} = -0.07, n.s.$) respectively. Consistent with H5b, we find that technological intensity positively moderates the relationship between product scope and firm value ($\beta^{scope\_tech} = 0.299, p < 0.05$). In support of H5c, results suggest that as technological intensity increases, the negative effect of irregular introduction on firm value goes down ($\beta^{rhythm\_tech} = -1.34, p < 0.05$). In contrast, we find that technological intensity negatively moderates the relationship between pace of NPI and firm value ($\beta^{pace\_tech} = -1062.57, p < 0.01$), which is against our proposed hypothesis. Firms have options to learn either from the introduction process or from the technological knowledge. Introducing products at a higher pace enables firms to learn properly, making the learning from technological knowledge redundant.

[Insert Figure 2 about here]

Results of our control variables are largely in line with the extant literature. Firm value decreases as firms introduces incrementally new products (β = -0.3132, $p < 0.01$).This suggests that market rewards a firm for its incremental NPIs relatively lesser than that of radical NPIs. As radical innovations have the potential to solve significantly bigger issues than the incremental products in the bio-pharmaceutical industry; market's positive response to such introduction is not a surprise. Results further suggest that as the age of the firm increases, market return also goes up (β = 0.033, $p < 0.01$). This is in line with the literature on the firm's maturity, that as age increases, a firm's accumulates experiences, thereby providing ability to build effective strategies to improve firm performance. In line with the view that size of a firm positively influences its performance, we find that total number of employees has a positive effect on firm performance (β = 0.00003, $p < 0.01$). Further, in line with our expectation, as competition increases, firm performance decreases (β = -0.001, $p < 0.05$). On the other hand, we find that total assets increases firm value decreases (β = -3.2, $p < 0.01$Finally, as evident from the Table 3, interaction between pace and rhythm has negative effect on firm performance (β^{pace_rhythm}=-35.63, $p < 0.05$). As pace has a diminishing effect, and rhythm (irregularity) has negative relationship with the firm performance, the interaction of both should negatively influence firm performance. However, we find that interaction

between rhythm (irregularity) and scope has positive relationship with firm value (β^{rhythm_Scope}=0.012, $p < 0.05$).

4.1. **Robustness Check**

In order to assess the sensitivity of our proposed model and selection of variables, we perform several additional analyses. We find that, selection of variables does not abruptly affect the results of the first stage regression (Equation 3a-3c). To check the robustness, we also include other variables (e.g., forward cites, ROA, nos. of patent) and obtained identical results. Further, alienation of control variables and use of only exclusion variables (industry average pace, rhythm and scope) provide similar results.

4.1.1. Alternate Dependent Variables

Our dependent variable (BHAR) is well regarded as a measure of long-term outcomes and has been extensively used in the marketing, finance, and strategy literature (e.g., Bessembinder and Zhang 2013; Sorescu et al. 2007). However, the 1-year window can include other confounding events that may influence abnormal returns. Thus, we replicate our analyses (Equation 4) using shorter event windows (e.g., 3 days and 5 days) and alternate dependent variables such as cumulative abnormal return (CAR) and Fama-French 4 factor model. These alternate specifications provide largely consistent results. However, the performance of the proposed model (AIC=6338.989) is superior to these alternate specifications (AIC for CAR (-1, +1) as DV=7855.6; AIC for Fama-French (-1, +1) as DV=6989.88; AIC for CAR (-3, +3) as DV=7954.6; AIC for Fama-French (-3, +3) as DV=6878.28)

In the absence of product-specific sales or profit data, which are impossible to obtain, we replicate our proposed model using several balance-sheet based measures. We use pre-tax operating cash flows (EBITA) to measure balance sheet based performance of the firm in the year following the new product introduction (e.g., Ghosh and Jain 2000). We use alternate balance sheet based measures such as difference in *Return on Assets* ($ROA_{t+1 \to t}$) to measure firm performance due to NPI. Across all the balance sheet based measures, we find significant and directionally consistent results. However, performance of the model with EBITA as DV (AIC=25,193.66) and ROA as DV (AIC=8965.22) is far inferior to our proposed model (AIC=6338.989).

