The use of product scarcity in marketing

Abstract

Purpose: as a frequently observed business phenomenon, the use of product scarcity to improve a product's market performance has received increasing attention from both academics and practitioners. The resulting literature has covered a wide variety of issues based on various theories, using different research methods, in a diverse range of settings. However, this diversity also makes it difficult to grasp the core themes and findings, and to see the outstanding knowledge gaps. This paper reviews previous studies on the use of product scarcity in marketing, and identifies new directions for future research.

Design/methodology/approach: a systematic review was conducted to identify and analyse 66 research papers published in business and management journals between 1970 and 2017.

Findings: we examined the underlying theories of scarcity-based marketing, and developed a conceptual framework that describes the key factors of product scarcity and how they influence both consumers and the market. We also highlighted some key achievements in modelling the processes involved in using product scarcity in marketing.

Originality/value: our analysis of the identified papers suggests that there are substantial gaps in our knowledge of this field, which opens up new paths for future research. For future research, we identified three directions aimed at: addressing the practical needs of firms in understanding product scarcity; guiding the implementation of scarcity-based strategies; and measuring, monitoring, and predicting the level of product scarcity and its impacts during implementation.

Keywords: product scarcity; supply shortage; limited edition; literature review.

1. Introduction

Scarcity refers to a basic economic problem, the gap between limited resources and limitless wants. This situation requires people to make decisions on how to allocate resources efficiently in order to satisfy basic needs and as many additional wants at possible. However, psychological studies show that people's perceptions can be influenced by the status of scarcity (Mittone *et al.*, 2009; Shah *et al.*, 2015); this creates business opportunities. By creating a temporary product scarcity—either unintentionally or deliberately—a product provider can increase overall demand and stimulate customer enthusiasm over a specific period of time, leading to improved overall market performance. For instance, Alibaba successfully created a national 'shopping carnival' in china (i.e., the Singles' Day, celebrated on November 11). The event is characterised by a wide range of products that are heavily discounted for a limited time (some of which are also offered in limited quantities). On that one day in 2018, Alibaba's sales recorded an astonishing US$30.8bn.

Product scarcity could either be the result of: mismanagements in market forecasting and production planning; supply bottlenecks; or, in an increasing number of cases, implicit or even deliberate marketing strategies aimed at limiting supply in order to stimulate market enthusiasm and greater market demand (John *et al.*, 2018; Song *et al.*, 2017). In most firms, excessive inventory is avoided because it results in low turnover, high maintenance costs, spoilage, obsolescence, inflexibility, and loss of other investment opportunities (Muller, 2011). However, reducing inventory increases the likelihood of product scarcity, which can lead to unsatisfied demand and loss of sales; thus, it is often treated as a mismanagement to be avoided or mitigated (Balakrishnan *et al.*, 2014). On the other hand, product scarcity can significantly influence price, sales promotions, product popularity, and purchasing behaviours. In many cases, such conditions can be deployed by firms to maximise a product's market performance

(Deval *et al.*, 2013; Wright *et al.*, 2013). Examples include limited edition products, time-limited discounts, and partially stocked shelves in supermarkets.

While numerous real world cases are observed across different sectors in different markets, academic research on the effective use of product scarcity has been patchy; so far, no synthetic research or systematic reviews have been conducted on the subject. This paper therefore presents a systematic identification and review of the related previous research in business and management journals. The review was conducted for two purposes: first, to describe the current state of research on the use of product scarcity in marketing and, second, to identify any gaps in the current literature and highlight opportunities for future research. In particular, the review sought to answer the following questions: *"What are the theories that underline the use of product scarcity in marketing?"* and *"How can different types of product scarcities help firms improve marketing performance, and what factors need to be considered in the process?"*

INSERT FIGURE 1 HERE

This research contributes to the burgeoning literature on the use of product scarcity in marketing. First, we identify four major theoretical lenses underpinning the value of product scarcity. More specifically, we show that the adoption of scarce products can satisfy consumer needs for: uniqueness—i.e., commodity theory (Brock, 1968); conformity—i.e., conformity theory (Jones, 1984); avoiding future regret—i.e., regret theory (Loomes *et al.*, 1982); and/or behavioural freedom—i.e., reactant theory (Brehm, 1966). Second, by reviewing and synthesising the existing literature through a process of analytic induction (Bansal *et al.*, 2000), we develop a framework (Figure 1) suited to illustrate the key factors of product scarcity and how they influence both consumers and the market, which could form a basis for future empirical research of the phenomenon. The framework indicates that the use of product scarcity in marketing depends on a combination of consumer characteristics, types of scarcity, and types

of product, which results in different impacts on consumers. Third, we highlight the mathematical models of the product scarcity phenomenon from three main fields—i.e., new product diffusion models, game theoretic models, and dynamic pricing models. Finally, given all that is known about product scarcity across multiple disciplines, a number of new themes for future research are also provided. In particular, we call for the development of a taxonomy for product scarcity, detailed guidelines to implement product scarcity for different products under different scenarios, and new tools to measure, monitor, and predict the phenomenon.

2. The literature selection

As the existing literature usually considers product scarcity as self-explanatory, it does not appear to provide a clear description of the phenomenon. For the purpose of this review, its central focus relates to firms exploiting insufficient product supply—relative to customer demand—in order to increase the subjective desirability of a product. The key findings of this review are drawn from 66 key papers published in business and management journals, identified through a topic search based on the *ISI Web of Science* and subsequent cross-referencing. Below, we explain how the literature was identified.

2.1. Topic search

Stage One – Initial Identification: we conducted a topic search using 'scarcity' as the search term in the *ISI Web of Science* database for the January 1970 to June 2017 time period, which resulted in 23,636 hits. The *Web of Science* is a well-established citation database covering academic papers published from 1970; it has been widely used for systematic reviews published in highly rated journals—e.g., Stephan (2018), Kim *et al.* (2018), Alves *et al.* (2016), Klang *et al.* (2014) and West *et al.* (2013)—because of its focus on scholarly journals, objective journal selection standards and wide-acceptance in the academic community (Klang *et al.*, 2014). The topic search allows the use of a combination of fields ('Title', 'Abstract', 'Author

Keywords', and 'Keywords Plus'), which is more comprehensive than a simple title or keyword search. Given the focus of this review, two *Web of Science* categories, business and management, were then used to filter out the initial results. Stage one of the search identified 698 items.

Stage Two – Filtering & Quality Assurance: first, we excluded any non-articles and non-English items, thus reducing the number of items to 426. We then manually excluded any items that had not been published in journals ranked with 4- or 3-stars in the Academic Journal Guide 2015 (CABS, 2015); i.e., the ABS journal list. This journal list is developed based on a wide range of evidence including the citation impact scores (i.e., the JCR, SJR, and SNIP scores and ranking are both considered by the list), and it covers the leading marketing journals that are often used in review articles (e.g., see the reviews of Cleeren *et al.* (2017) and Zlatevska *et al.* (2014)). Following this stage, 282 papers remained. Since the ABS journal list is less inclusive than some other journal lists such as the Australian Business Deans Council Journal Ranking List, a validity check was also introduced at a later stage to identify the variance and confirm the findings (see Section 2.4).

Stage Three – Final Identification of Papers: we conducted a qualitative analysis based on reading and interpreting each paper's title and abstract in order to identify the relevant papers for this review. In those cases in which a decision could not be made based on the title or abstract alone, the full article was read. After each paper had been judged according to its relevance to the intended issue, the final list included 46 papers. The process excluded many papers; for instance, environmental studies focusing on the scarcity of natural resources, human resource studies considering the lack of human capital, strategy and entrepreneurship studies examining business development with insufficient resources, and general psychological research discussing people's feelings around scarcity in non-business/management contexts.

INSERT TABLE 1 HERE

2.2. Cross-referencing

As only the term ‘scarcity’ had been used to conduct the topic search, its results could have overlooked some papers that had studied the intended issue without using that specific term in their topic field. To complement the results, we looked through the reference lists of the 46 papers to identify any other articles (i.e., those also published in 4-star and 3-star journals in the ABS list) that the topic search had not turned up (Wright *et al.*, 2007). To determine the relevance of the papers, the same inclusion and exclusion criteria presented in Table 1 were also applied in the cross-referencing; this generated 20 more papers that contained various keywords closely related to the focus issue, such as: “product unavailability”, “time restrictions”, “seller-induced excess demand”, “limited edition”, “limited availability”, “limited purchase opportunities”, “conspicuous consumption”, “shortage”, and “inventory consideration”.

2.3. Extraction and analysis

The 66 final papers were read, coded, and discussed by the authors. Then, following the approach of Watson *et al.* (2017), the underlying theories of product scarcity were summarized and the key factors of product scarcity were synthesised in order to develop the proposed conceptual framework. More specifically, the theories and key factors of product scarcity drawn from the most recent article were used as a starting-point, and an analytic induction approach was followed to look into each article for new factors suited to iteratively modify our results. In addition, the papers were filtered based on mathematical modelling techniques suited to the study of the product scarcity phenomenon.

2.4. Validity check

The 66 papers identified from the topic search and cross-referencing described above were used to analyse the literature. In addition, the cross-referencing identified some papers that had

been widely cited despite not being published in the targeted journals—such as the papers produced by Verhallen (1982), Verhallen *et al.* (1994), Lynn (1989), and Lynn (1992); some related theories and concepts were also traced back to books, rather than journal articles—such as Brock's (1968) commodity theory and Brehm's (1966) reactance theory; the relevant papers published in ABS 2 star journals were also identified and reviewed separately. The analysis of these papers and books served as a validity check and they confirmed our findings; that is, the papers and books did not alter our understanding of product scarcity drawn from the analysis of the 66 original papers.

2.5. The initial analysis

Publications discussing the use of product scarcity appear only occasionally before 2000, but have since featured more regularly. In particular, over 40% of the identified papers had been published since 2010, showing a particularly fast growth within the last decade. The 66 papers were scattered across many journals (see Table 2). Two journals—*Management Science* and *Journal of Advertising*—had published seven and six papers respectively. They were followed by *Journal of Consumer Research* and *Psychology & Marketing*, with five papers each. The remaining 43 papers were scattered across 23 different journals. In terms of the research fields, however, the papers were highly concentrated. Forty-three of the identified papers were from the field of *marketing*, indicating an ever-growing interest in the phenomenon in this field. The second largest field was *management science & operational research*, which accounted for nine papers, followed by *general management*, with six papers. The remaining eight papers were from the fields of *operations & technology management*, *psychology*, *economics*, and *sector studies*.

