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Scarcity tactics in marketing: A meta-analysis of product scarcity effects on consumer purchase intentions

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Abstract

Scarcity tactics are an essential tool for marketers. Cues that signal the current or potential unavailability of a product generally enhance its value and desirability and in turn increase purchase intentions. While there have been earlier reviews, the fragmented nature of the research to date means there is no cohesion across findings. Given that retailers employ a variety of scarcity cues in a diversity of settings, it is important to identify the magnitude of the effect of scarcity cues and how the effect on consumers' purchase intentions changes across conditions. This research presents a meta-analysis of 416 effect sizes from 131 studies. Results show that demand-based scarcity is most effective for utilitarian products, supply-based scarcity for experiences, and time-based scarcity for high involvement products. The results show that managers need to consider the above factors to maximize the success of scarcity tactics in their marketing campaigns.
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Keywords: Scarcity; Unavailability; Quantity restrictions; Time limits; Meta-analysis.

Scarcity cues and tactics play a prominent role in marketing. Examples include promotional campaigns featuring limited edition products and depleted shelf space. As evidenced during the COVID-19 pandemic, sudden increases in consumer demand can lead to unprecedented global stock runs on common household staples like pasta, flour, and, surprisingly, toilet paper. Online examples of scarcity cues and tactics are also abound and include restricted time frames for acquiring products, such as the Cyber Monday and Click Frenzy sales events (Hancock, Stevens, and Waites 2018) and the use of real-time sales and stock levels as signals of impending product scarcity (He and Oppewal 2018). Clearly, creating the perception that there is, or may be, potential unavailability of a product increases the perceived value and desirability (Cialdini, 2009) and consumers' purchase intentions for the product (Zeithaml, 1988). Scarcity tactics thus appear powerful and pervasive in their effects on behavior. It is precisely these strong, motivational effects of scarcity that have resulted in their longstanding use by marketing practitioners over the years.

Given the prominence and importance of scarcity, it is not surprising that a great deal of effort has been devoted to researching the impact of product scarcity on consumer behavior. Prior research has explored how scarcity cues change the perceived value of a product (Lynn, 1991) and how they affect consumer attitudes (e.g. Gierl and Huettl 2010; Howard and Kerin 2006; Inman, Peter, and Raghubir 1997), as well as enjoyment (Sevilla and Redden 2014), perceived popularity (Castro, Morales, and Nowlis, 2013; Parker and Lehmann 2011; Van Herpen, Pieters and Zeelenberg 2009), purchase intentions (Aggarwal, Jun, and Huh 2011; Ramanathan and Dhar 2010; Zhu and Ratner 2015), and perceived quality (Jeong and Kwon 2012; Suri, Kohli, and Monroe 2007; Van Herpen, Pieters, and Zeelenberg 2014).

Research has also disentangled the effects of scarcity on consumer behavior according to its three sources of demand,

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supply, and time-based scarcity (Gierl, Plantsch and Schweidler 2008).[1] However, whether these sources have a uniform effect on behavior, or if one source of scarcity has a greater effect than another remains less understood. For example, do the purchase intentions of consumers increase, decrease, or remain similar if a retailer employs demand, supply, or time-based scarcity cues when marketing a chocolate bar? Is one source of scarcity more effective and, if so, is that pattern of effects replicated when considering the purchase intentions for a handbag, jeans, or concert tickets?

Notwithstanding differences in the sources of scarcity, there exists other factors that may impact their effectiveness, including characteristics of the product being marketed, the consumption situation, and differences between consumers. Products differ in the benefits and experiences they provide, in their level of consumer involvement, and the consumption and use of products may also be more or less visible to others. Consumers differ on basic demographics such as age and sex, and they also vary in their level of brand familiarity, to name just a few potentially relevant characteristics. A recent conceptual review by Shi, Li, and Chumnumpan (2020) suggests several more potentially moderating factors such as need for cognition and the consumer's need for uniqueness.

In an early meta-analysis, Lynn (Lynn, 1991) indeed found significant heterogeneity in scarcity's effect on consumer perceptions of value, highlighting the potential for between-study moderators. However, due to the small number of effect sizes across sub-groups, the interpretation of moderating variables in his meta-analysis was difficult. Lynn conceptualized scarcity as unavailability resulting from market forces from an imbalance between supply and demand, and from more generalized restrictions.[2] The study meta-analyzed the aggregate effect of scarcity and reported an effect size for scarcity on perceived value of $r = 0.12$. Although Lynn's (Lynn, 1991) analysis provided valuable insight into the overall effect of scarcity on perceived value, the broader question of scarcity's differential impact based on its source and other product and consumer variables has been left unanswered, as has the question of whether the reported heterogeneity (x^2 (48) = 190.22, $p < .005$) in scarcity's effect in his meta-analysis can be explained by between-study moderating variables.

Providing insight into the conditions where scarcity has greater or smaller effects will help marketing practitioners decide which scarcity cues are most appropriate for stimulating consumer purchase intentions according to their product portfolios. Indeed, given the wide-ranging investment by retailers into the use of such scarcity tactics in practice, the implications of these efforts need to be better understood. The aim of our paper is therefore to build on and update the current literature's understanding of scarcity tactics and to articulate the magnitude of their effects on consumer behavior. Specifically, we examine how the sources of scarcity – demand, supply, and time – differ in their effects. We also explore how product level characteristics may further moderate the effect of scarcity on consumer purchase intentions. We do this by quantifying the effects of scarcity and identifying a number of moderating factors which may explain variation in the strength of scarcity cues.

Thus, the present paper, through the use of a meta-analytic framework, contributes to the literature by (1) synthesizing existing research, and building on and extending Lynn's (Lynn, 1991) meta-analysis, providing an updated analysis into the effects of scarcity cues on consumer behavior; (2) exploring the effects of different sources of scarcity; and (3) uncovering new moderators of the effects of scarcity on consumer purchase intentions to identify variation in the effect depending on differences in product and consumption level characteristics. The remainder of this paper is structured as follows. We review the role of scarcity in marketing, based in particular on the framework of commodity theory (Brock, 1968). We then discuss different sources of scarcity and identify potential product and consumption level moderators of the scarcity effect. We next present a meta-analysis of 416 effect sizes from 131 studies examining the effect of scarcity on consumer behavior. Specifically, we explore how various factors moderate the effects of the different types of scarcity on purchase intentions. We end with a discussion of the results and their implications for retail marketing practice and put forth an agenda for future research.

The role of scarcity cues in marketing

In his early review, Lynn (Lynn, 1991) adopts commodity theory (Brock, 1968) as the overarching framework for understanding the psychological effects of scarcity. The theory's main principle is that "any commodity will be valued to the extent that it is unavailable" (Brock, 1968), 246), where a commodity is defined as "anything which has usefulness to its possessor and which can be conveyed from person to person." Lynn (Lynn, 1991) highlights that first, a commodity must be useful and provide some utility to the person interested in possessing the product; second, a commodity must be able to be transferred from one person to another; and third, a commodity must be a possible possession. In a marketing context, this relatively broad definition signifies that any marketable product capable of providing utility to a consumer can be considered a commodity. Material and shelf-based goods such as clothing have been well examined in the scarcity literature; however, other types of products, including experiences, also meet the definition of a commodity. Tickets to a concert, seats on an airplane, and ski passes are all marketable products that provide utility to consumers and may be prone to the psychological effects of scarcity.

A second core concept to commodity theory as used by Lynn (Lynn, 1991) is value. A commodity's value refers to its ability to potently affect attitudes and behavior (Brock, 1968).

[1] Scarcity has also been considered to encompass not only scarcity of marketable consumer products but also scarcity of resources such as time and money (Hamilton et al. 2019). The latter, however, presents its own domain of theories, findings, and applications. The present paper therefore exclusively focuses on the effects of product scarcity.

[2] Generalized restrictions in Lynn (1991) include the legislation of restricted access to products such as pornographic materials, alcohol, and illicit substances.