4.1.2. Capturing the Effect from Previous NPIs

The success of a NPI at time *t* may be influenced by the previous product introduction as firms learn from their prior experiences. In order to capture and test the significance of such effects, we estimate Equation 4 by introducing past performance measures (due to NPIs) as additional independent variables (IVs). In this context, we include BHAR for firm *i* for introducing product at *t-1* and *t-2* respectively as two additional IVs in our proposed model. We also test our model with difference in $BHAR(BHAR_{t-2 \to t-1})$ as an additional IV. The results of these two sets of model are consistent to that our proposed model.

4.1.3. Is consideration of one of process characteristics enough?

It is worthwhile to consider if one of the process characteristics is sufficient to understand the effect of the NPI process on firm performance. In order to capture that, we estimate 7 different sub-models a) model without rhythm and scope and their respective interactions (AIC=6588.282); b) model without pace and scope and their respective interactions (AIC=6386.254); c) model without rhythm and pace and their respective interactions (AIC=6788.2061); d) model without scope and its respective interactions (AIC=6356.006); e) model without pace and its respective interactions (AIC=6381.037); f) model without rhythm and its respective interactions (AIC=6587.433); and g) model without pace, rhythm and scope and their respective interactions (AIC=7048.337). The performance of all these different specifications is inferior to our proposed model (AIC=6338.989), highlighting the need to consider all the three process characteristics.

4.1.4 Alternate Variable Operationalization

In our proposed model, we operationalize the pace at the day level (e.g., rate of introducing product per day) in order to gain insights at the granular level. However, we also test our model by calculating the pace at monthly and yearly level respectively and recalculating rhythm and product scope. We re-estimate the model with balanced sheet based measures (e.g., $ROA_{t+1 \to t}$) as dependent variables and the re-calculated variables and get consistent results.

4.1.5. Considering only radically new products

Our data consists of not only the radical new products, but also incremental new products introductions. As learning from the incremental new products is incremental (as firms already know some part of it) and as the organizational resources required to develop incremental NP is relatively lesser than that of radical NP, firms can introduce multiple incremental NPs. Accordingly, our proposed model shows that on average optimal pace is 14 products per year (i.e., pace=0.038/day or pace=14/year). However, the question remains that how many radical new products a firm should introduce in a specific time such that a firm can absorb the learning and get the best return from the introduction. In order to analyze that, we estimate Equation 4, considering the radical new products only for all the firms in our sample. In addition to getting the consistent results, we find that on average in biopharmaceutical industry, a firm should not introduce more than 3 radically new products in a year's time.

4.1.6. Other Benchmark Models

Finally, we estimated additional benchmark models. For example: a model that accounts for unobserved heterogeneity alone (AIC=6625.45); one that accounts for endogeneity alone (AIC=6339.697); and the model that does not account for both heterogeneity and endogeneity (AIC=6627.59) is inferior to the proposed model that accounts for both endogeneity and heterogeneity (AIC=6338.989).

5. Discussion

In a high-technology industry such as bio-technology, firms manage portfolio of products to compete in the market, fulfill customer demands, and update themselves to the changing preferences of customers. Biopharmaceutical companies have been relying on successful product introductions as an antecedent to drive growth (Ahlawat, Chierchia, and Arket 2014). New products are critical for such firms and firms take utmost care such that their products can generate value. In spite of such efforts, the failure rate of new products, especially in biopharmaceutical market is very high (Chierchia, Doll, and Arket 2013), indicating that firms are yet to craft something unique such that they can achieve the purported goals of a NPI. Managers are mostly uncertain in deciding what should be the introduction strategy and it is rare to see in the pharmaceutical industry to take steps to frame the uncertainty they face and develop plans to

manage it (Chierchia et al. 2013). Hence, in the context of biopharmaceutical industry, we attempt to provide additional contingencies that may affect the performance of new products. We examine whether the new product performance is associated with a) the rate at which products are introduced (pace of NPI); b) the irregularity in the NPI process (rhythm of NPI), and c) the number of categories, a firm extend their product portfolio to (scope of NPI). We further examine the theoretically derived contingencies that map into the notion of learning and absorbing information (e.g., marketing and technological intensities). Finally, we account for all major control variables such as competition, firm's financial health, innovativeness and expected performance of the products.