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Of the 66 identified papers (see Figure 2), 42 had adopted the experimental method, whereby the researchers created a scenario for the participants, manipulated the variables of interest, and studied the intended causal relationships. The second most widely used method was mathematical modelling and analysis; such papers (18) had attempted to model the phenomenon of product scarcity and to seek optimal solutions such as pricing and inventory management. Other methods involved the use of data drawn from surveys, structured interviews, observations, and secondary sources. Interestingly, few papers were based on in-depth case studies or ethnographic research in order to illustrate the process by which product scarcity can be implemented (***Knowledge Gap 1***). This is because the existing literature has mainly focussed on the basic instances of product scarcity—such as limited edition/time/quantity offers—most of which are self-explanatory. Although the identified literature mentioned some cases of scarcity-based strategies, such as those involving Hush Puppies (Dye, 2000), the Nintendo cartridge, Sony's PlayStation 2 (Stock *et al.*, 2005), and the Mazda Miata (Balachander *et al.*, 2009a), the main purpose of these examples had been to introduce the papers' research topics and/or to corroborate the research findings.

Following the initial analysis of the search results, three themes were identified by carefully reviewing the contents of the identified literature on product scarcity; i.e., its underlying theories, the factors that influence it, and its study through mathematical models. The following three sections will discuss these themes.

3. The underlying theories for product scarcity

The identified literature referred product scarcity to message (Aggarwal *et al.*, 2011), appeal (Eisend, 2008), effect (Jung *et al.*, 2004), variable (Wright *et al.*, 2013), driver of consumer utility (Franke *et al.*, 2008), and strategy (Stock *et al.*, 2005). In fact, many studies simply treated it as a de facto factor to sales, without clearly explaining product scarcity and the logic behind it. However, the study of product scarcity is not precluded by its fuzzy definitional

nature. For the purpose of this review, the notion of product scarcity relates to firms exploiting insufficient product supply—relative to customer demand—in order to increase the subjective desirability of a product.

Through our review and analysis, we were able to identify four explanations for the use of product scarcity in marketing (see in Table 3). The first—and perhaps the most cited—explanation is commodity theory (Brock, 1968), which states that any commodity will be valued to the extent to which it is unavailable. Commodity theory is closely linked to the consumer need for uniqueness (Brock, 1968; Fromkin, 1970)—as people in general need to see themselves as moderately unique (Belk, 1988; Snyder *et al.*, 1980), consumers perceive a higher value in those products that can signal their uniqueness. In other words, product scarcity enables the satisfaction of this need by allowing some people to own things that others do not; thus, consumers with a high need for uniqueness exhibit a greater preference for scarce products (Lynn, 1991; Wu *et al.*, 2012). In the light of this theory, scholars have developed several scales suited to measure an individual's need for uniqueness (Ayalla *et al.*, 2008; Snyder *et al.*, 1977; Tian *et al.*, 2001a; Tian *et al.*, 2001b).

INSERT TABLE 3 HERE

Second, conformity theory explains how people align their attitudes, beliefs, and behaviours to group norms (Jones, 1984). Consumers who have a greater need for conformity value a product as a direct function of the number of people who are buying it (Bernheim, 1994; Jones, 1984). As noted by van Herpen *et al.* (2009), sometimes, a product is neither exclusive in nature nor restricted by its supplier; scarcity occurs simply because its supply cannot meet its demand. Such scarcity also accelerates demand, something that cannot be explained by consumer need for uniqueness, or by the reactance or regret theories mentioned below, but can well be explained by consumer need for conformity—consumers tend to buy a scarce product because

they see evidence that many others have already purchased it. One typical example of this can be referred to empty shelves in supermarkets stimulating consumer purchase intentions. More recent literature on product scarcity has shown that consumers tend to incorporate their perceived influence of scarcity on self and others into their purchase behaviours, although debates exist regarding whether it is because of the perceived influence on self and others or because of the perceived influence on self relative to others (Eisend, 2008; Sharma *et al.*, 2016). The identified literature also included studies on reference group effects, and the results showed that these can influence firm profits from limited-edition products (Amaldoss *et al.*, 2008, 2010).

It should be noted that uniqueness and conformity represent two competing consumer needs; i.e., the need to differentiate oneself from others and the need to assimilate oneself with others (Brewer, 1991). Therefore, product scarcity works differently in the context of different consumer needs. When studying conspicuous products, Amaldoss *et al.* (2005b) found that, while the consumer need for uniqueness leads to higher product prices and thus higher profits, the need for conformity lowers the prices and profits of such products. Furthermore, product scarcity works differently on consumers who differ in terms of the two needs. For instance, although those consumers who have a greater need for uniqueness (than they have for conformity) are more willing to adopt *radically* new products, product scarcity can reverse the effect by making them more willing to adopt *incrementally* new ones (Ma *et al.*, 2014). Therefore, to gain a more comprehensive understanding of the phenomenon, some scholars—including Amaldoss *et al.* (2005a), Ames *et al.* (2005) and Hwang *et al.* (2014)—attempted to combine the commodity and conformity theories in their studies of scarce products.

The third explanation refers to consumer desire to avoid future regret (Loomes *et al.*, 1982). Product scarcity often requires consumers to make a choice between buying now and risking missing out on the purchase opportunity—for instance, due to the item later being out of stock.

Therefore, those consumers who have a greater need to avoid future regret choose to buy a product not because of its utility but, rather, because they are concerned that they won't be able to buy it in the future. This feeling occurs especially when consumers are faced with time pressures, such as time-limited offers and coupons with expiration dates. In certain circumstances, this can even result in hoarding consumer behaviours (McKinnon *et al.*, 1985; Sterman *et al.*, 2015). In terms of the empirical evidence, studies suggest that, although product scarcity can lead to regret regardless of whether a consumer decides to act (i.e., to buy now) or not (i.e., to not buy now), the regret from inaction is more salient than that from action (Gabler *et al.*, 2017; Simonson, 1992). Abendroth *et al.* (2006) also pointed out that, under conditions of product scarcity, inaction leads to greater short-term regret, although this feeling can decrease over time.

Fourth, psychological reactance occurs when people feel that their behavioural freedom—in the context of the current review, their freedom to choose products—is threatened (Brehm, 1966). In other words, when their choice of a product becomes limited, consumers can become increasingly motivated to obtain it (Clee *et al.*, 1980). Although reactance theory appears fewer times in our identified literature, it can be more useful in explaining demand for products the availability of which is restricted due to government policies or market regulations; in these cases, consumers may have strong protest feelings. For instance, the theory can be important in explaining consumer purchasing behaviours of pirated media products (Anthony *et al.*, 2009). During the time when many US states were considering the enactment of laws to eliminate phosphate laundry detergents, reactance theory was found to be valid when examining consumer reactions to this type of product (Mazis *et al.*, 1973). Through an experiment, Lessne *et al.* (1988) also found that the attitudes expressed by consumers in relation to a restricted product (Coca-Cola brand soda, in their experiment) were consistent with reactance theory.

It is worth noting that, although the above theories can work individually in some scenarios, they can also be integrated to better understand some cases of product scarcity, which warrants more attention from future research. One instance that supports the need for integration is the understanding of buying frenzies (Courty *et al.*, 2016; DeGraba, 1995; Liu *et al.*, 2014). Under normal circumstances, consumers benefit from waiting because they can gather more information and thus make better-informed decisions; however, in buying frenzies, those consumers who take a wait-and-see approach will be worse off—for instance, due to the price increases after the sales period or to the discounted product utility over time. Therefore, many consumers rush to buy in order to avoid future regret (regret theory). At the same time, as consumers are given less time and less information to make decisions, they are more likely to follow others into early purchases (conformity theory). Another example can be drawn from the signalling literature, which emphases the role played by product scarcity in signalling the superior quality of a product (Balachander *et al.*, 2009a; Stock *et al.*, 2005) and/or its consumer's social status (Bernheim, 1994; Corneo *et al.*, 1997). Therefore, the consumer need for uniqueness (i.e., owning products of a superior quality) and for conformity (i.e., sharing the status of a prestigious social group) can both be relevant in the case of products that are rare by nature, such as conspicuous and customised products.

Although developed decades ago, the four theories remain valid and, together, they constitute the foundation of scarcity strategy by explaining why product scarcity can be relevant and useful to marketing. They suggest that insufficient supply can make consumers agitated, causing their focus to narrow, their emotions to rise, and their cognitive processes to often become suppressed by 'brain-clouding arousal' (Cialdini, 2009), which further influences their product evaluation and buying behaviours (Chung *et al.*, 2017; Gorn *et al.*, 2001). On the basis of these theories, researchers have explored various factors in relation to the use of product scarcity in marketing; these will be detailed in the next section. The theories also correspond

to the different consumer characteristics that influence their perceptions of product scarcity; these characteristics were used as the starting point to identify the factors of product scarcity and to develop the integrated framework.

4. An integrated framework of product scarcity

Our review and the proposed framework show that the main body of the literature on the issue of product scarcity concerns the causal relationships between four clusters of factors; i.e., the consumer characteristics related to product scarcity, the types of scarcity, the types of product, and the positive impacts of product scarcity. More specifically, the impacts of product scarcity on consumers are influenced by a combination of the latter's individual characteristics, the types of scarcity, and the types of the applied product. As each cluster contains diverse factors of interest, many causal relationships exist. Figure 1 and the rest of this section highlight the key factors and the relationships.

4.1. The consumer characteristics

Different consumers can react differently to product scarcity as a function of their individual characteristics. The underlying theories of product scarcity have already indicated four related consumer characteristics—i.e., the needs for: uniqueness, conformity, to avoid future regret, and for behavioural freedom. In general, those consumers that are more sensitive to these needs are more vulnerable to the scarcity strategies imposed by firms.

In addition to the above characteristics underpinned by the theories of product scarcity, the identified literature shows that other consumer characteristics also play important roles in the process. For instance, the consumer need for cognition can moderate the market effect of product scarcity. People differ in terms of their tendency to engage in effortful and systematic thinking, which determines how they process information (Haugtvedt *et al.,* 1992). When faced with the scarcity of a particular product, consumers with a high need for cognition are likely to

think more, for instance, about the reason and the incentive behind the scarcity, and other purchase-related factors, which renders them less vulnerable to firms' scarcity strategy. Therefore, product scarcity is more effective in relation to consumers with a low need for cognition (Inman *et al.*, 1997; Whittler *et al.*, 2015). Another moderating role can be referred to the level of consumer expectation of the product scarcity (i.e., whether the scarcity will last long). For instance, any inconsistency between the consumers' low expectation of scarcity and the firm's actual scarcity claim is likely to result in consumer suspicion of the incentives behind the scarcity; thus, scarcity appeals only work when consumers have a high expectation of scarcity (Mukherjee *et al.*, 2016).