Since a commodity must be useful and provide some positive utility to the person interested in possessing the product, any enhancement of its potency should increase the perceived utility of the commodity, and therefore its desirability. Perceived value is critical to marketers, as it is regarded as the primary driver of purchase intentions, as suggested by Zeithaml (Zeithaml, 1988) and thus an important factor for retailers to consider.

Third, unavailability of a commodity refers to restrictions placed on the availability of, or ability to obtain, a product (Lynn, 1991). The source of unavailability may vary across contexts, however in marketing the three main sources of unavailability include supplier restrictions on production and manufacture, for example limited edition product lines or restricted distribution channels, excess consumer demand, and time limits or windows to obtain products. While unintentional or accidental stock-outs due to non-market forces, such as natural disasters or technological faults disrupting supply, are also prone to the effects of scarcity, the present study focuses on sources of unavailability arising from market forces.

Although it is considered the dominant framework, commodity theory is not the only framework that can be used to explain scarcity effects. Shi et al. (Shi et al., 2020) summarize three alternative frameworks, specifically, conformity theory (Jones, 1984), regret theory (Loomes and Sugden 1982), and reactance theory (Brehm, 1989). First, conformity theory explains scarcity effects as the result of adherence to group norms. As scarcity signals popularity and this in turn indicates what other group members apparently prefer, individuals try to conform to this perceived norm which leads to further increases in demand (Cialdini, 1993; Parker and Lehmann 2011; Van Herpen et al., 2014). However, conformity theory cannot explain consumers' preference for products scarce due to limitations in supply, which is more related to a need for uniqueness (Fromkin, 1970; Snyder and Fromkin 1977). Next, regret theory describes how consumers seek to avoid making the wrong choice, regardless of perceived norms or need for uniqueness. Third, reactance theory is most applicable when consumers are restrained from accessing a particular product, for example because of regulatory frameworks or because of external constraints not related to the market forces of supply and demand. In this manner, conformity theory explains the effects of demand-based scarcity, uniqueness theory explains the effects of supply-based scarcity, and regret theory explains the effects of time-based scarcity. On the other hand, commodity theory broadly explains all of scarcity effects on consumer behavior.

In the following section we use the framework of commodity theory to help provide an overview of the role of scarcity in marketing. We also extend our conceptualizations to incorporate bandwagon effects, which are related to conformity theory and uniqueness theory to further explain how demand and supply-based scarcity cues influence consumer behavior. We use regret theory to further explain how time-based scarcity affects consumer behavior. In our overview, we outline the sources of product scarcity and identify a number of potential product and consumption level moderators.

Sources of product scarcity

Sources of product scarcity can be classified according to whether the unavailability is due to quantity or time (Gierl et al. 2008) (Fig. 1). Scarcity due to quantity restrictions can be further categorized according to whether the unavailability is driven by consumer demand or by supplier restrictions. On the other hand, product scarcity due to time limits typically only results from restricted supply. When the seller communicates a product's availability until an explicit deadline or time limit using messages such as "only available until …" or "for the next hour," availability of the product is guaranteed if the consumer purchases before the deadline imposed, irrespective of the level of demand.

Quantity restrictions

Under quantity restrictions, supply-based scarcity cues articulate that the supply of the product is restricted via limited production or distribution channels. Products scarce due to supply can be found across a range of categories, from groceries (e.g. Birthday Cake flavored Kit Kat), to shoes and clothing (e.g. limited-edition Travis Scott Air Jordan 1 Hi OG trainers), cars (e.g. Volkswagen R32), and even gaming consoles (e.g. Animal Crossing Nintendo Switch Console) and toys (e.g. Celebration Barbie Doll's). Supply-based scarcity cues signal a product's quality and status, thereby increasing the product's desirability (Lynn, 1992).

Increases in a product's perceived desirability due to supply-based scarcity can partly be explained by uniqueness theory (Fromkin, 1970; Snyder and Fromkin 1977), which states that consumers pursue scarce commodities because of the exclusivity they provide, as these products serve as a means to differentiate oneself from others. The need to be unique also relates to a 'snob effect' (Leibenstein, 1950), whereby the demand for scarce products among this segment decreases when others are consuming the same product or increasing their consumption of it. In other words, as consumption of the product increases, the less that product serves as a marker of uniqueness, and so, the less it is desired by those with a greater need to be unique. Products restricted in quantity through supplier limits serve as better markers of uniqueness than products restricted in quantity through excess consumer demand because they are being consumed by the masses. The exclusivity associated with supplier-imposed quantity limits fulfills consumers' desire to be unique (Amaldoss and Jain 2005; Thorstein, 1973) because fewer people have the opportunity to obtain the product. For example, luxury automobile manufacturers, such as Ferrari, are known to purposefully keep production quantity low in order to maintain brand status. In the case of Ferrari, "…the company was founded on one simple principle, you only produce one car less than the demand for the vehicle. To meet demand would destroy the exclusivity of the brand" (Alexander, 2020). Thus, supply-based scarcity seems most effective for marketing products that convey status and uniqueness, in particular those that are associated with conspicuous consumption (Gierl and Huettl 2010).

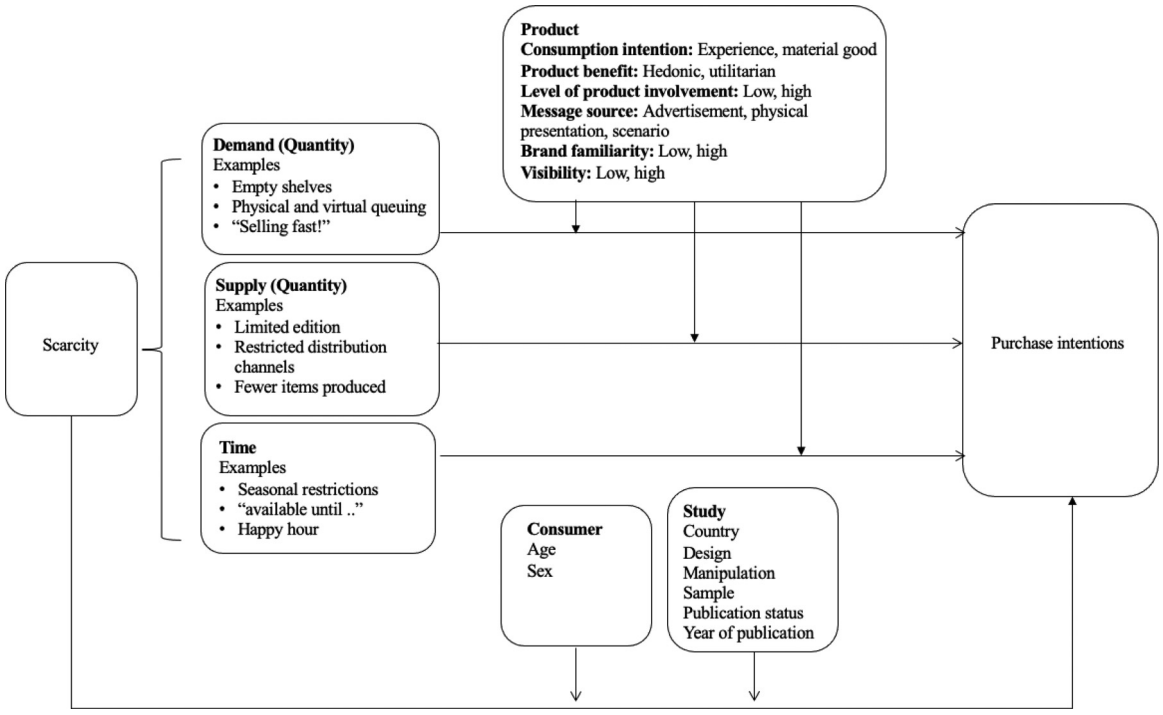

Fig. 1. The role of scarcity cues in marketing.