Our main effect results that pace and scope of NPI has diminishing effect relationship and irregularity of introduction is negatively related to firm performance bring many benefits. Our results indicate that there is an optimal level of pace and scope (due to the quadratic effect in the model). It is for the benefits of the managers that they look at the process of introduction carefully, in order to improve the performance of firm over time.

Results also indicates that it is not enough to consider only one process characteristic (e.g., *how* in terms of *pace* and *rhythm* of NPI). As discussed in the robustness section, avoiding any of the process characteristic can lead to poor fit. Further, as discussed in the managerial implication, pace, rhythm and scope of the NPI process have economic significance and firms can improve performance by carefully aligning strategies according to the findings of the study.

We also note that the interpretability of the negative moderating effect of technological intensity on the relationship between the pace of NPIs and firm performance is not obvious (as opposed to our proposed relationship). As firms can learn either from the process of introduction or from the marketing spend, perhaps in the context of our study, firms' learning from the process is much more dominant; marketing spend does not essentially contribute to firm value and performance suffers when spending is increased.

5.1. Theoretical and Empirical Contributions

The new product introduction is a complex decision for firms. Although many benefits from new products are identified in the literature, there are abundant examples that not all new products succeed as per the expectations of the firms. Further, the empirical support for the theory- that firm performance goes up as a result of new product is decidedly mixed. We add to the new product literature by studying the additional contingency "*process of introduction of new product*" that helps to explain the firm performance due to the new products. We contribute by showing that performance a firm at time t in terms of introducing new products; depends on how the firm has arrived there, i.e., the evolution of product portfolio over time influences firm performance. We develop and test a set of hypothesis regarding the process characteristics of NPI process and how it influences firm performance. Consistent with the theoretical background and the predictions, we find that firms that introduce products at a faster pace increase their performance at a decreasing rate. Interesting findings from the study shows that the irregularity of introducing new products negatively influences the firm's performance. Finally, as firms expand their introductions in to multiple categories, the firm's performance increases at a decreasing rate.

We argue that the impact of pace, rhythm and scope of the NPI process can be realized in terms of three fundamental concepts: time compression diseconomies, absorptive capacity and time diversification. As firms are constrained in terms of their resources, time compression diseconomies arises due to the properties such as cognitive limitation, bounded rationality and structural inertia (Vermeulen and Barkema 2002), and firms are limited in terms of the number of products they introduce at a time and absorb the learning from such introductions. Firms introducing new products in irregular fashions that overstrained the absorptive capacity are most likely to allocate suboptimal time to identify, acquire, assimilate and implement learning; integrating the knowledge gained for future introductions such that firm value is maximized. Finally, although introducing products in different categories over time is beneficial as it gives scale and scope economies, provides learning from diversifications, and reduces risk through spread; expansion to multiple categories requires firms to invest more to understand development in technology and market, changing preferences of consumers, changes in organizational routine, system

and process; which may be counterproductive. We find that there is a limit to the pace at which firms can introduce products and the categories that a firm can expand their product portfolio to.

Our first moderator is the marketing intensity of the firms. We reinforce the importance of marketing in the success of new products. Although prior research has shown that marketing knowledge builds absorptive capacity (e.g., Xiong and Bharadwaj 2011), the literature is largely silent about specific ways marketing knowledge may actually help leverage product market opportunities. We demonstrate a specific manner in which the above may happen. We show that marketing intensity can provide a firm with the required information about the market, customers, and the changing trends in the market, reducing the burden posed by faster pace, irregular introduction and expansion to multiple categories; and thereby create firm value. Similarly, our second moderator "technological intensity" can help a firm in understanding the market reality in terms of choices for product designs, technological know-how, and technology acceptance and mitigate the complexities associated with faster pace, irregular introduction and expansion to multiple categories.