The identified literature also classifies consumers into categories, and compares their responses to a scarcity cue. For instance, promotion-motivated and low self-monitoring consumers are shown to be more likely to purchase scarce products that are unique in the market (e.g., scarcity due to restricted supply); meanwhile, prevention-motivated and high self-monitoring consumers are more likely to acquire products that are scarce due to excessive demand (Ku *et al.*, 2012; Ku *et al.*, 2013). Other consumer characteristics that influence product scarcity can include consumer demographics such as age, income and financial deprivation (Lessne *et al.*, 1988; Sharma *et al.*, 2012), prior preferences and experiences (Deval *et al.*, 2013; Parker *et al.*, 2011), impulsiveness (Chung *et al.*, 2017), materialisms and price consciousness (Gabler *et al.*, 2017). Jung *et al.* (2004), Effron *et al.* (2011) and Ma *et al.* (2014) also examined a set of country and culture differences that influence the use of product scarcity, including cultural context, product familiarity, uncertainty avoidance, perception of fairness, and need for cognitive closure.

Our review and discussions have covered a wide range of consumer characteristics in relation to product scarcity. Still, less is understood in regard to the consumer characteristics in terms of different countries and cultures, which can provide the necessary contexts to explain why

some types of product scarcity can be particularly useful in some markets (***Knowledge Gap 2***). For instance, by manipulating the availability of in-game items and taking advantage of gamer thirst for power and desire to win, free-to-play games have dominated the market in many regions, such as Asia. Meanwhile, western games rely heavily on local firm expertise to access and profit from the market.

4.2. The types of scarcity

Although firms may find it difficult to influence consumer characteristics, they may be able to control the types of product scarcity that they impose on consumers. Product scarcity can be categorized as demand-induced or supply-induced (Roy *et al.*, 2015). The former is created by increases in customer demand that outgrow product supply, and the latter occurs due to decreases in supply that cause failure to match consumer demand. In generalized terms, demand-induced scarcity results in a higher perceived product value than supply-induced scarcity (Worchel *et al.*, 1975). However, firms need to be very cautious when coding the two types of scarcity into marketing messages, especially in relation to demand-related scarcity appeals (e.g., "*in popular demand*" and "*over* [number] *sold*"), because consumers may feel that firms cannot accurately gauge demand information (compared with supply information), which triggers perceptions of deceptiveness (Aguirre-Rodriguez, 2013). By referring to the previous section on consumer characteristics, close connections can be made between demand-induced scarcity and conformity theory (i.e., consumer need for conformity), and between supply-induced scarcity and commodity theory (i.e., consumer need for uniqueness). More specifically, while the bandwagon effect generated by demand-induced scarcity works better for individuals with a greater need for conformity (Ku *et al.*, 2013; van Herpen *et al.*, 2009), consumers with a greater need for uniqueness are more vulnerable to supply-induced scarcity (Gierl *et al.*, 2010; Roy *et al.*, 2015). Furthermore, it has been noted that message specificity plays a moderating role in the process; i.e., advertising messages based on supply-induced

scarcity become less effective when such scarcity is stated specifically (because consumers tend to focus on the attributes of a product more than on its scarcity), and message specificity also does not have a significant impact on advertisements based on demand-induced scarcity (Aguirre-Rodriguez, 2013).

Although they represent a type of supply-induced scarcity, limited-edition products are given a separate discussion paragraph in this review because of their wide existence in both the literature and practice. In general terms, scarcity appeals can positively influence limited-edition products (Aggarwal *et al.*, 2011). However, they can be particularly useful when the products are purchased for self-use, rather than for others—e.g., as gifts (Wu *et al.*, 2016). In addition, introducing limited-edition products into a product portfolio can benefit overall brand profit, as demonstrated by Balachander *et al.* (2009b). Such practice can be observed in many product categories of today's market, such as fashion items, automobiles, and musical instruments. An extreme instance of limited-edition products can be represented by customized products tailored for individual needs. The perceived uniqueness of customized products is not simply a selling point, but a key driver of their utility (Franke *et al.*, 2008).

In addition, product scarcity can occur outside of a firm's intentions or can be deliberately planned, although this difference is not explicitly discussed in the literature. Both these types of scarcity can be beneficial to firms, but are respectively linked to a firm's retroactive and proactive strategies. For instance, Volkswagen (unintentionally) underestimated the demand for their New Beetles in 1998, but then made the smart decision to convert the product shortage into a positive effect (Stock *et al.*, 2005). In another example, Nintendo stated that it would only (deliberately) produce 40 million units of game cartridges despite 43 million forecasted sales, thus forsaking 7.5% of the market demand (Stock *et al.*, 2005). We developed a simple typology of product scarcity based on the two characteristics mentioned above (see Table 4).

INSERT TABLE 4 HERE

In practice, however, it can sometimes be difficult to tell whether a product scarcity is supply- or demand-induced, unintentional or deliberate. For instance, both Apple and Xiaomi often incur supply shortages during the launch of their new smartphones. Despite public suspicion and criticism, they both deny that such scarcity is planned (i.e., supply-induced and deliberate); instead, they ascribe it to issues such as excessive market demand relative to production capacity (i.e., demand-induced and unintentional) (Husmith, 2013) and production difficulties linked to sophisticated product design (i.e., supply-induced and unintentional) (Fekete, 2012). In addition, the causes of product scarcity can change over time. For instance, Uber's Surge Pricing is triggered when demand is higher than the supply—which can happen because there are fewer drivers on the road (i.e., supply-induced), because more users are calling the service due to bad weather conditions (i.e. demand-induced), or both.

Product scarcity can be brought about not only by limited quantities, but also by limited time (Inman *et al.,* 1997). Time limits influence the shopping behaviours of consumers by affecting their ability to source and process information (Park *et al.*, 1989; Svenson *et al.*, 1993) because, faced with time pressure, consumers are more likely to rely on the primed naïve theories, such as scarcity, when purchasing. In their experiment, Inman *et al.* (1994) studied consumer coupon redeeming patterns and found that a stated expiration date tends to induce redemptions just prior to that date. It is worth noting that limited-quantity scarcity and limited-time scarcity work differently for different products. The identified literature provides some comparisons between the two, although these are not systematic. In particular, Aggarwal *et al.* (2011) showed that a limited-quantity scarcity message is more effective in influencing consumer willingness to buy symbolic brands. When studying limited-edition products, Jang *et al.* (2015) found that the limited-quantity message is more influential when the product is also conspicuous, while the limited-time message is more influential when the product is not. In addition, product scarcity

can be triggered by certain pricing strategies. One typical example is markdown or discount pricing, which reduces the selling price of a product. As such offers may last only for a limited time period, they can stimulate consumer purchasing willingness and market performance (Elmaghraby *et al.*, 2008; Soysal *et al.*, 2012; Yin *et al.*, 2009).

Finally, the recent literature on product scarcity also shows a consistent interest in shelf-based scarcity in stores. As shelf inventory is constantly changing (due to purchases and restocking) and is highly visible to consumers, it becomes an ideal context to study consumer response to product scarcity. Experiments indicate that partially stocked shelves have a positive impact on consumer willingness to purchase, because consumers have a general preference for clearly popular yet currently less available products, which may be evidenced by scarcity on the shelves (Robinson *et al.*, 2016; van Herpen *et al.*, 2009). Shelf-based scarcity can even increase the product sales of unfamiliar brands (Castro *et al.*, 2013; Robinson *et al.*, 2016) because it implies product popularity; i.e., that many other consumers have already purchased the product. By eliminating other influences, shelf-based scarcity can become even more effective for product sales in stores. For instance, Parker *et al.* (2011) found that partially stocked shelves work better when consumers do not have strong prior preferences and do not see price promotions around. However, it should be noted that the products considered in the above studies were mostly utilitarian products. If the level of scarcity becomes too high or causes the product to be out of stock, consumers can always choose other brands or even alternative stores, which can result in substantial financial losses (Campo *et al.*, 2000, 2004; Fitzsimons, 2000).

One primary challenge faced by many firms is to identify the best way to impose product scarcity on the market for different products. Although various types of product scarcity are covered in the extant literature, more research is still needed to explore any emerging types and enable a better comparison between them (***Knowledge Gap 3***). Such a comparison could

provide a better understanding of the phenomenon and help managers plan the scarcity strategy appropriate to their products.

4.3. The types of product

The identified literature covered a variety of products such as food, beverages, clothing, music, consumer electronics, and automobiles. There were also studies of service products such as fine dining (Chung *et al.*, 2017) and tour packages (Suri *et al.*, 2007). A review of the product types and of the corresponding results indicates that product scarcity differs in terms of the concept of the underlying brand; for instance, conspicuous vs. non-conspicuous products, symbolic vs. functional products, and hedonic vs. utilitarian products.

It is generally accepted that conspicuous goods signal higher value in terms of product quality (Stock *et al.*, 2005) and social status (Belk, 1988); hence, they can simultaneously satisfy consumer need for uniqueness in relation to the general public and for conformity within a prestige group (Amaldoss *et al.*, 2005a). Therefore, chronic consumer desire for scarce and conspicuous goods can be strong enough to even dampen the price effect (Hwang *et al.*, 2014). Similarly, consumers are more willing to purchase scarce products of symbolic brands, because the strong symbolism of the brands can signal their own identity and status (Aggarwal *et al.*, 2011).

Another concept closely related to the above two is hedonic shopping, in which the shopper aims to receive a joyful experience from the process (Babin *et al.*, 1994). By comparing hedonic shopping (for enjoyment and satisfaction) and utilitarian shopping (for function and actual need), both shopping values are found to be potentially enhanced by scarcity messages (Chung *et al.*, 2017). The further integration of demand-induced vs. supply-induced scarcity into the discussion shows that consumers who engage in hedonic shopping (and conspicuous shopping) are more inclined to choose products that are scarce due to limited supply, whereas when

shopping for utilitarian (and non-conspicuous) products, consumers prefer products that are scarce because of high demand (Gierl *et al.*, 2010; Ku *et al.*, 2013).

Furthermore, while most studies in the literature are based on existing products that are familiar to participants, a small number of recent papers have included unfamiliar brands and products (Ames *et al.*, 2005; Castro *et al.*, 2013; Jang *et al.*, 2015; Robinson *et al.*, 2016) and new products (Ma *et al.*, 2014) as the unit of analysis. The findings show that product scarcity can still play a positive role in enhancing a product's market performance, even when the objects are unfamiliar to the consumers. However, more empirical evidence is needed to demonstrate and test the results across more cases.