In contrast to supply side restrictions, quantity restrictions arising due to demand occur during the selling process, whereby the number of consumers purchasing a product exceeds available supply. This excess demand often results in depleted stock levels and empty shelf space, from which consumers may infer popularity (Parker and Lehmann 2011) and quality (Van Herpen et al., 2014). This excess demand causes further increases in demand, leading to bandwagon effects. As these informational cascades occur, consumers compete for the remaining products. In extreme situations this competition can lead to aggression towards other consumers (Kristofferson, McFerran, Morales, and Dahl 2017), as exemplified by worldwide media reports of supermarket aggression over common household items like pasta, rice, and toilet paper during the coronavirus pandemic (Kang and Chaudhuri 2020).

While uniqueness theory explains scarcity's effects on consumer behavior for products restricted in supply, it cannot explain increases in preference for products scarce in quantity due to prior consumer demand. Uniqueness theory predicts that when a shelf display signals that many items of a product have been sold and there is increasing consumption, the product is less likely to be selected, because products high in demand, and consumed by many others, are inefficient markers of uniqueness. Nevertheless, in many cases consumers still select the scarce option. Under these circumstances, selection of the scarce option is better explained by bandwagon effects (Leibenstein, 1950), and the desire to conform with, rather than differentiate from, others (Berger and Heath 2007; Roy and Sharma 2015).

Time restrictions

Under conditions of time-based scarcity, the supply of a product or offer is constrained to an explicit time frame, and can often be found in seasonal restrictions, such as Hot Cross Buns at Easter and Starbucks Phantom Frappuccino's at Halloween. As well as seasonal windows, sellers may restrict supply temporally with expiration dates and times for offers. A classic example is the "Happy Hour", often used for promotional offers in hospitality settings. Other examples include discounted food and airline tickets, and vacation packages. With time-based scarcity, supply is guaranteed, irrespective of the level of consumer demand and competition as long as the consumer meets the supplier-imposed deadline or expiry. Accordingly, the product being purchased is not the scarce commodity but rather the offer itself (Aggarwal et al., 2011), and consumers may feel a sense of urgency to act to avoid the anticipated regret associated with missing out (Abendroth and Diehl 2006). Similar to demand-based scarcity, time-based scarcity creates a sense of competition as consumers compete to beat deadlines to obtain products that other consumers cannot obtain post expiry of the deadline. Purchasing products limited by time-restrictions leads to a sense of achievement (Garretson and Burton 2003), and feelings of pride and satisfaction from being a 'smart shopper' (Babakus, Tat, and Cunningham 1988).

As can be seen, each source of scarcity can influence consumer behavior for reasons additional to the perception of increased value as explained by commodity theory. Since Lynn's (Lynn, 1991) meta-analysis, value has been examined through the lens of consumer attitudes to products, percep-

tions of exclusivity, popularity, and quality, as well as purchase intentions and behavior, and willingness-to-pay. However, despite this expanded conceptualization of value, there has been little exploration of how these different sources of scarcity may vary in how they affect attitudes and behavior. For example, while uniqueness theory predicts that products limited in supply are highly desired by those with a greater need to be unique, it is unknown whether this effect is similar in size to the effect of demand or time-based scarcity for the same product, and whether a retailer is best placed to implement one tactic over another given their product portfolio. To address this gap, we focus our analysis on how scarcity influences consumer perceptions of different dimensions of value, and more specifically whether the source of scarcity leads to differences in consumer purchase intentions based on competing theories presented above.

We do not expect differences between the three scarcity sources in how they affect purchase intentions. Instead, we focus our hypothesizing on how the effects of scarcity differ based on characteristics of the product and consumption settings. Specifically, we seek to test whether product characteristics, such as their material/experiential and hedonic/utilitarian distinctions, and consumer characteristics including level of brand familiarity, involvement, and whether the product is more or less visible to others when being consumed, impact how effective the different sources of scarcity are at influencing consumer purchase intentions.

Hypotheses

Experiences and material goods

In a marketing context, a commodity is not only a material good such as a bicycle or pair of shoes, a commodity is also an experience. However, a great deal of the research into the effects of scarcity cues has utilized material goods as stimuli (Aggarwal et al., 2011; Gierl and Huettl 2010; Gierl et al. 2008; Howard and Kerin 2006; Worchel, Lee, and Adewole 1975). Many of these studies involved shelf-based visual cues (Castro et al., 2013; Gabler and Reynolds 2013; Parker and Lehmann 2011), a strategy not available for many experiential products due to their intangibility.

A substantial research program has explored differences in the effect of consuming experiences rather than material goods on various consumer behavior outcomes such as happiness and satisfaction (Caprariello and Reis 2013; Carter and Gilovich 2010; Carter and Gilovich 2012; Nicolao, Irwin, and Goodman 2009; Van Boven and Gilovich 2003; Zhang, Howell, Caprariello, and Guevarra 2014), as well as how scarcity of financial resources shifts choice and preference from experiences to material goods (Tully, Hershfield, and Meyvis 2015). However, no prior research has investigated how the type of product (experience or material good) moderates the effects of scarcity and whether experiences are better marketed by a particular source of scarcity. Lynn (Lynn, 1991) observed no moderating effect of the tangibility of the purchase in his meta-analysis, however intangibility is only one aspect characterizing the ephemeral nature of an experience, as noted by Shi et al. (Shi et al., 2020). For example, a bottle of fine wine is both a tangible product and an experiential product.

Another difference between the product types is the extent to which the product can be stored and stockpiled. Because experiences cannot be stored and as such are innately time-dependent, they may be more susceptible to supply and time-based scarcity cues as consumers seek to beat expiry dates and access experiences limited by these inherent supply and time restrictions. On the other hand, demand-based scarcity cues may be less effective for experiences, since demand increases for experiences are less observable and are only evidenced through queuing for ticket sales or claims such as "X people looking at this right now." When considering material goods, imbalances between demand and supply become obvious through depleted shelves and empty clothing racks, and thus may have a greater impact on consumer purchase intentions compared to supply and time-based scarcity cues.

To explore these potential moderating effects, we take a consumption intention approach to the products used as stimuli in the studies. Material goods are purchases "…made with the primary intention of acquiring a material good: a tangible object that is kept in one's possession" while experiences are purchases "…made with the primary intention of acquiring a life experience: an event or series of events that one lives through" (Van Boven and Gilovich 2003, 1194).

H1a: For experiences, supply-based and time-based scarcity cues, compared with demand-based scarcity cues, lead to greater increases in purchase intentions.

H1b: For material goods, demand-based scarcity cues, compared with supply-based and time-based scarcity cues, lead to greater increases in purchase intentions.

Hedonic and utilitarian products

Consumer products can be broadly classified along hedonic and utilitarian dimensions. Whilst many products involve both hedonic and utilitarian attributes, consumers typically purchase products for either hedonic gratification or instrumental, utilitarian reasons (Batra and Ahtola 1991). Hedonic products are those that are self-defining and deliver consumption episodes primarily characterized by affective and sensory experiences of fantasy, fun, and sensual pleasure (Hirschman and Holbrook 1982). On the other hand, consumption of utilitarian products is goal-oriented and fills a basic need or accomplishes a functional task (Strahilevitz and Myers 1998). Hedonic goods are subject to "want" preferences that better satisfy promotion goals whilst utilitarian products are subject to "should" preferences and better satisfy prevention goals (Chernev, 2004; Dhar and Wertenbroch 2000). Thus, the "social proof" offered by demand-based scarcity cues is particularly effective for utilitarian products which tend to satisfy goals relating to the need to "fit in" and conform (Roy and Sharma 2015; Steinhart, Kamins, Mazursky and Noy 2014; Van Herpen et al., 2009), whilst supply-based scarcity cues are advantageous for hedonic products which tend to satisfy transformational or promotion goals that allow con-

sumers to differentiate themselves from others (Das et al. 2018; Ku, Kuo, and Kuo 2013; Van Herpen et al., 2009).

H2a: For hedonic products, supply-based scarcity cues, compared with demand-based and time-based scarcity cues, lead to greater increases in purchase intentions.
H2b: For utilitarian products, demand-based scarcity cues, compared with supply-based and time-based scarcity cues, lead to greater increases in purchase intentions.