We also contribute to the process literature by responding to calls from scholars for greater emphasis on the process research to understand the temporal patterns across events (e.g., Rumelt et al. 1991). We study the portfolio of products and bring the process perspective to the new product introduction strategy, which provides a deeper understanding of the phenomenon. This is to note that this is the first study to investigate the impact of process characteristics and the additional contingencies on firm performance in marketing literature.

Our study highlights that even if two firms appear similar in their strategic position- for example, having similar product portfolio, they may have gone through very different strategies in terms of "*processes*", which may results in differed market values. This leads to the warning that cross-sectional research, specially to understand the values generated by new product introductions may not be sufficient, and one needs to look back in time and account for how a firm has arrived at the current stage. This is also in line with a more general theory on the growth of firms- a firm can grow by learning from the past and following the process (e.g., Penrose 1995; Rumelt 1997).

Methodologically, unlike prior studies that look at the impact of an individual product introduction by a firm, we explicitly account for the product portfolio. By doing so, we are able account for firm-level unobserved heterogeneity (using a random effect specification of our estimation model). We also account for the heteroscedasticity in the error term. Finally, we explicitly correct for the potential endogeneity (using a control function approach) in pace, rhythm and scope. Endogeneity poses a critical problem in new product research because managers typically make strategic decisions with the anticipation of favorable outcomes. Regression estimates that are not corrected for endogeneity may be biased in both direction and size, leading to incorrect or inflated conclusions about strategic decisions (Albers 2012; Hamilton and Nickerson 2003). Similarly, many unobserved variables may create omitted variable bias in that they may be correlated with variables of interest, and therefore produce biased estimates (Gormley and Matsa 2014) and distort managerially relevant conclusions.

Finally, our study provides an implementable and robust framework that can be applied across different businesses where the NPI process is critical and there is a known nomenclature of new products.

5.2. Managerial Implications

Although extant literature looks at a variety of factors that affect new product performance, the importance of the process has not received light in marketing literature. Our study shows the importance of process characteristics for the performance of new products. Our results caution that in addition to the factors that are found to affect new product performance, process characteristics significantly affect firm value. Our results are managerially relevant and are economically significant as well. Given the average size of an S&P firm is about $34.55 billion, a firm can increase its market value by over $412 million by increasing the pace of introduction by 10% (from the average pace). Similarly, by reducing the irregularity of NPIs by 10% from the mean, a firm can increase its market value by $3.74 billion. Further, an increase in scope by 10% from the average product scope can yield $348 million increase in firm value. A firm, by operating at the optimal level of product scope as obtained from Eq. 4, on average can increase its value by $261 million (as compared to the value when operating at average product scope). In the presence of high marketing intensity (e.g., at 10% increase from average marketing intensity), a firm

can get a $1.1 billion increase in firm value by increasing pace by 10%. In contrast, by increasing technological intensity by 10% and managing average pace, a firm can lose market value by $2.35 billion. Our results suggest that firms in technologically dominant industries should care about both marketing and technological intensities as it helps firms to envision the market and customers well, which is particularly of importance in NPI decisions.

Firms are forced into a strategy of fast growth as investors and customers repeatedly ask for superior performance. While such expectation is understandable, our study poses a restriction to managers that they should not mindlessly introduce new products or imitate competitors in introducing new products. There is a limit to the number of new products that a firm can introduce and digest the success-failure from such introductions. These limits arise due to the limited organizational capacity to absorb new products and thus benefit from such products. Managers need to be aware of such restrictions before embarking on a growth path.