Other types of products studied in the identified literature include enduring vs. transitory luxuries (Janssen *et al.*, 2014), ingested vs. non-ingested products (Castro *et al.*, 2013), seasonable goods (Soysal *et al.*, 2012) and products for self vs. products as gifts (Hwang *et al.*, 2014; Wu *et al.*, 2016). The results of the above comparisons confirm that, although product scarcity works in broad product categories, it leads to different results if the applied products are different.

Our review and discussions indicate that, whereas the extant research was often focussed on some particular product categories—such as conspicuous products and luxury brands—managers may want to know whether other types of products and services also can benefit from scarcity, and how (***Knowledge Gap 4***). For instance, for its mobile ride hail service, Uber developed an algorithm that automatically increases prices when taxi demand is higher than available drivers (i.e., Surge Pricing); this can effectively pick up and utilise dynamic scarcity to benefit customers, drivers, and the firm simultaneously; that is, it provides customers with extra reliability and availability at an extra cost; increases driver earnings and encourages more of them to get back on the road; and helps Uber to generate more profits and recruit more drivers. In addition, we still have limited knowledge of how product scarcity may benefit new

products of which consumers have no or low awareness in the market, and how product scarcity may benefit service products.

4.4. The impacts of product scarcity

The various combinations of the factors linked to consumer characteristics, types of scarcity, and types of product can have different impacts on consumers (and thus on their behaviours), which involve firm decisions in relation to, among other things, advertising strategy, pricing strategy, inventory strategy, and product line strategy. We highlight the impacts as follows.

First, by purchasing scarce products, consumers satisfy their needs for uniqueness, for conformity, for behavioural freedom, and/or to avoid future regret. All of the above can lead to increased consumer perception of value in regard to the products, and consequently increased consumer willingness to purchase. The identified papers confirm the benefits of product scarcity, although the actual impact differs in different scenarios. In general terms, the need for uniqueness is better satisfied by supply-induced scarcity (Roy *et al.*, 2015) and, more specifically, by limited-edition products (Jang *et al.*, 2015) along with their associated brands (Balachander *et al.*, 2009b), conspicuous products (Amaldoss *et al.*, 2005a), customized products (Franke *et al.*, 2008), and automotive industry products (Balachander *et al.*, 2009a). The need for conformity can be satisfied in various cases by both supply-induced scarcity (DeGraba, 1995) and demand-induced scarcity (van Herpen *et al.*, 2009). The need for behaviour freedom is satisfied by products that are restricted by law or policy (Clee *et al.*, 1980; Lessne *et al.*, 1988). And the need to avoid future regret has been found to be predominantly satisfied by instances of time-limited offers (Abendroth *et al.*, 2006; Gabler *et al.*, 2017; Inman *et al.*, 1994).

Second, the increased value perception generated by product scarcity is not only limited to a specific product, but also applies to a product's category (Balachander *et al.*, 2009b; Zhu *et al.*, 2015) as well as to the reputation of the overall business (Janssen *et al.*, 2014). Therefore, we

see many firms introducing limited edition products, as part of their product line strategy, in order to enhance overall brand awareness and business image.

Third, product scarcity can influence consumer perceptions of product price, which offer ample opportunity for firms to increase profits. It is a common understanding that product inventory has a direct impact on price in the futures market. For instance, an analysis of the historical soybean data indicates that decreasing inventory relates to increasing price volatility (Geman *et al.*, 2005). Similar patterns can also be observed in the markets for other products. Experiments show that people have the tendency to choose scarce goods over abundant ones, and that they are willing to pay higher prices for limited offers (Mittone *et al.*, 2009). Taking a closer look, product scarcity can be seen to trigger consumer heuristic processing and, at the same time, lead to a decrease in recall accuracy (Bozzolo *et al.*, 1992). Therefore, consumer perceptions of quality and value as well as purchase intentions in relation to high-priced products can increase under conditions of scarcity (Hwang *et al.*, 2014; Simonson, 1992; Suri *et al.*, 2007; Suri *et al.*, 2003). In other words, consumers operating in the presence of scarcity cues are more likely to adopt high-priced and well-known products. The above results endorse firms charging higher prices for scarce products (e.g., limited-edition products) and creating scarcities of pricy products (e.g., conspicuous products). Another interesting paper in our identified literature studied consumer perceptions of the high prices of conspicuous products from the perspective of corporate social responsibility. (Janssen *et al.*, 2014) found that when an enduring luxury product is scarce (e.g., jewellery), it is easier for the business to establish a socially responsible image among the public. The result stands on the assumption that enduring luxury products are mostly based on scarce resources, and therefore their high price is desirable to protect the future of the resources.

Fourth, product scarcity influences other consumer aspects in addition to their purchasing intentions. For instance, research has shown that consumers are satisfied more slowly if the

consumption of the product is limited, providing a viable solution to increase consumer demand without the high cost of product development (Sevilla *et al.*, 2014). Consumers may also experience personality changes when exposed to product scarcity. People tend to assume that their opinions are shared by others, which is social projection (Krueger, 2000; Robbins *et al.*, 2005). Following this concept, consumers who value scarce products are likely to project their personal appraisal onto others within a social group (Ames *et al.*, 2005). Therefore, during a supply shortage they may perceive other shoppers as competitive threats and consequently adopt more aggressive purchasing attitudes (Kristofferson *et al.*, 2017). The competitive environment generated by continuous scarcity messages is also likely to make consumers focus more on their own welfare, and thus promote selfish behaviours in them (Roux *et al.*, 2015). The above-noted personality changes can provide important implications for consumer motivational orientations and purchasing behaviours, as well as for the firms' corresponding business activities.

Finally, due to the referral effect, product scarcity is also considered a useful catalyst in viral marketing, which speeds up the dissemination of product information (Dye, 2000). People tend to share information with others for social capital (Berger *et al.*, 2013). Hence, scarcity messages, when considered to carry valuable information, can trigger and enhance consumer referral propensity. For instance, Koch *et al.* (2015) designed an experiment to study people's referral behaviours concerning a new online shopping recommendation service that linked to discount offers. The results show that a high level of product scarcity (e.g., one achieved by restricting access to the discount offers) encourages consumer referral propensity. When it comes to conspicuous and limited products, scarcity-induced viral marketing remains valid, although its effectiveness is moderated by the degree of consumer need for uniqueness (Jang *et al.*, 2015). That is, consumers with a greater need for uniqueness may be less likely to pass on the information to others in order to maintain their own uniqueness.

Our review and the above discussions indicate that the existing literature mainly emphasizes the role played by product scarcity in increasing market demand and sales, which may have resulted in an underestimation of its impacts on other business aspects (***Knowledge Gap 5***). For instance, XiaoMi, a Chinese smartphone producer, first created an image of high performance/price ratio through web-based mass communication before the product launch, which was subsequently amplified by a series of carefully planned and scarcity-based flash sales. Then, based on the increasing market demand and product shortage, the firm convinced its customers to pay first and wait for weeks for the phone to be produced and despatched. The time gap and healthy cash-flow gave the firm more bargaining power with suppliers to further reduce production cost and improve margins. Future research can explore how product scarcity may influence firm performance indirectly, by considering product scarcity as an integrated part of the firm's overall strategy and business model.

5. Models of the product scarcity phenomenon

Our identified literature also included a number of papers that had sought to study the product scarcity phenomenon through mathematical models. Despite the various factors and causal relationships they identified, those models tended to focus on selective factors of interests (e.g., price). However, through analytical and simulation analysis, they could generate additional insights (e.g., into competition between scarce products, entry timing of scarce products, and pricing strategy of scarce products) to aid managerial decision making. We reviewed the models in three categories; i.e., new product growth models, game theoretic models, and dynamic pricing models.

The new product growth model family is an important research area in the field of management/marketing science. New product growth models are able to explain—and, more importantly, predict—the growth trajectory of a product in the market. The original Bass model (Bass, 1969, 2004) only contains two variables, mass media effect and social contagion effect,

based on diffusion theory (Rogers, 1962). By adding the consideration of supply shortage into the process, these models can more realistically reflect the product growth phenomenon and provide relevant implications for inventory management and pricing. However, supply constraints are usually viewed in a negative light in early market growth models (Ho *et al.*, 2002; Jain *et al.*, 1991; Kumar *et al.*, 2003; Simon *et al.*, 1987). More recent studies in this field have started to consider the positive role played by product scarcity in the process. Following this trend, Swami *et al.* (2003) modelled the phenomenon under the conditions of limited supply and known expiration date; Swami *et al.* (2006) suggested that the best pricing strategy under conditions of supply shortage is to gradually increase the price as the sales approach product availability; the model analysis performed by Balakrishnan *et al.* (2014) showed that supply shortage exists widely and can enhance the social contagion effect in the Bass framework.

Some scholars have modelled the product scarcity phenomenon as a game and have sought insights through analytical solutions. For instance, the model proposed by Stock *et al.* (2005) and its analysis provided insights on the signalling explanation for product scarcity, which can explain why firms sometimes may not want to charge high prices for clearance products or increase inventory to eliminate scarcity. Amaldoss *et al.* (2005b) and Tereyağoğlu *et al.* (2012) modelled conspicuous consumer shopping behaviours and examined the model's implications for firm pricing policies, production decisions, and profits. By using a game theory model, Balachander *et al.* (2009b) studied how two brands competed for consumers with limited-edition products, and offered managerial implications for when and when not a firm should introduce such products into its portfolio. For instance, a brand could benefit from limited-edition products if they are of better quality than those of its competitor; at the same time, although the lower-quality brand could respond by introducing its own limited-edition products, its overall profits would decrease due to the increased price competition between the brands.

Due to the dynamic nature of demand and supply during product scarcity, firms are encouraged to adopt dynamic pricing policies. Dynamic pricing refers to the setting of flexible prices in response to dynamic demand and/or supply, a strategy which is widely used in various industries, including transportation, hospitality, sports, and electric utilities (Elmaghraby *et al.*, 2003). A dynamic pricing policy can provide valuable implications for firm pricing and inventory decisions in different scarcity-related scenarios. For instance, during a new product launch, when product supply can be limited, firms often initially set a high price, and gradually decrease it afterwards (Elmaghraby *et al.*, 2008). Firms may face pricing and inventory decisions when they introduce substitute products (Dong *et al.*, 2009). When dealing with perishable products, firms (e.g., supermarkets and bakeries) usually choose to decrease prices after products have been on display for a certain length of time; otherwise, they would have to dispose of any leftover inventory (Nan *et al.*, 2014).