Level of product involvement

Products differ in their tendency to arouse involvement (Bloch, 1981), and the level of arousal generated also varies between consumers (Antil, 1984). Broadly speaking, involvement reflects the extent of personal relevance and importance a decision has to an individual (Zaichkowsky, 1985), and reveals a level of interest in an object or activity (Mittal, 1983) stemming from the consumer's perception that the product meets important values and goals (Mittal and Lee 1989). High involvement products typically satisfy hedonic goals, whilst low involvement products satisfy more functional, utilitarian goals. As the level of importance increases, consumers move from decisions that are trivial and casual to more deliberative choice processes where information is scrutinized and elaborated upon. Thus, in low involvement situations, demand-based scarcity cues that provide evidence of popularity and quality will be more effective at influencing consumer behavior compared to supply-based or time-based scarcity cues. This effect should weaken as involvement increases and consumers elaborate on their decision process. Therefore, to the extent that high involvement products meet hedonic goals, supply-based scarcity cues may be more effective at influencing consumer behavior than demand-based or time-based scarcity cues.

H3a: For low involvement products, demand-based scarcity cues, compared with supply-based or time-based scarcity cues, lead to greater increases in purchase intentions.
H3b: For high involvement products, supply-based scarcity cues, compared with demand-based or time-based scarcity cues, lead to greater increases in purchase intentions.

Message source

A variety of message sources have been employed in the literature to communicate product scarcity. Researchers have utilized advertisements, scenario-based references, physical and shelf-based product presentations, and sales-person communications to indicate current or potential product scarcity in their studies. Shelf-based scarcity has been shown to lead to increased consumer preference through popularity and quality inferences (Parker and Lehmann 2011), with depleted stock levels being interpreted as evidence of prior consumer demand, leading to bandwagon effects (Van Herpen et al., 2009). Because of its greater concreteness, physical display of strong prior consumer demand may be more likely to influence consumer behavior for low involvement and utilitarian products than other message sources. Conversely, for supply-based scarcity the physical display of products is already limited in quantity, and advertisements communicating supply-based scarcity are thus better able to influence purchase intentions than the physical display of products. In the case of time-based scarcity, advertisements of the deal are not likely to lead to greater effects on purchase intentions, since the supply of the product is guaranteed up until the purchase deadline, irrespective of competing consumer demand, and it is the offer itself that is scarce.

H4a: Advertisements lead to greater increases in purchase intentions when they communicate supply-based scarcity than when they communicate demand-based or time-based scarcity cues.
H4b: Physical presentations lead to greater increases in purchase intentions when they communicate demand-based scarcity cues than when they communicate supply-based or time-based scarcity cues.

Brand familiarity

Consumers are often faced with making purchase decisions without prior knowledge or experience in a particular product class, or when new brands enter into existing markets. Whilst consumer familiarity with a brand leads to increased confidence in that brand, in turn leading to increased purchase intentions (Laroche, Kim, and Zhou 1996), in the absence of brand familiarity consumers may rely on cues and heuristics to form judgement and purchase decisions (Gigerenzer and Gaissmaier 2011). Perceived scarcity of a product is one such heuristic, where scarce objects are believed to be more valuable (Cialdini, 2009). As mentioned previously, perceived scarcity leads to popularity and quality inferences (He and Oppewal 2018; Parker and Lehmann 2011; Van Herpen et al., 2009), a type of "social proof" that allows consumers to interpret a product's superiority (Gierl and Huettl 2010; Ku, Kuo, and Kuo 2012; Van Herpen et al., 2009). In the context of a new brand entering the market, where restricting availability via supply may serve as a motivating factor for consumers to purchase and adopt the product, demand-based scarcity is expected to be a more important factor because it provides more direct social proof of the brand's value. On the other hand, for brands that are high in familiarity, consumers may interpret supply-based and time-based scarcity cues as evidence of exclusivity, leading to greater purchase intentions for those brands and products.

H5a: For brands low in familiarity, demand-based scarcity cues, compared with supply-based and time-based scarcity cues, lead to greater purchase intentions.
H5b: For brands high in familiarity, supply-based and time-based scarcity cues, compared with demand-based scarcity cues, lead to greater increase in purchase intentions.

Visibility

Products play important symbolic roles in consumers' lives (Belk, 1988; Sidney, 1959; Solomon, 1983), including being used as markers of uniqueness (Snyder and Fromkin 1977) and status (Han, Nunes, and Drèze 2010; Thorstein, 1973). Products consumed conspicuously provide an avenue for consumers with a high need for uniqueness to differentiate themselves from others (White and Dahl 2006; White and Dahl 2007) through invidious consumption while others may consume conspicuously via pecuniary emulation to associate with others, typically those belonging to higher social classes (Han et al., 2010). In order for a product to convey the uniqueness and status desired by these consumers, the product must be visible, as uniqueness and status are based on judgments of similarity and dissimilarity to others (Snyder and Fromkin 1977; Thorstein, 1973). As such, products scarce due to supply are more suitable for situations where there is a greater likelihood of being seen, as the visibility helps others to make these inferences of uniqueness and status (Belk, Bahn, and Mayer 1982; Richins, 1994). Conversely, for products consumed inconspicuously, or in situations where visibility is low, there is no advantage for a consumer to expend resources to attain scarce products because of their exclusivity as there is lower potential for social comparison to take place. Instead, for these products, consumers can still be expected to be susceptible to demand and time-based cues.

H6a: For products consumed in highly visible settings, supply-based scarcity cues, compared with demand-based and time-based scarcity cues, lead to greater increases in purchase intentions.

H6b: For products consumed in low visibility settings, demand-based and time-based scarcity cues, compared with supply-based scarcity cues, lead to greater increases in purchase intentions.

In summary, there are several product and consumption level characteristics that may impact whether one source of scarcity may influence purchase intentions to a greater degree than other sources. In the following section we outline the methodology and results of our meta-analysis. The analysis incorporates all the variables listed in Fig. 1, including the sources of scarcity and moderator variables identified above, and examines how these impact consumer purchase intentions.

Method

Search process and sampling frame

An extensive search was conducted to locate research examining the relationship between scarcity and consumer behavior outcomes. The search was not restricted to any particular publication form and included the following methods to identify all relevant research conducted since the publication of Brock (Brock, 1968) as available per September 2021:

(1) Searches for the keywords "scarcity," "consumer," "choice," and "decision," in the ABI/INFORM Collection, Business Source Premier, Google Scholar, ProQuest Dissertations and Theses, PsycARTICLES, PsycINFO, Scopus, and Web of Science databases;
(2) A search of the Social Sciences Citation Index based on Lynn's (Lynn, 1991) meta-analysis;
(3) Manual searches of journals and conference proceedings that frequently include articles on scarcity cues and heuristics: *Journal of Advertising, Journal of Consumer Research, Journal of Marketing, Journal of Retailing, Psychology and Marketing, International Journal of Research in Marketing, Journal of Marketing Research,* and *Journal of Personality and Social Psychology.*
(4) Backward and forward citation chaining of all found relevant articles using Google Scholar, Scopus, and Web of Science databases.

Variable coding

The search process yielded 659 records, of which 185 duplicates were identified. Of the 474 unique works related to the effects of scarcity cues and tactics and consumer behavior outcomes, abstract screening led to 69 records being excluded due to the study being qualitative in nature or related to resource scarcity. The remaining 405 full text articles were assessed for eligibility. To be included in the meta-analysis, a study had to include (1) a treatment that allowed the comparison of a scarce consumer product with a control condition, and (2) an interpretable dependent variable related to the marketing mix, leaving 74 articles included in the dataset. Studies were excluded that compared different sources of scarcity but did not compare the effects of scarcity cues to a condition without scarcity cues. Applying these criteria, 416[3] effect sizes were included in the meta-analysis. See Web Appendix A for a list of works included in the meta-analysis.

Dependent variables

The dependent variables included in the meta-analysis comprised the effects that measured the relationship between manipulations of scarcity and an interpretable consumer behavior outcome measure related to the marketing mix. Dependent variables were coded according to whether the effect concerned any of the variables: attitude, desirability, enjoyment, exclusivity, purchase intentions, popularity, quality, value, and willingness-to-pay. Illustrative examples of the various operationalizations' of coded variables are in Web Appendix B.