5.3. Limitation and Future Research Directions

Our study captures a novel understanding of the NPI process and how it influences firm performance and guides managers in developing rigorous and implementable new product introduction strategies. Yet, our research is not without limitations and highlights several avenues for future research. First, an important avenue for future research would be quantifying the mechanism behind these effects. For example, we argue that the pace of NPI has a diminishing effect relationship with firm performance as firms cannot learn and implement properly as the pace increases. Future research may model the firms' learning behavior and provide empirical explanation to our findings. Second, although we account for the innovativeness of the product as well as the expected product performance, it would be worthwhile to look into if these product-specific variables moderate the proposed relationships in our framework. Third, we investigate NPIs in the biopharmaceutical industry based on the importance of new products, availability of information for the newness of the products, and the strategic importance of the industry. Future scholars should examine the phenomenon in different or multiple industries and explore the

robustness of our findings. Finally, we estimate a static model in this study. However, pace, rhythm and scope may have a dynamic impact on firm performance and this is another great avenue for future research.

6. Conclusions

Overall, we must acknowledge that our study only provides descriptive rather than causal associations in a specific industry context. However, in the context of NPI, where Holy Grail of success is very much uncertain, we address an important issue which past literature has not incorporated. We hope to inch forward the NPI process research by identifying the relevant constructs that can help new product to succeed. Accordingly, we empirically highlight the impact of process characteristics- pace, rhythm and scope of the NPI process on firm performance, and propose that managers should look at the process of NPI and design their strategies for improved firm performance.

Table 1: Bivariate Correlation Coefficients and Descriptive Statistics

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
(1)Pace	1															
(2) Rhythm	-0.05***															
(3) Scope	0.35***	0.02														
(4) Technological Intensity	-0.28***	-0.12***	-0.22***													
(5) Marketing Intensity	-0.22***	0.11***	-0.23***	-0.32***												
(6)Total assets	-0.12***	-0.006	-0.008	0.001	0.03*											
(7) Expected Prod. Performance	-0.03*	0.01	-0.006	0.02	-0.04*	-0.007										
(8) Total forward Cites	-0.22***	0.001	-0.15***	0.07***	0.02	0.59***	0.02									
(9) Age	-0.09	0.30***	0.15***	0.01	0.01	0.26***	0.01	0.35								
(10)Nos. of Product forms	0.08	-0.03**	0.12***	0.04**	-0.06***	0.03**	0.008	0.01	-0.02							
(11) Innovation Type	0.29	0.02	0.31***	-0.17	-0.19***	-0.25***	-0.04*	-0.29***	-0.08***	0.022						
(12) BVPS	-0.006	0.02	0.17***	-0.17	-0.18	0.22***	0.05***	0.0486**	0.08***	0.02	0.02					
(13) # of Employees	-0.098	0.05***	-0.06***	0.03	0.08***	0.53***	-0.01	0.127***	-0.008	0.04**	-0.16***	0.12***				
(14) Competition	0.08	-0.04**	0.20***	-0.05**	-0.05***	0.04***	0.09***	-0.007	-0.0513***	-0.04**	0.04***	0.15***	0.02			
(15)Net-Income	-0.19	0.005	-0.11***	0.05**	0.02	0.84***	-0.01	0.59***	0.25***	0.03**	-0.29***	0.13***	0.53***	-0.002		
(16)BHAR	0.04**	0.01	0.12***	0.02	-0.02	0.05**	0.01	0.0396**	0.06***	0.05***	-0.02	0.06***	0.03**	0.02	0.03*	1
Mean	0.01	-0.35	7.07	0.06	0.09	6088	14.66	3377.7	61.26	1.96	0.84	7.7	4791.2	38.43	778.1	-0.193
Std. Deviation	0.01	1.00	13.97	0.04	0.08	17305	75.79	10031.16	42.10	1.36	0.36	6.92	15679.96	44.42	2073.14	1.32

***significant at 1%|**significant at 5%|*significant at 10%

Table 2: First Stage Regression Results

Predictors	Model 3a DV: Pace		Model 3b DV: Rhythm		Model 3c DV: Scope	
	Estimates	Std. Error	Estimates	Std. Error	Estimates	Std. Error
Intercept	0.004***	0.0019	2736.31***	824.5	-9.45***	1.79
Total Assets	8.56***	2.29	-10.3	2.06	1.8***	0.499
Age of the Firm	-10.8	6.74	0.009***	0.0006	0.079***	0.0169
# of total employees	-4.11	13.5	1.05***	0.025	-2.7	2.8
Net-Income	-2.24***	0.257	3.88	23.2	-0.003***	0.0005
Competition	7.6	6.07	-0.0004	0.0004	-0.002	0.01
Avg. Industry Pace	0.025***	0.004				
Avg. Industry Rhythm			8213.14***	2474.082		
Avg. Industry Scope					0.282***	0.014
Test Statistics						
R square	10%		15.438%		23.15%	
F statistics	51.71***		50.54***		111.53***	
RMSE	0.0108		0.94		19.53	