Overall, Figure 2 and our review show that, in this field, modelling activities have been slowing down over the last decade. This is because the extant literature has mainly focussed on simple cases of product scarcity (e.g., limited edition/time/quantity), where the main issues (e.g., pricing, entry timing, and inventory management) in relation to those cases had already been covered by modellers. However, the need for new models of the phenomenon will emerge due to the new factors, relationships, and processes being identified from emerging cases of product scarcity. More importantly, to empirically validate and further examine the developed models, researchers can benefit from the level of product scarcity as input, which requires making use of specific data sets and/or mechanisms to measure product scarcity levels (***Knowledge Gap 6***). In practice, the 'real-time' execution of product scarcity also requires the development of measures suited to monitor and predict it.

6. Conclusion and future research avenues

This paper has systematically reviewed a sample of previous studies on product scarcity, with a particular focus on the use of product scarcity as an effective marketing strategy to improve market as well as firm performance, and has identified a number of avenues for future research. The analysis of the identified literature highlighted the main findings obtained so far, summarised the underlying theories for product scarcity in marketing, developed a framework based on the key factors and causal relationships, and reviewed the modelling of the product scarcity phenomenon through new product diffusion models, game-theoretic models, and dynamic pricing models.

Inevitably, the findings from this review are limited due to the methodological constraints resulting from the research design, such as the selection of a specific database, journal, and topic. In addition, the findings only represent a snapshot of the articles published during the review period, and exclude conference papers and ongoing research. To provide further validation of our findings, we also reviewed the papers published in ABS 2 star journals. Our analysis of the papers shows that most of them—e.g., Shin *et al.* (2017), Gupta *et al.* (2016), Harrison *et al.* (2014), Wu *et al.* (2012), Shu *et al.* (2012), Chaudhuri *et al.* (2011), and Grewal (1995)—sought to reaffirm existing findings with additional evidence or in new contexts, but did not alter our understanding of product scarcity, as summarized in the current paper. Therefore, it is reasonable to assume that the papers analysed represent the main research efforts in this particular field.

Our review shows that, although the benefits provided to firms by product scarcity have been subject to their fair share of academic attention, the literature has covered a wide variety of issues based on various theories, using different research methods, in a diverse range of settings, which makes it difficult to grasp the core themes and findings. The identified knowledge gaps

also hinder the development of product scarcity into a more effective marketing strategy, which makes it difficult to offer practical guidance and provide managers with practical tools for innovative solutions. In response to the knowledge gaps identified in this review, we highlight three directions for future research, showing where further development is needed if the relevance of product scarcity is to be sustained.

6.1. Future research avenue 1: a taxonomy for product scarcity

Our framework (Figure 1) and our review show that the extant literature has covered different forms of product scarcity in different scenarios. However, despite the continuous interest observed in this issue, we failed to see a comprehensive understanding of the various uses of product scarcity available to firms (see ***Knowledge Gaps 3, 4, and 5***). This is exacerbated by the fact that new business practices concerning product scarcity are still emerging. Therefore, the current review calls for a taxonomy for product scarcity.

Given the complex nature of the phenomenon, a simple list or typology may not be sufficient to generate a holistic picture. Janssen *et al.* (2014) listed four product scarcities: natural scarcity due to a shortage of natural resources, techno-scarcity due to advanced innovations, limited edition due to restriction of supply, and information-based scarcity due to consumer selective reception of product information. However, this classification is neither systematic nor comprehensive. For instance, both time-limited scarcity and shelf-based scarcity received fair attention in the literature, but are not explicitly included in the above classification.

One possible solution is to generalize the key characteristics of the different types of product and product scarcity, and then match these to the various identified cases of product scarcity. One recent taxonomic contribution is the framework developed by Li *et al.* (2017) (see Table 5), which can be used to explain and compare the cases of time-limited discounts (I1;F1;D2;T3;P4), limited editions (I1;F2F3;D1;T2;P1P2P3), the long waiting list at famous restaurants (I1;F2;D1;T2;P1P2P3), Boxing Day and Black Friday sales (I1;F1;D2;T3;P4), the

1989 Nintendo cartridge shortage (I1;F2;D2;T1;P3P4), the 1998 supply shortage of Volkswagen Beetles (I2;F2;D2;T1;P3P4), and the iPhone supply shortage (I3;F2;D2;T1;P2P3P4). For instance, time-limited discounts can be explained as an intended and time-limited strategy that is used temporarily before/after a specific time point in order to trigger a buying frenzy; limited editions can be described as an intended and quantity-limited strategy (often with special conditions) that is used constantly throughout a product's lifecycle in order to increase its price, signal high quality, and increase public awareness.

INSERT TABLE 5 HERE

Future research could advance the framework with more characteristics of product scarcity, such as the differences between demand-induced and supply-induced scarcity, and different brand-related concepts (i.e., conspicuous vs. non-conspicuous, hedonic vs. utilitarian, and symbolic vs. functional). In addition, they could introduce new characteristics from emerging business cases to produce a more complete view of the phenomenon. Such taxonomies could also help to examine the related causal relationships in a more systematic manner.

6.2. Future research avenue 2: opening the black box

The simple advising of practitioners on the causal relationships between product scarcity and its impacts offers limited actionable prescriptions. Firms need to understand the process by which product scarcity can be implemented as well as the conditions needed in order to practise a scarcity strategy, which requires a holistic understanding of the phenomenon. Unfortunately, although product scarcity has been prevalent as a framing perspective in marketing communications, it is not well documented as a strategic orientation. Furthermore, prior studies usually chose a few factors (i.e., consumer characteristics, type of scarcity, type of product, and the impacts from Figure 1) and examined the causal relationships between them. Hence, they contain many separate references to the factors and their causal relationships, but are

devoid of a careful synthesis for strategies and systematic guidelines that can be followed by different firms under different scenarios.

One generalization that relates to the implementation of the strategy can be found in the work of Brown (2001). The author called for a return to "retro-marketing", and proposed five principles for its implementation: (1) create *exclusivity* for consumers to crave; (2) maintain *secrecy* before product launch; (3) *amplify* the message of the product and its scarcity; (4) keep the marketing process *entertaining*; and (5) *tricksterism*; that is, "*using tactics akin to those of Loki (of Norse myth), the wily Coyote (of Native American legend), and Hermes (the Greek god of the marketplace)*". Although these principles can work well for some products in some scenarios, they may not apply to other cases of product scarcity. For instance, many successful scarce products are not kept secret before product launch and many firms do not make a dedicated effort to render the process entertaining. Furthermore, as the principles were developed based on evidence from 15 years ago, the literature needs to advance in order to reflect the increasing number of scarcity-induced business practices in recent years.

Therefore, based on the current review, we see a key limitation resulting from the lack of research uncovering the process black box between product scarcity and performance improvement. This is also largely caused by the lack of high-quality case studies of this issue in the existing literature (see ***Knowledge Gap 1***). We propose the following three possible paths to advance the current literature and we call for qualitative and cross-disciplinary research to support any advances. Qualitative research would provide a better understanding of the product scarcity phenomenon, especially of newly emerged practices, so as to contribute to the identified ***Knowledge Gaps 2, 3, 4, and 5***. It would also redefine the contexts and identify new factors and relationships that could be tested by further quantitative studies.

First, more studies are needed to systematically illustrate the implementation of product scarcity—from its creation to its subsequent utilisation—for different products and in different

scenarios. This could be achieved by conducting a series of in-depth case studies, especially based on emerging product scarcity practices. Scholars could connect the intended issue to the business model literature (Wirtz *et al.*, 2016; Zott *et al.*, 2011), placing product scarcity in the context of a firm's overall business model and examining its links to the business model elements. This would help explore the wider impact of product scarcity on business performance; i.e., its direct contribution to sales and any other potential contributions (e.g., brand building and demand management) that indirectly link to market and firm performance. By documenting the case studies in a business model construct that contains information around the WHAT (i.e., the product), the WHO (i.e., the firm and its customers), the WHERE (i.e., the context of the firm, the industry, and the market), and the HOW (i.e., how scarcity is created and subsequently utilised) would also help record and codify successful practices for firms to follow.

Second, the generalisation and validation of this issue are still limited in terms of the studied products. In particular, most prior studies were based on products that had already achieved a degree of awareness and demand. The insights derived from those studies offer little value for new products that are entering the market for the first time, an issue that is particularly important in today's dynamic and innovative markets. Although the literature has provided some examples of scarce new products, the evidence and descriptions are insufficient for robust theory generalisation. In fact, the literature still has some reservations as to the usefulness of product scarcity for new products—while most studies found that scarcity also works for unfamiliar or new products (Ames *et al.*, 2005; Castro *et al.*, 2013; Ma *et al.*, 2014; Robinson *et al.*, 2016), contradictory views (e.g., Stock *et al.* (2005) exist. Therefore, more studies of this intended issue, especially in the context of new products and markets, would be needed to understand how scarcity can be created and consequently linked to market and firm performance. This new research direction would benefit from cross-disciplinary studies,

including some in the new product launch literature. An analytic and simulation modelling of the phenomenon could also help generate new insights and shed more light on it.

Third, while product scarcity can in many cases be perceived as a blessing, its potential negativity requires careful consideration before and during its implementation. The literature has noted that, depending on its severity, product scarcity can repel consumers (Lessne *et al.*, 1988), or result in consumers deferring purchases, especially when the choice involves high conflict (Dhar *et al.*, 1999), a phenomenon that can be explained by the sour grapes effect (Clee *et al.*, 1980; Hammock *et al.*, 1966). In addition, product scarcity as a deliberate business strategy may lead to frustrated consumers, public criticisms, and returned purchases if consumers become suspicious about the reasons behind the scarcity. However, few studies have hitherto discussed the relationship between firm product scarcity and ethical and credible practices, or provided mechanisms to migrate the relevant risks. Therefore, more cases would be needed to demonstrate promising and credible ways of imposing product scarcity on the market; and more studies would be needed to examine consumer reactions upon realisation that the supply shortage is deliberately caused by firms, and to explore the countermeasures.

6.3. Future research avenue 3: the measures of product scarcity

The measures of product scarcity and the related market dynamics can be vital for market planning. Product scarcity is essentially the mismatch between actual demand and actual supply. Firms know the level of their supply; however, to accurately understand how much the dynamic market demand exceeds (and should exceed) supply can be challenging (see ***Knowledge Gap 6***). Such measures of product scarcity also can benefit researchers in relation to identifying the factors of product scarcity, so as to contribute to ***Knowledge Gaps 2, 3, 4, 5***. Unfortunately, the identified literature provides insufficient references in this manner, as they are based on either experiments or mathematical analyses to study scarcity and its impact in a pre-set scenario or assumed context.