Moderator variables

The moderating variables included in the meta-analysis were coded according to (1) source of scarcity (demand-based, supply-based, time-based); (2) consumption category (experience, material good); (3) primary product benefits (hedonic, utilitarian); (4) level of product involvement (low,

[3] The complete dataset comprised 425 effect sizes from 74 papers. Nine effect sizes were identified as outliers (see Web Appendix D), leaving a final data set of k = 416.

high); (5) message source (advertisement, physical presentation, scenario); (6) brand familiarity (low, high); and (7) visibility (low, high). Consumer characteristics were coded as continuous variables according to (1) the mean age of the sample; and (2) the proportion of female participants in the sample. Lastly, we explored the data for potential differences based on methodological practices. Variables were coded according to (1) country of data collection; (2) experimental design (between-, mixed-, within-subjects design); (3) study manipulation (actual, hypothetical); (4) publication status (dissertation, published, working paper); (5) sample composition (public, student), and (6) year of study availability (continuous). See Web Appendix C for a correlation matrix.

Effect size computation

The effect size statistic chosen for the meta-analysis was the standardized difference in means expressed as Cohen's d (Cohen, 1977). This statistic compares groups according to their standardized mean scores for the dependent variables as follows: $d = \frac{Ms - Mc}{SD}$, where M_s is the scarcity group mean, M_c is the control group mean, and SD is the pooled standard deviation. To account for differences in study sample size, each effect size was weighted by the inverse of its variance (Marín-Martínez and Sánchez-Meca 2010). Each weighted effect size estimate was then corrected for error in the measurement of the dependent variable y. To calculate δ, the reliability adjusted, inverse variance-weighted standardized mean difference, Bobko, Roth, and Bobko (2001) formula was used: $\delta = \frac{d}{\sqrt{\alpha_y}}$, where α_y represents the reliability of y. Most studies reported coefficient of reliability values, such as Cronbach's α, which were used to estimate α_y. If a study did not report the reliability of y, average reliabilities were imputed. Sub-groups within studies were assumed to have a common among-study variance component, and thus within-group estimates of tau-squared were pooled. Sub-groups were then combined using a random effects model to yield the overall effect (Borenstein, Hedges, Higgins, and Rothstein 2013). The Q statistic was used to determine the presence of between-study heterogeneity (Huedo-Medina, Sanchez-Meca, Marin-Martinez, and Botella 2006).

Sensitivity analysis

In a meta-analysis, the presence of influential cases and outliers can affect not only the magnitude of the effect, but also the robustness and validity of conclusions drawn (Viechtbauer and Cheung 2010). To ensure the results were not biased by influential cases, a sensitivity analysis was conducted to examine the dataset for outliers and publication bias.

Outliers were identified by following the procedure outlined in Hedges and Olkin (Hedges and Olkin 2014) and Viechtbauer and Cheung (Viechtbauer and Cheung 2010). Standardized residuals were calculated for each effect size, and effect sizes with standardized residuals equal to or greater than 3 in absolute value were considered outliers. Nine studies were identified as outliers (see Web Appendix D). The meta-analysis was conducted with these studies removed to ensure mean effect sizes were not biased by extreme cases. To assess publication bias we calculate the file drawer N, or the number of studies with a null result required to reduce the combined probability level to $\alpha = 0.05$ (Robert, 1979).

Table 1
The effect of scarcity on consumer behaviors.

	k	N	δ	CI	z	FD
Effect of scarcity on						
Attitude	76	18,766	0.15	0.05-0.24	3.07**	827
Desirability	52	6650	0.25	0.13-0.36	4.22***	1112
Enjoyment	14	1926	0.33	0.11-0.54	3.00**	157
Exclusivity	6	492	0.52	0.15-0.89	2.79**	32
Popularity	12	1122	0.71	0.46-0.96	5.57***	329
Purchase intentions	193	22,655	0.31	0.25-0.37	10.01***	20,400
Quality	25	2969	0.47	0.30-0.64	5.33***	760
Value	20	1867	0.37	0.18-0.57	3.73***	264
Willingness-to-pay	18	1749	0.47	0.26-0.67	4.52***	370

Note.—k = number of effect sizes; N = number of participants in the original studies; δ = reliability corrected inverse variance-weighted standardized mean difference; CI = lower and upper limit of the 95% confidence interval around the reliability corrected inverse variance-weighted standardized mean difference; z = test of null (two-tailed); FD = file-drawer N giving an indication of publication bias. . $p < .10$; * $p < .05$; ** $p < .01$; *** $p < .001$.

Analysis and results

The data were analyzed using the software Comprehensive Meta-Analysis v.3 (Borenstein et al., 2013). A mixed effects model was estimated to allow for variation within and between studies, such that the combined effect estimates the overall mean effect for the distribution (Borenstein, Hedges, and Rothstein 2007). Within-study estimates were pooled using the fixed effect z before calculating the 95% confidence interval and random effect z between studies (Hunter and Schmidt 2004). First, the overall effect of scarcity on each dependent variable was examined. Following this, we conducted a spotlight analysis on the dependent variable purchase intentions only to examine the moderating effect of different sources of scarcity. We then test our hypotheses using planned contrasts to examine how different scarcity cues influence purchase intentions. To examine the effects of consumer characteristics and methodological practices, we combined the sources of scarcity for a single moderation analysis.

Effects of scarcity cues on consumer attitudes and behavior

Results at the aggregate level across different conceptualizations of value show that scarcity has significant positive effects for each of these (Table 1). Scarcity cues lead to more favorable attitudes ($\delta = 0.15$, $z = 3.07$, $p < .01$), increased product desirability ($\delta = 0.25$, $z = 4.22$, $p < .001$) and enjoyment ($\delta = 0.33$, $z = 3.00$, $p < .01$), enhanced perceptions of exclusivity ($\delta = 0.52$, $z = 2.79$, $p < .01$), popularity ($\delta = 0.71$, $z = 5.57$, $p < .001$), quality ($\delta = 0.47$, $z = 5.33$, $p < .001$), value ($\delta = 0.37$, $z = 3.73$, $p < .001$), and greater purchase intentions ($\delta = 0.31$, $z = 10.01$, $p <$

Table 2
The moderating effect of different sources of scarcity on purchase intentions.

	k	N	δ	CI	z	Q
Source of scarcity						
Demand-based	90	9459	0.28	0.18-0.38	5.36***	
Supply-based	64	9056	0.39	0.26-0.51	6.12***	1.76
Time-based	27	3265	0.34	0.16-0.53	3.67***	

Note.—k = number of effect sizes; N = number of participants in the original studies; δ = reliability corrected inverse variance-weighted standardized mean difference; CI = lower and upper limit of the 95% confidence interval around the reliability corrected inverse variance-weighted standardized mean difference; z = test of null (two-tailed); Q = test of difference between moderator levels. . $p < .10$; * $p < .05$; ** $p < .01$; *** $p < .001$. *Twelve effect sizes combined different sources of scarcity or did not specify the source of scarcity.

.001) and willingness-to-pay ($\delta = 0.47$, $z = 4.52$, $p < .001$). Having examined the effect of scarcity across multiple dependent variables, the remainder of our analysis focuses on purchase intentions.

Purchase intentions

We first analyze the effects of different sources of scarcity on purchase intentions (Table 2) and analyze the scarcity effects for each of the identified product types (Table 3, Panel A). For the product types that show significant differences, we next test our hypotheses by conducting planned comparisons for each source of scarcity (Table 3, Panel B).

Effects by scarcity source and product type

Purchase intentions significantly increase with the presence of each of the scarcity cues. Supply-based scarcity has the largest effect ($\delta = 0.39$, $z = 6.12$, $p < .001$), followed by time-based scarcity ($\delta = 0.34$, $z = 3.67$, $p < .001$), while demand-based scarcity shows the smallest effect ($\delta = 0.28$, $z = 5.36$, $p < .001$) but, as expected, these effects are not significantly different ($Q_{(2)} = 1.76$, $p = .414$) (Table 2).