***significant at 1%|**significant at 5%|*significant at 10%

Table 3: Parameters Estimates for the Hypothesized model

Predictors	Hypothesized Effects	Estimates	Robust Std. Error
Main Effects			
Pace	H1(∩)	89.37***	37.77
Pace Square		-1148.5***	433.38
Rhythm(irregularity)	H2(-)	-2.945***	0.477
Scope	H3(∩)	0.012*	0.015
Scope Square		-0.0008***	0.0002
Interaction-Main Effects			
Pace × Rhythm		-34.83**	15.24
Pace ×Scope		1.178	0.615
Rhythm × Scope		0.012***	0.005
Moderators' Main Effects			
Marketing Intensity(MKT)		0.225	0.888
Technological Intensity(TECH)		2.392	1.398
Moderating Effects			
Pace × MKT	H4a(+)	265.31**	123.29
Scope × MKT	H4b(+)	-0.07	0.061
Rhythm × MKT	H4c(-)	0.403	0.309
Pace × TECH	H5a(+)	-1062.57***	337.03
Scope ×TECH	H5b(+)	0.299**	0.151
Rhythm × TECH	H5c(-)	-1.345**	0.6402

Endogeneity Correction		
Pace	-47.48	26.14
Rhythm	3.043***	0.464
Scope	0.022**	0.008
Control Variables		
Total Assets	-3.2***	0.614
Expected Product Performance	0.0001	0.0003
Age of the Firm	0.033***	0.004
Nos. of Product Form	0.011	0.021
Innovation Type	-0.313***	0.101
Total Forward Cites	5.55	5.91
BVPS	0.005	0.006
# of Total Employees	3.6***	0.571
Net-Income	-0.842	3.18
Competition	-0.001**	0.0007
Intercept	-3.78***	0.488
Test Statistics		
log-likelihood	-3137.49	
AIC	6338.989	