Therefore, it is vital for firms to identify appropriate methods that can measure, monitor, and, ideally, predict product scarcity and its impact on consumers and the market. Assuming that firms are constantly aware of their supply levels, the measurement of product scarcity is down to the measures of consumer dynamic demand. One possible solution is to utilise the rich literature on new product growth models (Mahajan *et al.*, 2000; Meade *et al.*, 2006; Peres *et al.*, 2010). By incorporating the variables of interest such as supply shortage, new product growth models are expected to estimate the corresponding influences on the product growth process. As an example, the model proposed by Balakrishnan *et al.* (2014) and its estimation prove that a mismatch between demand and supply does exist in a series of historical products, and that product scarcity has a positive influence on product growth rate. Therefore, future research could expand this stream of studies to model various product scarcities in different scenarios. In addition, after validation, the models could be used to monitor and predict product growth over time, which would be particularly valuable to firm market planning and operations management.

Another possible solution would involve the introduction of big data. For instance, recent research shows that the online consumer behavioural data gathered through search engines, social networking tools, and other channels can be a good indicator of consumer interests, attitudes, and even actions towards a particular topic or product (Chumnumpan *et al.*, 2019; Lamba *et al.*, 2017); thus, future research could further explore the potential of big data in predicting customer demand in the context of product scarcity. Together with their supply-side data, the predicted customer demand can help firms better understand, monitor and predict the level of product scarcity in order to aid managerial decision making. However, the introduction of big data could also pose various challenges, including the cost and difficulty of collecting and processing the data, data security, privacy issues, and ethical considerations, which need to be carefully managed in the process (Sheng *et al.*, 2017; Sivarajah *et al.*, 2017).

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Figure 1: Research of Product Scarcity in marketing: predominant constructs and key factors

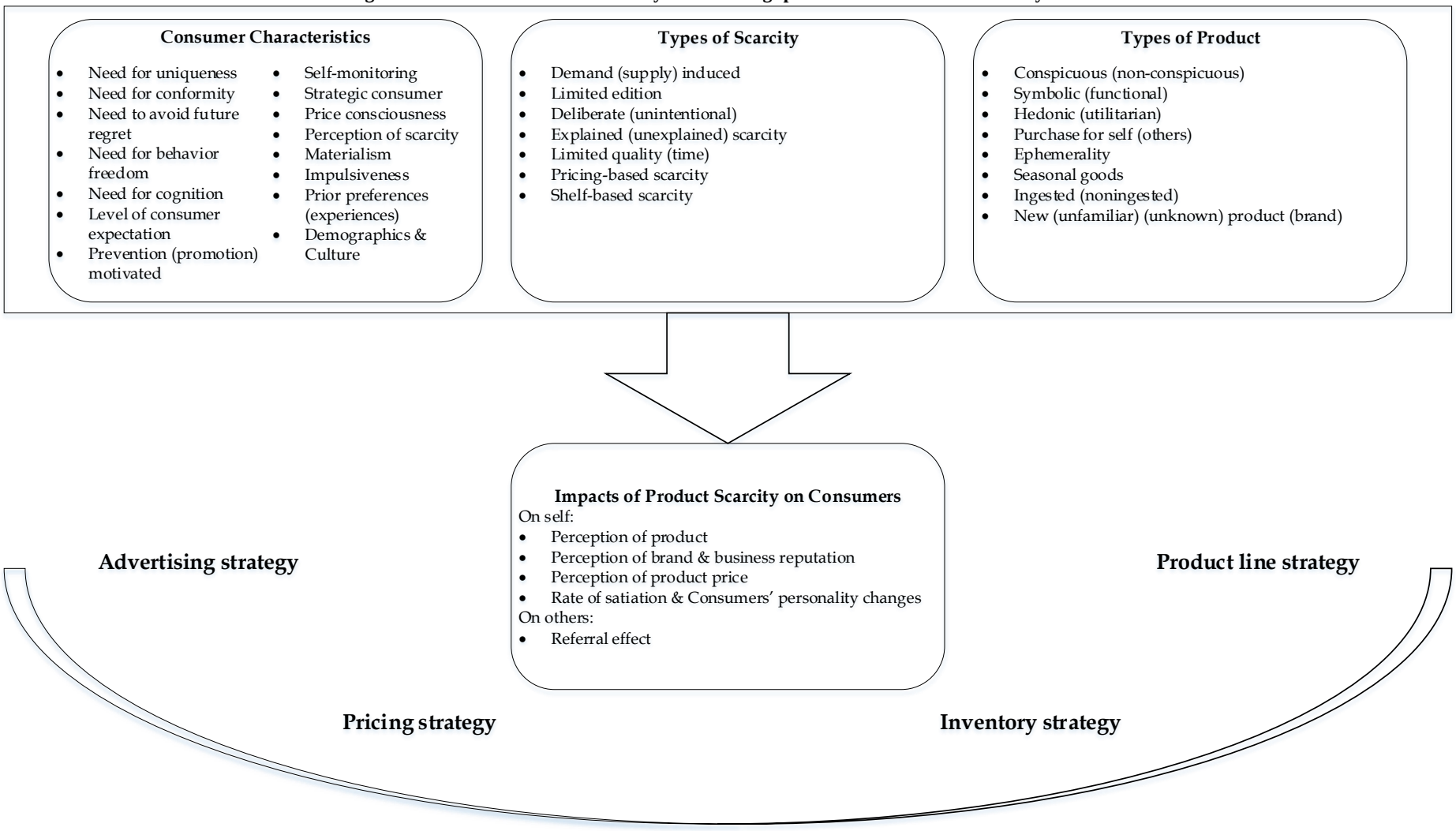
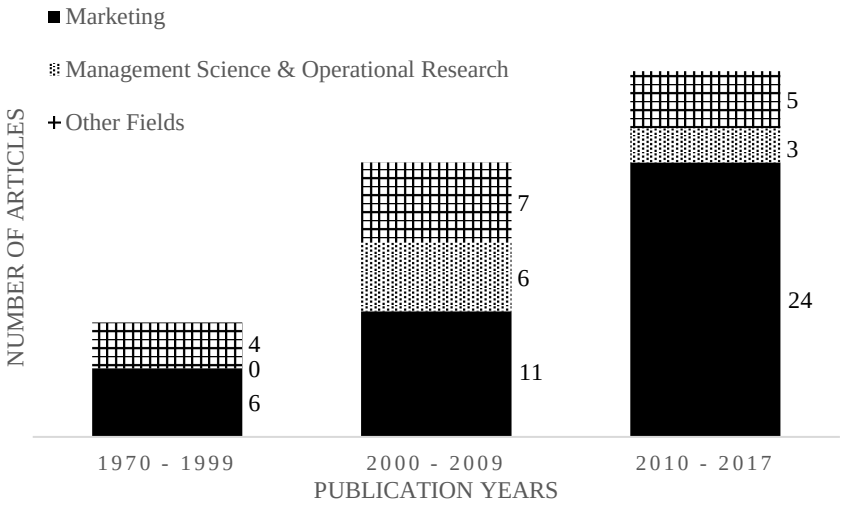


Figure 2: Publication Years, Research Fields and Research Methods



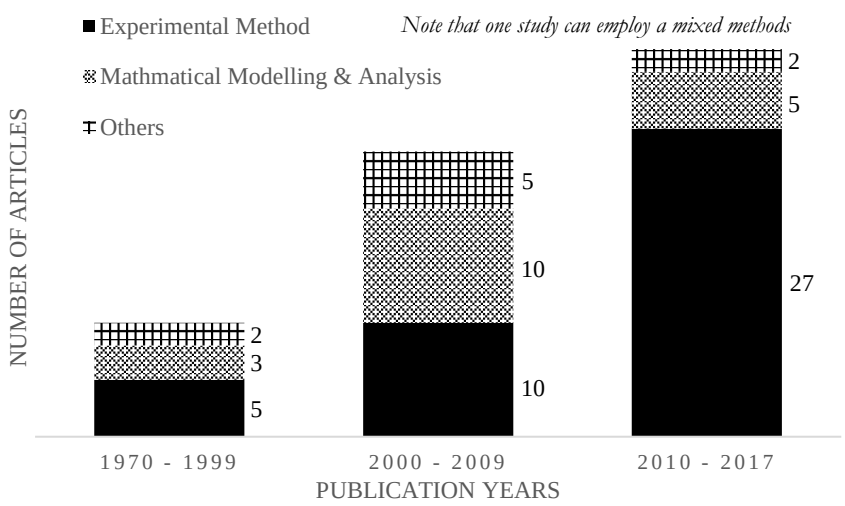


Table 1: Inclusion and Exclusion Criteria for Topic Search

Criterion	Inclusion	Exclusion	Number of Publications
Date	1970 – 2017	Any study published before 1970	23636
Web of Science Category	Business and Management	Any other categories	698
Document Type	Article	Any other document types	435
Language	English	Any other languages	422
Quality	Studies published in 3- or 4-star journals on the Academic Journal Guide 2015	Any other studies not published in journals of the required quality measure;	282
Relevance	Studies that research the use of product scarcity as a marketing strategy to increase consumer purchasing intentions, so as to improve market and firm performance;	Any other studies including: • Environmental studies of resource scarcity; • HRM studies of scarce human capitals; • Strategy and entrepreneurial studies of firm development under scarce resources; • psychological studies of scarcity in a non-business/management context;	46

Table 2: Summary of Considered Publications

Research Fields	Number of Articles
Marketing	43
Management Science & Operational Research	9
General Management	6
Psychology	3
Operations & Technology Management	3
Economics & Sector Studies	2
SUM	66

List of journals of the considered publications: *Annals of Operations Research, European Journal of Marketing, Harvard Business Review, International Journal of Contemporary Hospitality Management, International Journal of Research in Marketing, Journal of Advertising, Journal of Applied Social Psychology, Journal of Business Ethics, Journal of Business Research, Journal of Consumer Psychology, Journal of Consumer Research, Journal of Experimental Social Psychology, Journal of Interactive Marketing, Journal of Marketing, Journal of Marketing Research, Journal of Operations Management, Journal of Personality and Social Psychology, Journal of Public Policy & Marketing, Journal of Retailing, Journal of the Academy of Marketing Science, Management Science, Manufacturing & Service Operations Management, Marketing Letters, Marketing Science, Operations Research, Psychology & Marketing, The RAND Journal of Economics.*