Purchase intentions significantly increase with the presence of scarcity cues within each of the product types (Table 3, Panel A). Scarcity cues lead to greater purchase intentions of experiences ($\delta = 0.30$, $z = 4.53$, $p < .001$), material goods ($\delta = 0.33$, $z = 6.87$, $p < .001$), hedonic and utilitarian products ($\delta_{\text{hedonic}} = 0.31$, $z = 5.89$, $p < .001$ and $\delta_{\text{utilitarian}} = 0.25$, $z = 4.53$, $p < .001$), low and high involvement products ($\delta_{\text{low}} = 0.28$, $z = 6.84$, $p < .001$ and $\delta_{\text{high}} = 0.38$, $z = 4.58$, $p < .001$), products communicated with advertising ($\delta = 0.35$, $z = 4.62$, $p < .001$), physical presentation ($\delta = 0.31$, $z = 5.99$, $p < .001$), and via scenarios ($\delta = 0.24$, $z = 3.55$, $p < .001$). Scarcity cues also lead to greater purchase intentions of products low and high in brand familiarity ($\delta_{\text{low}} = 0.41$, $z = 6.22$, $p < .001$ and $\delta_{\text{high}} = 0.21$, $z = 3.43$, $p < .001$) and those consumed in low and high visibility settings ($\delta_{\text{low}} = 0.27$, $z = 5.76$, $p < .001$ and $\delta_{\text{high}} = 0.33$, $z = 5.74$, $p < .001$). In sum, for all identified product types, the overall effect of scarcity cues is consistently positive. The largest difference between types is observed for brand familiarity, with low familiar brands displaying twice as large an effect on purchase intentions than high familiar brands.

Hypothesis tests

We now test for each of the product types how the effects of scarcity cues on purchase intentions differ by scarcity source (Table 3, Panel B). For experiences, scarcity sources show a marginally significant difference ($Q_{(2)} = 4.97$, $p = .083$). Comparisons reveal that supply-based scarcity cues lead to significantly greater purchase intentions than demand-based scarcity cues ($Q_{(1)} = 4.97$, $p < .05$) while there is no significant difference between time-based and demand-based scarcity cues ($Q_{(1)} = 0.15$, $p = .701$). H1a is therefore partially supported.[4] Specifically, effect sizes for the purchase intentions of experiences in response to supply-based scarcity ($\delta = 0.60$, $z = 3.98$, $p < .001$) cues are approximately three times greater than those in response to demand-based scarcity cues ($\delta = 0.21$, $z = 2.52$, $p < .01$). In contrast, material goods display no significant differences between the sources of scarcity ($Q_{(2)} = 0.17$, $p = .919$). We therefore reject H1b.

For hedonic products, purchase intention effect sizes are significantly different across scarcity types ($Q_{(2)} = 9.63$, $p < .01$). The effect for supply-based ($\delta = 0.55$, $z = 5.48$, $p < .001$) is larger than for demand-based scarcity ($\delta = 0.17$, $z = 2.35$, $p < .05$) ($Q_{(1)} = 9.17$, $p < .01$). The difference between supply-based and time-based scarcity cues is however not significant ($Q_{(1)} = 2.10$, $p = .148$), so H2a is only partially supported. Conversely, the significant differences for utilitarian products ($Q_{(2)} = 12.38$, $p < .01$) reveal that demand-based scarcity cues lead to greater purchase intention effects ($\delta = 0.41$, $z = 5.93$, $p < .001$) than supply-based ($\delta = -0.02$, $z = -0.16$, $p = 0.872$) and time-based scarcity cues ($\delta = 0.02$, $z = 0.13$, $p = .896$) ($Q_{(1)} = 9.16$, $p < .01$) and ($Q_{(1)} = 6.30$, $p < .01$). This supports H2b.

Low involvement products show no significant differences between the sources of scarcity ($Q_{(2)} = 1.04$, $p = .595$), so we reject H3a. Instead, within high involvement products, we find a marginally significant difference in scarcity source effects ($Q_{(2)} = 5.63$, $p = 0.060$). Supply-based scarcity cues ($\delta = 0.50$, $z = 4.21$, $p < .001$) lead to greater purchase intentions than demand-based scarcity cues ($\delta = 0.08$, $z = 0.49$, $p = .627$) ($Q_{(1)} = 4.19$, $p < .05$). But as there is no significant difference between supply-based scarcity cues and time-based scarcity cues ($\delta = 0.63$, $z = 2.85$, $p < .01$) ($Q_{(1)} = 0.28$, $p = .598$), H3b is only partially supported.

When considering the message source, we find significant differences across scarcity cues for products communicated with advertising ($Q_{(2)} = 10.09$, $p < 0.01$). Advertising is particularly effective at driving purchase intentions of products based on supply ($\delta = 0.69$, $z = 4.93$, $p < .001$) compared to demand-based scarcity ($\delta = -0.03$, $z = -0.13$, $p = .900$) ($Q_{(1)} = 6.44$, $p < 0.01$), and time-based scarcity ($\delta = 0.26$, $z = 2.17$, $p < 0.05$) ($Q_{(1)} = 5.69$, $p < 0.05$), supporting H4a. Instead, although the effects are in the expected direction,

[4] See Web Appendix E for supplemental analyses exploring differences between product characteristics at each level of scarcity.

Table 3
Scarcity source as a moderator of purchase intentions by product type.

		k	N	δ	CI	z	FD	Multiple comparisons	Q
Panel A: Combined effects									
Consumption intention									
Experience		63	6048	0.30	0.17-0.43	4.53***	1674		4.97*
Material good		115	10,994	0.33	0.24-0.42	6.87***	6985		0.17
Product benefit									
Hedonic		94	8871	0.31	0.21-0.41	5.89***	3926		9.63**
Utilitarian		57	5078	0.25	0.14-0.36	4.53***	976		12.38***
Level of product involvement									
Low		128	12,661	0.28	0.20-0.37	6.84***	6868		1.04
High		58	5204	0.38	0.22-0.55	4.58***	2099		5.63.
Message source									
Advertisement		44	3796	0.35	0.20-0.50	4.62***	988		10.09**
Physical presentation		73	6822	0.31	0.21-0.41	5.99***	2683		1.62
Scenario		64	6138	0.24	0.11-0.37	3.55***	1122		0.00
Brand familiarity									
Low		46	4344	0.41	0.28-0.54	6.22***	1542		1.48
High		47	4912	0.21	0.09-0.33	3.43***	595		4.01
Visibility									
Low		94	9817	0.27	0.18-0.36	5.76***	3339		3.84
High		92	8709	0.33	0.22-0.44	5.74***	4049		6.77*
Panel B: Effects by source									
Consumption intention									
Experience	Demand-based scarcity	37	4013	0.21	0.05-0.38	2.52**	372		
	Supply-based scarcity	14	836	0.60	0.30-0.89	3.98***	181	Supply > Demand	4.97.
	Time-based scarcity	12	1199	0.28	−0.01-0.57	1.88·	45	Time = Demand	0.15
Material good	Demand-based scarcity	47	5086	0.34	0.20-0.49	4.60***	1364	Demand = Supply	0.00
	Supply-based scarcity	43	4067	0.33	0.18-0.49	4.24***	862		
	Time-based scarcity	13	1841	0.40	0.14-0.66	2.99***	165	Demand = Time	0.15
Product benefit									
Hedonic	Demand-based scarcity	49	4862	0.17	0.03-0.32	2.35*	417	Supply > Demand	9.17***
	Supply-based scarcity	29	2201	0.55	0.35-0.75	5.48***	833		
	Time-based scarcity	16	1808	0.32	0.09-0.56	2.75**	140	Supply = Time	2.10
Utilitarian	Demand-based scarcity	29	3265	0.41	0.28-0.55	5.93***	782	Demand > Supply	9.16**
	Supply-based scarcity	10	943	−0.02	−0.27-0.22	−0.16			
	Time-based scarcity	6	870	0.02	−0.26-0.29	0.13		Demand > Time	6.30**
Level of product involvement									
Low	Demand-based scarcity	75	8003	0.32	0.21-0.42	5.96***	3240		
	Supply-based scarcity	27	2597	0.26	0.08-0.44	2.85***	208	Demand = Supply	0.32
	Time-based scarcity	17	2061	0.20	−0.01-0.42	1.84.	54	Demand = Time	0.88
High	Demand-based scarcity	15	1456	0.08	−0.24-0.40	0.49			
	Supply-based scarcity	31	2667	0.50	0.26-0.73	4.21***	840	Supply > Demand	4.19*
	Time-based scarcity	9	1081	0.63	0.20-1.06	2.85**	185	Supply = Time	0.28
Message source									
Advertisement	Demand-based scarcity	5	484	−0.03	−0.51-0.45	−0.13		Supply > Demand	6.44**
	Supply-based scarcity	18	1177	0.69	0.41-0.96	4.93***	430		
	Time-based scarcity	17	2135	0.26	0.02-0.49	2.17*	100	Supply > Time	5.69*
Physical presentation	Demand-based scarcity	54	5607	0.32	0.21-0.44	5.42***	1637	Demand = Supply	1.62
	Supply-based scarcity	11	1215	0.14	−0.12-0.40	1.04			
Scenario	Demand-based scarcity	31	3368	0.25	0.06-0.45	2.54**	328		
	Supply-based scarcity	28	2770	0.26	0.05-0.46	2.44*	190		
Brand familiarity									
Low	Demand-based scarcity	20	2129	0.39	0.18-0.59	3.71***	305	Demand = Supply	0.57
	Supply-based scarcity	20	1397	0.50	0.28-0.72	4.50***	297		
	Time-based scarcity	6	818	0.25	−0.05-0.55	1.65.		Demand = Time	0.52
High	Demand-based scarcity	22	2452	0.15	0.00-0.31	1.96*	53	Supply > Demand	5.54
	Supply-based scarcity	7	1096	0.51	0.25-0.77	3.89***	97		
	Time-based scarcity	12	1364	0.26	0.00-0.52	1.99*	38	Time = Demand	0.45
Visibility									
Low	Demand-based scarcity	47	5112	0.36	0.23-0.49	5.55***	1551	Demand > Supply	3.40.
	Supply-based scarcity	20	2107	0.14	−0.06-0.34	1.37	30		
	Time-based scarcity	16	1821	0.21	−0.01-0.43	1.85.	46	Time = Supply	0.20