***significant at 1%|**significant at 5%|*significant at 10%

Figure 1: Conceptual Framework

Figure 2: Interaction Effects

Interaction between Pace and Marketing Intensity

Interaction between Scope and Technological Intensity

Interaction between Rhythm and Technological Intensity
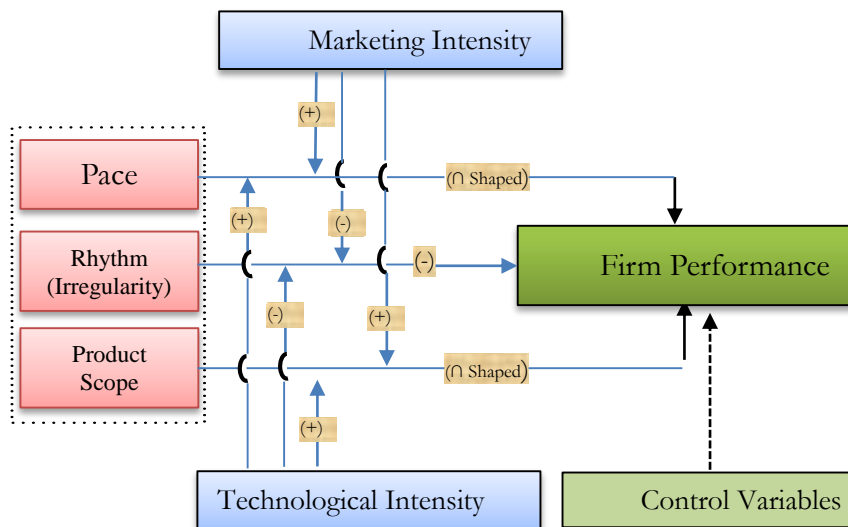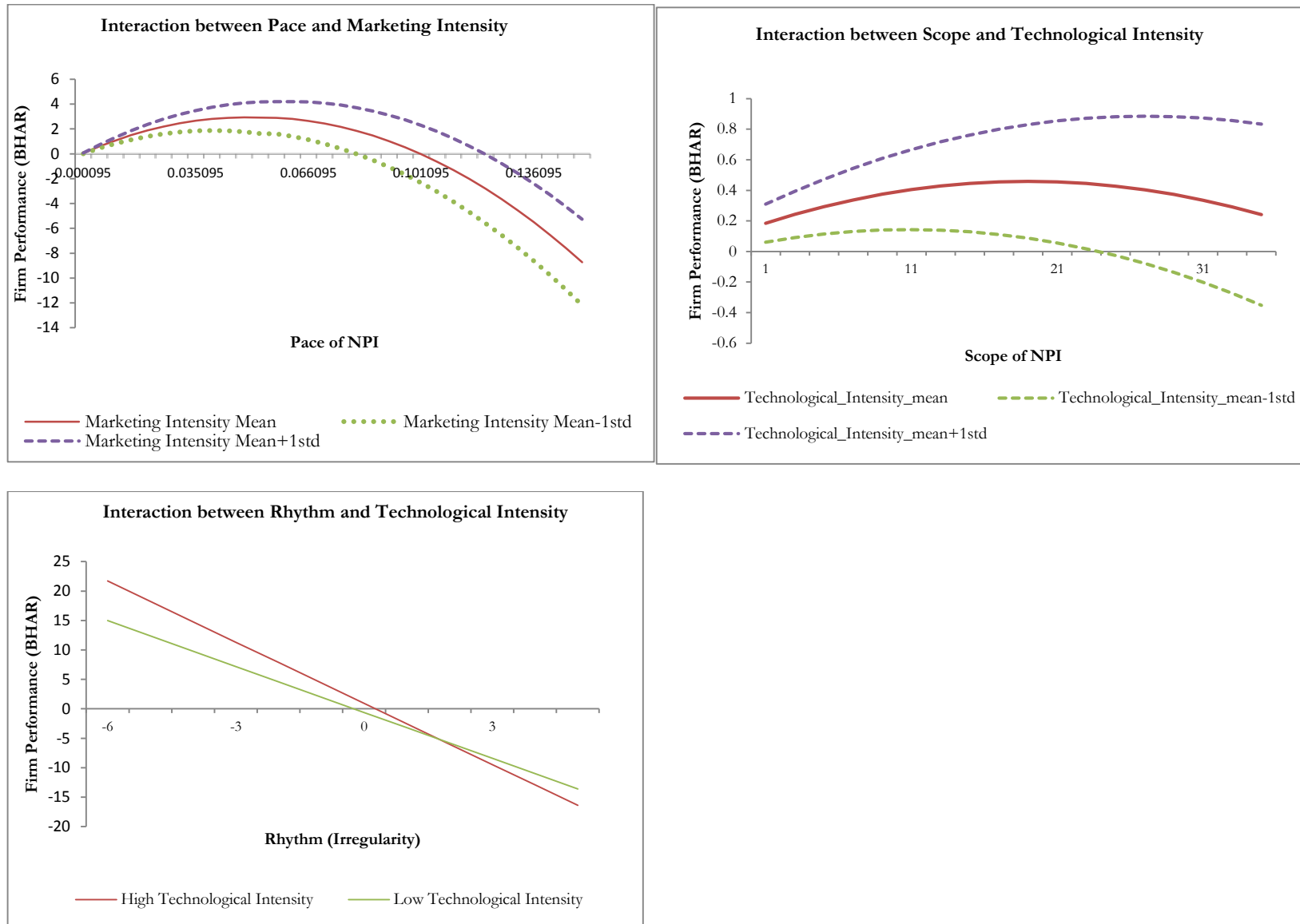
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