Table 3: Underlying Theories for Product Scarcity

Theoretical Framework	Related Consumer Characteristics	Description	Source/Exemplary Studies
Commodity theory	Need for uniqueness	• Commodity theory indicates that any commodity will be valued to the extent that it is unavailable. Scarcity enhances the value of anything that can be possessed. • Those consumers with a greater need for uniqueness value a product more if the product's availability is limited.	(Brock, 1968; Lynn, 1991; Roy *et al.*, 2015; Wu *et al.*, 2012)
Conformity theory	Need for conformity	• Conformity theory explains how people align their attitudes, beliefs, and behaviours to group norms. • Those consumers with a greater need for conformity value a product more when more people are buying it, which can be evidenced by the product's unavailability.	(Bernheim, 1994; Eisend, 2008; Jones, 1984; van Herpen *et al.*, 2009)
Regret theory	Need to avoid future regret	• People anticipate the regret they will feel if they make a wrong choice, and take this anticipation into consideration when making decisions. • Those consumers with a greater need to avoid future regret value a product more if the product's future availability is in doubt.	(Gabler *et al.*, 2017; Loomes *et al.*, 1982; Simonson, 1992)
Reactant theory	Need for behavioural freedom	• Psychological reactance occurs when people feel that their behavioural freedoms are threatened. • Those consumers with a greater need for behavioural freedom value a product more if the product's availability is restricted.	(Anthony *et al.*, 2009; Lessne *et al.*, 1988; Mazis *et al.*, 1973)

Table 4: Types of Scarcity: deliberate vs. unintentional and supply-induced vs. demand-induced

	Deliberate	**Unintentional**
Supply-induced	Businesses deliberately lowering/limiting product supply	Businesses failing to match market demand due to unexpected supply issues
Demand-induced	Businesses deliberately ignoring increased market demand	Businesses failing to supply enough due to unexpected demand increase

Table 5: An Exemplar Taxonomy for Product Scarcity – adopted from Li et al. (2017)

Intentional Scarcity?	**Form of Scarcity**	**Duration of Scarcity**	**Timing of Scarcity**	**Purpose of Scarcity**
I1: Yes **I2**: No **I3**: Unknown	**F1**: limited time **F2**: limited quantity **F3**: special conditions	**D1**: constant **D2**: temporary	**T1**: during product launch **T2**: throughout product lifecycle **T3**: before/after a specific time point	**P1**: increase product price **P2**; signal high quality **P3**: increase public awareness of products **P4**: create buying frenzy

Appendix: Key Factors and Causal Relationships of Product Scarcity

Author (Year)	Key Factor	Studied Product	Research Method	Key Messages collected from the article
Gabler *et al.* (2017)	Action (inaction) regret, steadily increasing discount pricing, materialism, price consciousness	CDs, jeans	Experimental method	Product scarcity increases both action regret and inaction regret while the level of discount only influences inaction regret. The individual characteristics of materialism and price consciousness both impact the decision to buy; only materialism influences purchase decision regret.
Chung *et al.* (2017)	Impulsiveness, hedonic (utilitarian)	Restaurant products in social commerce	Survey	Impulsiveness is a strong predictor for two types of shopping values (hedonic and utilitarian). Scarcity acts as moderator in the relationships between impulsiveness and both shopping values.
Robinson *et al.* (2016)	Shelf-based scarcity, unfamiliar brand	Sunscreen, laptop processing chips, soap	Experimental method	Shelf-based scarcity cues impact consumer willingness-to-pay, increase the likelihood of selecting unfamiliar brands, and influence actual product choices.
Wu *et al.* (2016)	Limited edition, purchase for self (others)	Coffee mugs, bobble heads, wines	Experimental method	When purchasing for oneself, scarcity cues outperform popularity ones in eliciting purchase intentions, whereas when purchasing for someone else, popularity cues are more effective.
Mukherjee *et al.* (2016)	Expectation of scarcity	Consumer electronics	Experimental method	Scarcity appeals have a positive effect when expectation of scarcity (due to both demand and supply) is high but not when it is low
Sharma *et al.* (2016)	Perceived influence, value perception	BlackBerry mobile phones	Experimental method	It is the perceived influence on self and others, rather than the difference between them, as hypothesized by Eisend (2008), that mediates the impact of scarcity-induced value perception on purchase intentions.
Roux *et al.* (2015)	Selfish (generous) behaviours	Not specified	Experimental method	Reminders of resource scarcity guide consumer decision making towards advancing their own welfare. This tendency can manifest itself in behaviours that appear selfish, but also in behaviours that appear generous, under conditions where generosity allows for personal gains.
Koch *et al.* (2015)	Referral propensity, perception of offer value	Online fashion service	Experimental method	While scarcity cues affect referral propensity regardless of whether a campaign is personalized or not, personalization cues are particularly effective when scarcity is absent, they are cancelled out when scarcity is prevalent. Consumers' perceptions of offered value drive the impact of scarcity on referral likelihood.

Jang *et al.* (2015)	Limited time (quantity) (edition), conspicuous (non-conspicuous), need for uniqueness, unknown brands	Watches, automobiles, beers, yogurts, and shampoos among other product categories	Experimental method	A limited quality scarcity message is generally more effective in enhancing consumer responses than a limited time scarcity message. A limited time scarcity message is still effective in enhancing the intention of consumers to purchase non-conspicuous limited edition products, while limited quality scarcity message have a positive effect for conspicuous limited edition products.
Whittler *et al.* (2015)	Need for cognition, product evaluation	Cordless telephones, cellular telephones, garment bags	Experimental method	In response to sales representatives' closing expressions, the effect of scarcity heightened subsequent product evaluation as the need for cognition decreased.
Zhu *et al.* (2015)	Product class, perception of scarcity	Yogurts, vegetables, gift cards, candy	Experimental method	Overall perception of scarcity versus overall perception of abundance increases choice share of the most-preferred item from a product class.
Roy *et al.* (2015)	Need for uniqueness, demand (supply) scarcity appeal	Fashion clothing; smartphones	Experimental method	Whereas participants with lower levels of need for uniqueness show a greater impact of demand (versus supply) scarcity appeal on their attitudes and purchase intentions; participants with higher levels of need for uniqueness show a greater impact of supply (versus demand) appeal.
Sterman *et al.* (2015)	Limited supply, hoarding	Not specified	Model analysis & Experimental method & Post-play survey	Hoarding and phantom ordering can be rational when customers compete for limited supply in the presence of uncertainty or capacity constraints. But they may also be behavioural and emotional responses to scarcity.
Thompson *et al.* (2015)	Quantity (time) limits, targeted (untargeted) consumers	Various products - promotions on Slickdeals.net	Content analysis (comments and views posted on Hot Deals forum)	Promotions containing a time limit and promotions featuring a quantity limit are evaluated more favourably by the untargeted consumers.
Hwang *et al.* (2014)	(Chronic) desire for conspicuousness (rarity), price' impact, luxury brand	Dresses, handbags, shoes, jewellery, scarves; and necklaces (products for best friend's wedding)	Experimental method	High vs. low manipulated desire for conspicuousness and manipulated desire for rarity conjoined with high vs. low chronic desire for conspicuousness and chronic desire for rarity moderates the typically hypothesized negative main effect of price on demand and may cause a positive main effect of price on luxury brand choice across a relevant range of price-points.
Sevilla *et al.* (2014)	Limited availability, rate of satiation	Grapes, chocolate	Experimental method	Consumers are satisfied more slowly by a product when it is available for consumption only at limited times. Specifically, they found that perceived limited availability makes a product more enjoyable, and yet this effect largely emerges only after repeated consumption.

Ma *et al.* (2014)	Independent (interdependent) mind-set, new product	Consumer electronics	Experimental method	The presence of popularity cues and scarcity cues can reverse the effect of self-perspective, such that the independent self becomes less willing to adopt really new products and more willing to adopt incrementally new products than does the interdependent self.
Janssen *et al.* (2014)	Perception of fit with CSR, ephemerality, luxury product	Clothing, jewellery	Experimental method	Ephemerality moderates the positive impact of scarcity on consumer perceptions of fit between luxury and CSR. When luxury products are enduring (e.g., jewellery), their scarcity is perceived as more socially responsible than wider availability one and provokes positive attitudes.
Nan *et al.* (2014)	Dynamic pricing	Not specified	Model analysis	When the scarcity effect of inventory is sufficiently strong, the firm should display no positive inventory and deliberately make every customer wait. Both the profit loss due to ignoring the scarcity effect and the value of dynamic pricing under the scarcity effect are significant.
Steinhart *et al.* (2013)	Explained (unexplained) product scarcity	T-shirts	Experimental method	When lack of product availability is perceived positively, it influences purchase intentions via consumer involvement. However, when lack of product availability is perceived negatively, it influences purchase intentions via perceived feasibility, irrespective of consumer involvement.
Castro *et al.* (2013)	Shelf display, ingested product, familiar (unfamiliar) brands	Shelf-based products, ingested (non-ingested)	Experimental method	For products that are ingested (e.g., juices), purchasing likelihood is reduced when the product appears to be disorganized and product quantity is limited. However, for products that are not ingested (e.g., fabric softeners), purchasing likelihood increases when the product appears to be disorganized and product quantity is limited. brand familiarity moderates these effects
Wright *et al.* (2013)	consumers' expectation	American energy drinks	Experimental method	Scarcity can replicate the marketing placebo effect; i.e., scarcity increases consumer expectation and enhances behavioural performance.
Deval *et al.* (2013)	Consumer expertise	Wines	Experimental method	When popularity was activated, participants formed more favourable product judgments with a social validation appeal compared with a scarcity appeal. This pattern reversed when scarcity was activated. Consumers who have expertise in a given product category are less susceptible to the priming of a naive theory.
Aguirre-Rodriguez (2013)	Demand (supply) related scarcity, message specification	Fast food coupons	Experimental method	Supply related scarcity appeals are less likely to activate persuasion knowledge than demand related scarcity appeals. Stating the appeal in