(*continued on next page*)

Table 3 (*continued*)

		k	N	δ	CI	z	FD	Multiple comparisons	Q
High	Demand-based scarcity	43	4347	0.18	0.01-0.35	2.10*	346		
	Supply-based scarcity	39	3031	0.49	0.31-0.68	5.30***	1193	Supply > Demand	6.11**
	Time-based scarcity	9	1125	0.46	0.09-0.82	2.46**	91	Supply = Time	0.03

Note.—k = number of effect sizes; N = number of participants in the original studies; δ = reliability corrected inverse variance-weighted standardized mean difference; CI = lower and upper limit of the 95% confidence interval around the reliability corrected inverse variance-weighted standardized mean difference; z = test of null (two-tailed); FD = file-drawer N giving an indication of publication bias; Q = test of difference between moderator levels. . $p < .10$; * $p < .05$; ** $p < .01$; *** $p < .001$.

scarcity cues communicated by physical presentation do not show significant differences ($Q_{(1)} = 1.62$, $p = 0.203$) based on scarcity type. Demand-based scarcity cues significantly affect the effect sizes of purchase intentions of products communicated via physical display ($\delta = 0.32$, $z = 5.42$, $p < .001$) but supply-based scarcity cues[5] have no significant effect ($\delta = 0.14$, $z = 1.04$, $p = 0.296$). We thus reject H4b.

For products low and high in brand familiarity, the type of scarcity cue does not lead to significantly different purchase intention effects for products ($Q_{(2)} = 1.48$, $p = .477$ and $Q_{(2)} = 4.01$, $p = .140$). We thus reject H5a and H5b. Lastly, scarcity cues result in significant differences in purchase intention effect sizes for products consumed in a highly visible manner ($Q_{(2)} = 6.77$, $p < .05$), with supply-based scarcity having a greater effect ($\delta = 0.49$, $z = 5.30$, $p < .001$), than demand-based scarcity ($\delta = 0.18$, $z = 2.10$, $p < .05$) ($Q_{(1)} = 6.11$, $p < .01$) but not time-based scarcity ($\delta = 0.46$, $z = 2.46$, $p < .01$) ($Q_{(1)} = 0.03$, $p = .863$), thus H6a is partially supported. There is no significant difference between scarcity cues for products consumed in a less visible manner ($Q_{(2)} = 3.84$, $p = .147$), and we reject H6b.

Consumer characteristics and methodological practices

To explore the effect of consumer characteristics and methodological practices on purchase intentions, we combine the sources of scarcity for a single moderation analysis. The effects of scarcity cues overall show no significant differences for purchase intentions based on a consumer's age ($Q_{(1)} = 0.73$, $p = .394$) or sex ($Q_{(1)} = 0.18$, $p = .668$) (Table 4). Exploring the effect of different methodological practices on purchase intentions, there is a marginally significant difference by country ($Q_{(5)} = 10.33$, $p = .066$). Contrast analyses between each of the countries revealed a number of differences. The effect of scarcity cues on purchase intentions was greater in Canada than in Germany ($Q_{(1)} = 4.02$, $p < .05$), while Korea had the largest effect overall and was significantly greater than Germany ($Q_{(1)} = 5.13$, $p < .05$), The Netherlands ($Q_{(1)} = 2.91$, $p < .10$), and the USA ($Q_{(1)} = 7.10$, $p < .01$) (Table 4). A marginal difference emerged between effect sizes across different study designs ($Q_{(2)} = 5.17$, $p < .10$). The effect of scarcity cues on purchase intentions is greater in within-subjects designs than in mixed-design studies ($Q_{(1)} = 7.35$, $p < .01$). However there is no significant difference with between-subjects ($Q_{(1)} = 2.17$, $p = .141$), or between mixed-designs and between-subjects designs ($Q_{(1)} = 2.25$, $p = .134$). There are no significant differences based on actual or hypothetical studies ($Q_{(1)} = 0.08$, $p = .772$), sample composition ($Q_{(1)} = 1.56$, $p = .212$), publication status ($Q_{(2)} = 0.22$, $p = .638$) or year of publication ($Q_{(1)} = 0.01$, $p = .905$).

Table 4
The moderating effect of consumer characteristics and methodological practices.

	k	N	δ	CI	z	Q
Consumer characteristics						
Age	74	8089	−0.01	−0.03-0.01	−0.85	0.73
Sex	101	10,666	0.00	−0.01-0.01	−0.43	0.18
Methodological						
Country of data collection						
Canada	15	976	0.49	0.23-0.76	3.68***	
Germany	8	640	0.05	−0.29-0.39	0.29	
Korea	8	942	0.70	0.36-1.04	4.06***	10.33.
Taiwan	27	2786	0.27	0.08-0.45	2.88**	
The Netherlands	11	1242	0.19	−0.11-0.49	1.26	
USA	96	5847	0.28	0.19-0.38	5.81***	
Design of study						
Between-subjects	156	16,068	0.31	0.24-0.39	7.91***	
Mixed design	15	1364	0.11	−0.14-0.36	0.85	5.17.
Within-subjects	22	5223	0.48	0.28-0.68	4.61***	
Manipulation						
Actual	15	1489	0.35	0.10-0.61	2.73**	0.08
Hypothetical	178	21,166	0.31	0.24-0.39	8.47***	
Sample						
Public	38	4090	0.23	0.07-0.39	2.80***	1.56
Student	152	18,142	0.34	0.26-0.42	8.43***	
Publication status						
Dissertation	40	3788	0.35	0.19-0.50	4.44***	0.22
Peer-reviewed	151	18,752	0.31	0.23-0.39	7.62***	
Year of publication	193	22,655	0.00	−0.01-0.01	−0.12	0.01

Note.—k = number of effect sizes; N = number of participants in the original studies; δ = reliability corrected inverse variance-weighted standardized mean difference; CI = lower and upper limit of the 95% confidence interval around the reliability corrected inverse variance-weighted standardized mean difference; z = test of null (two-tailed); Q = test of difference between moderator levels. $p < .10$; * $p < .05$; ** $p < .01$; *** $p < .001$.