				specific (versus vague) terms decreases the persuasiveness of supply-related scarcity appeal ad messages.
Ku *et al.* (2013)	Demand (supply) regenerated scarcity, utilitarian (hedonic), high (low) self-monitors	Sunscreen, chocolate, perfumes, drinking tumblers and alcoholic beverages	Experimental method	Demand generated scarcity works better for utilitarian products. Whereas the opposite holds true for hedonic products. High and low self-monitors react differently to demand and supply generated scarcities.
Ku *et al.* (2012)	Prevention (promotion) motivated, demand (supply) based scarcity	Digital cameras, cruiser bikes	Experimental method	Prevention-focussed participants were more inclined to accept demand based scarcity, while promotion-focussed participants responded positively to supply based scarcity. Products that could be associated with a prevention (promotion) motive enhanced purchase intentions when presented as demand (supply) scarce but not if perceived to be supply (demand) scarce.
Tereyağoğlu *et al.* (2012)	Conspicuous, optimal pricing (production) (sourcing)	Not specified	Model analysis	In equilibrium, firms may offer a high availability of goods despite the presence of conspicuous consumption; the scarcity strategy is applied when the fraction of snobs in the market is neither too high nor too low.
(Soysal *et al.*, 2012)	Seasonal goods, strategic consumers	Clothing and clothing accessories	Model analysis & Estimation	While strategic consumers delay their purchases to take advantage of markdowns, limited availability reduces the extent of strategic delays by motivating consumers to purchase earlier.
Aggarwal *et al.* (2011)	Limited quantity (time), functional (symbolic)	Watches, laptop computers	Experimental method	Limited quantity messages are more effective than limited time messages in influencing consumer purchasing intentions. This differential impact is further enhanced for symbolic brands. Consumer competition is found to mediate the effect of scarcity messages on purchase intentions.
Parker *et al.* (2011)	Shelf-based scarcity, consumers prior preferences, price promotions	Wines	Experimental method	Shelf-based scarcity is likely to affect choices when consumers lack strong prior preferences and under conditions in which price promotions are either not present or are similar across alternatives
Amaldoss *et al.* (2010)	Limited edition, reference group effects	Not specified	Model analysis & Experimental method	In the presence of strong reference group effects, limited editions and multiple products can help improve firm profits.
Gierl *et al.* (2010)	Demand (supply) related, conspicuous (non-conspicuous)	Consumer electronics, wrist watches, various non-conspicuous goods	Experimental method	If a product is used for conspicuous consumption, signals of scarcity due to limited supply are advantageous compared to signals of scarcity due to high demand. On the contrary, if a product is not used for conspicuous

				consumption, signals of scarcity due to high demand result in more favourable product evaluations.
van Herpen *et al.* (2009)	Shelf-based scarcity; uniqueness	Wines, personal computers, shirts	Experimental method	Consumers prefer products that are scarce because many others have previously bought them. Scarcity effects even occur when consumers only see traces of others' behaviours through emptied shelf spaces. This effect disappears when uniqueness is threatened due to others in close spatial distance.
Anthony *et al.* (2009)	Psychological reactance	Pirated media products	Experimental method	Factors that may be perceived as limiting consumption can lead to higher piracy-related activity, and such factors are moderated by ethical beliefs, interpersonal social influence, and trait psychological reactance.
Balachander *et al.* (2009b)	Limited editions, competing brands	Not specified	Model analysis	Limited edition products have a positive effect on brand profits, but also have a negative effect in terms of increased price competition between brands.
Balachander *et al.* (2009a)	consumer preference, supplier (demand) induced scarcity, buying frenzies, signalling theory, demand uncertainty	Automobiles	Model analysis & Historical data	The analysis of the automobile market provides more support for the signalling theory than the buying frenzy theory or the demand uncertainty theory.
Dong *et al.* (2009)	Dynamic pricing	Not specified	Model analysis & Numerical study	Full-scale dynamic pricing is of great value in the presence of inventory scarcity
Eisend (2008)	Value perception, perception of susceptibility	Clothes	Experimental method	The impact of perceived value on purchase intention is mediated by consumer perceptions of personal susceptibility and the susceptibility of others.
Franke *et al.* (2008)	Commodity theory, need for uniqueness, mass customization, willingness to pay	Cell phone covers	Experimental method	The perceived uniqueness of a self-designed product contributes independently to the utility a customer experiences; this effect is moderated by consumer need for uniqueness.
Elmaghraby *et al.* (2008)	Markdown pricing with limited supply,	Not specified	Model analysis & Numerical study	Optimal markdown pricing mechanisms are discussed when (1) buyers know the clearing price, (2) buyers do not know the clearing price.

Suri *et al.* (2007)	Perception of quality, perceived scarcity, price information	Televisions, computer bundles, and DVD players; concert performances, travel packages, museum exhibits	Experimental method	Consumer perceptions of quality and monetary sacrifice exhibit different response patterns, depending on the relative price level and consumer motivation to process information.
Abendroth *et al.* (2006)	Limited purchase opportunities, actions (inaction) regret	Shirts; products purchased on a cruise (not specified)	Experimental method	In limited purchase opportunities, not purchasing (inaction) is seen as a loss and is associated with greater short-term regret than purchasing, reversing the omission bias. With respect to long-term regret, inaction (non-purchase) regrets decrease over time.
Swami *et al.* (2006)	Pricing policy, advertising policy, limited availability	Not specified	Model analysis & Numerical study	The pricing policy suggests that firms gradually increase the price as the sales approach the product availability, and the advertising policy suggests that firms gradually decrease expenditure on awareness advertising and increase expenditure on availability advertising.
Ames *et al.* (2005)	Unusual objects, need for uniqueness, appraisal	Neckties, women's shoes, sunglasses, or men's and women's first names	Experimental method	Uniqueness motives do not govern projection of appraisals; rather, individual differences in perceived similarity to a target group do.
Stock *et al.* (2005)	Product quality, signalling theory,	Not specified	Module analysis	High-quality sellers may optimally choose to make a product scarce to credibly signal its quality to uninformed customers. Scarcity strategies are usually observed for discretionary or specialty products, but not for commodity, staple, or new-to-the-world products.
Amaldoss *et al.* (2005b)	Desire for uniqueness and conformism, conspicuous	Not specified	Model analysis & Experimental studies	Although a desire for uniqueness leads to higher prices and firm profits, a desire for conformity leads to lower prices and profits. Consumers purchase high-quality products not because of their desire for uniqueness, but despite it.
Geman *et al.* (2005)	Price	Soybeans	Model analysis & Historical data	Price volatility is an increasing linear function of inverse inventory, which we term "scarcity."
Amaldoss *et al.* (2005a)	Conspicuous, desire for exclusivity, desire for conformity	Not specified	Model analysis & Numerical study	Subjects used some degree of sophisticated thinking to arrive at their first-period decisions. Their behaviours in the subsequent trials, however, can be adequately captured by a purely adaptive learning mechanism.

Jung *et al.* (2004)	Purchase intent, cross-national differences	Wines	Experimental method	A positive effect of scarcity on purchasing intent and a greater proneness to such among participants from a lower- (U.S.) versus higher- (France) context culture; the scarcity effect is moderated by product familiarity, uncertainty avoidance, and need for cognitive closure
Campo *et al.* (2004)	Permanent assortment reductions, out-of-stocks	Breakfast cereals and margarine	Structured interview	Retailer losses incurred in case of a PAR may be substantially larger than those in case of a stock-out for the same item; stock-out losses may disproportionately grow with OOS frequency and duration, emphasizing the need to keep their occurrence and length within limits
Suri *et al.* (2003)	Time constraints, product evaluation, price levels, motivations to process information	Televisions and cordless telephones	Experimental method	Perceptions of quality and monetary sacrifice exhibit different response patterns depending on the time constraints, price levels, and subjects' motivations to process information
Elmaghraby *et al.* (2003)	Dynamic pricing, inventory considerations	Not specified	Literature review	Three main areas of research in terms of dynamic pricing policies with inventory considerations: (1) increased availability of demand data, (2) the ease of changing prices due to new technologies; (3) the availability of decision-support tools.
Swami *et al.* (2003)	Limited supply, known expiration date, diffusion of product	Tickets for performing arts events	Model analysis & Historical data	The paper develops a Bass type model for diffusion of products, which are available in limited quantity until a known expiration data.
Brown (2001)	Need for uniqueness	Not specified	Observation	The paper proposes five principles for implementing "retro-marketing": (1) create exclusivity for consumers to crave; (2) maintain secrecy before product launch; (3) amplify the message of the product and its scarcity; (4) keep the marketing process entertaining; and (5) tricksterism.
Tian *et al.* (2001)	Need for uniqueness measure, possession benefit, shopping behaviours	Not specified	Survey	The research supports the relation of consumer need for uniqueness to salient possession benefits, consumer valued possessions and shopping behaviours. It also supports the stability and predictive validity of the measure over the period.
Dye (2000)	Controlled distribution, word-of-mouth	Not specified	Observation	Buzz is increasingly the result of carefully managed marketing programmes; e.g., people often crave what they or others cannot have. The objective is to somehow encourage customers to talk about a product or to use that product so that it is noticed by other people.

Swami *et al.* (1999)	Dynamic demand, shelf based scarcity, profit	Movie screens	Model analysis	The paper develops a decision support model to help exhibitors make effective and timely decisions regarding theatre screens management.
Inman *et al.* (1997)	Purchase limit (precondition), time limit, signalling value	Various household products, Kodak alkaline batteries, Sony UX 90-minute audiocassettes	Experimental method & Historical data	Restrictions serve to accentuate deal value and act as "promoters" of promotions;
Lynn *et al.* (1996)	Consumers' perceptions, price appreciation,	Collectible goods: stamps and coins	Experimental method	Although scarcity does not affect a product's actual potential for price appreciation, news reports of scarce collectibles that have appreciated in value may lead people to develop naive economic theories associating scarcity with price appreciation.
DeGraba (1995)	Seller-induced demand, buying frenzies	Not specified	Model analysis	A monopolist prefers selling to customers while uninformed because uninformed customers have a more homogeneous (expected) valuation for a good than informed customers.
Inman *et al.* (1994)	Coupon expiration date, regret	Coupons for spaghetti sauce	Experimental method	Expiration dates induce a second mode in the redemption pattern just prior to them.
Lynn (1991)	Commodity theory	Not specified	Literature review	The paper reviews existing research that tested the commodity theory in explaining scarcity effects.
Jain *et al.* (1991)	Diffusion, supply restrictions	Telephones	Model analysis & Historical data	Based on the Bass model, the paper develops a parsimonious model that integrates demand side dynamics with supply side restrictions.
Lessne *et al.* (1988)	Limits, reactance theory	Coca-Cola sodas	Experimental method	Limits are capable of increasing attraction. Increasing limits tend to have a higher impact on attraction. In the forward selection discriminant analysis, age and income are the only significant discriminators.
King (1986)	Price, free-marketing pricing	Automobiles	Observation & Historical data	Shortages of consumer goods are pervasive in the Polish economy, and the paper is focussed on the market supply of the automobile on related price behaviours in the new and used car markets.
Worchel *et al.* (1975)	Demand (supply) induced scarcity	Cookies	Experimental method	The experiments show that cookies in scarce supply were rated as more desirable; cookies were rated as more valuable when their supply changed from abundant to scarce than when they were constantly scarce, and cookies with demand induced scarcity were rated higher than cookies with supply induced scarcity