Summary of results

Results at the aggregate level showed that scarcity has significant positive effects on a variety of dependent measures, while our moderator analysis focused on purchase intentions. It showed that supply-based scarcity has the largest

[5] Time-based scarcity was excluded from the analysis due to the small number of effect sizes (k = 4).

effect on purchase intentions, followed by time-based scarcity, and demand-based scarcity has the smallest effect overall. The moderator analysis and planned comparisons next revealed that supply-based scarcity has the largest effect for experiences, while the purchase intentions of material goods are not significantly different between sources of scarcity. Along these lines, supply-based and time-based scarcity cues have the largest effects for hedonic products, while demand-based scarcity has the largest effect for utilitarian products. Similarly, supply-based and time-based scarcity cues lead to greater purchase intentions of high involvement products and products consumed in a highly visible context (Van Herpen et al., 2009), while supply-based scarcity cues are most effective when consumers are exposed to advertising messages. Contrary to our prediction, there was no significant difference between demand-based and supply-based scarcity cues for the physical presentation of products, and between time-based and supply-based scarcity cues for high involvement and hedonic products. The effects of scarcity type do not depend on brand familiarity. We nevertheless note that the overall effect of scarcity has a greater effect on purchase intentions for brands low in familiarity than for those high in familiarity.

We found no significant moderation of scarcity effects on purchase intentions based on age or sex but we did find a marginally significant difference for purchase intentions by country. The largest effects are found in Korea, which were significantly greater than Germany, The Netherlands, and the United States. The smallest effect for scarcity cues was found in Taiwan. Lastly, we found a significant difference based on experimental design, with within-subjects designs leading to greater effects on purchase intentions than mixed designs. This demonstrates how scarcity effects are amplified when consumers are repeatedly exposed to and so are more likely to notice the scarcity cue.

General discussion

Extending the analysis by Lynn (Lynn, 1991), our meta-analysis examined the overall effect of scarcity on a range of dependent variables. We then focused on the dependent variable purchase intentions, and disentangled the effect of scarcity based on its source. Our moderator analysis hypothesized variation in scarcity's effect on purchase intentions to exist dependent upon whether scarcity was due to demand-based, supply-based, or time-based restrictions, the characteristics of the product, the consumer, and the consumption context. We will discuss the results of our hypothesis tests and then discuss explanations and implications of the scarcity effect and provide directions for future research.

Regarding experiences and material goods, while supply-based scarcity is the greatest driver of purchase intentions of experiences (H1a partially supported), there are no significant differences between sources for material goods (H1b rejected). We note that for supply-based scarcity, the effect on consumer purchase intentions for experiences is approximately three times greater than demand-based scarcity, and time-based scarcity only marginally affects the purchase intentions of experiences. We suggest that for experiences, because of their ephemerality, sources of scarcity that stimulate a fear of missing out are most effective in influencing purchase intentions. Further, reinforcing this with supply-based scarcity cues alongside their natural time constraints is potentially advantageous for marketers.

Concerning product benefit type, supply-based scarcity has a larger effect than demand-based scarcity on purchase intentions of hedonic products but it does not have a significantly larger effect than time-based scarcity cues (H2a partially supported). Instead, demand-based scarcity has a larger effect than supply-based and time-based scarcity cues on purchase intentions of utilitarian products (H2b supported). For product involvement we found, in contrast to our expectations, that all scarcity cues are equally successful at driving purchase intentions of low involvement products (H3a rejected). For high involvement products however, supply-based scarcity leads to greater purchase intentions than demand-based scarcity (H3b partially supported). This may be due to increased elaboration in the decision-making process as the consumer's involvement increases. As the consumer elaborates, the decision-making process moves from experiential and intuitive to rational and analytical processing (Epstein, Pacini, Denes-Raj, and Heier 1996), paying more attention to brands, product attributes, and other features to satisfy the consumer's goal (Mittal and Lee 1989). Inferences drawn from different sources of scarcity would thus become less required and prominent as the consumer increases the involvement with the product and includes more information in the decision, explaining the absence of significant effects for demand-based scarcity cues. Similarly, the strong effect of time-based scarcity cues on purchase intentions of high involvement products may be because time-based scarcity is frequently paired with sales promotions. This may lead to an increase in a consumers' urgency to buy, consistent with the findings of (Aggarwal and Vaidyanathan 2003), who find that under time-based scarcity consumers expedite purchases to avoid any regret associated with missing deadlines (Inman and McAlister 1994) and forfeiting the purchase opportunity.

Considering message source, advertising messages have the greatest effect when combined with supply-based scarcity (H4a supported) whereas when products are physically presented there are no differences (H4b rejected). We suggest this is because products scarce in supply have a naturally diminished physical presence compared to products scarce due to demand or time, in which case the scarce physical presence is a stronger marker of potential unavailability. Similarly, when selecting communication channels to promote a product, the use of advertising materials will be most effective for supply-based scarcity tactics.

For brand familiarity, our analysis showed that supply-based scarcity has the largest effect on purchase intentions for brands either low or high in familiarity, although the difference between sources was not significant (H5a and H5b rejected). This means that all scarcity cues are equally successful at driving purchase intentions, and that brands may

themselves be important signals of a product's value and input into the decision-making process and so may outweigh scarcity cues and heuristics (Escalas and Bettman 2003; Escalas and Bettman 2005; Han et al., 2010). While each source of scarcity significantly lifted purchase intentions for brands low and high in familiarity, we find that supply-based scarcity cues were more effective than demand-based scarcity cues at increasing purchase intentions for brands high in familiarity.

When considering how visible the consumption setting is, supply-based scarcity is more effective than demand-based scarcity for stimulating purchase intentions of products that are highly visible to others, while demand-based scarcity is more effective than supply-based scarcity for lifting purchase intentions of products low in visibility (H6a and H6b both partially supported). This suggests that restricting the quantity available for purchase may lead to consumers inferring higher product quality and enhanced value perceptions (Stock and Balachander 2005) because supply-scarce products and their exclusivity serve as efficient markers of uniqueness (Gierl and Huettl 2010), helping consumers to satisfy the need to distinguish oneself from the 'herd' (Leibenstein, 1950). An implication of this is that supply-based scarcity cues are better coupled with products that meet these needs, in particular conspicuous consumption goods such as designer handbags and shoes, and symbolic brands (Aggarwal et al., 2011).

We also considered differences across countries and find scarcity cues to have a significantly greater effect in Korea than in the USA, Germany, or The Netherlands. The overall effects of scarcity in Germany and The Netherlands were not significant. This result is in contrast to an early study by Jung and Kellaris (Jung and Kellaris 2004) that showed that lower context cultures such as the United States are more prone to the effects of scarcity compared to higher context cultures, and that this effect is moderated by uncertainty avoidance and need for cognitive closure. One potential explanation for this contrast is that even though Korea is considered a high context culture (Kim, Pan, and Park 1998; Thomas, 1998), where there is embedded meaning in information and not everything is written or spoken (Hall, 1989), it does exhibit certain low context features and similarities to the US, a low context culture (Thomas, 1998). Low context cultures are characterized by communication styles where meaning is directly or explicitly conveyed through language. This may suggest consumers in these low context cultures may comprehend scarcity cues in a more literal sense and are more susceptible to their effects compared to higher context cultures.

Beyond commodity theory

Our findings largely reconfirm but also broaden the results of Lynn (Lynn, 1991) and allow a more refined insight into the conditions where scarcity cues are particularly effective, versus those where their effects are only modest. We adopted a broader framework than commodity theory to explain why each of the sources of scarcity affects consumer perceptions and behavior and included conformity theory (Jones, 1984), uniqueness theory (Snyder and Fromkin 1977), regret theory (Loomes and Sugden 1982) and reactance theory (Brehm, 1989), as also summarized by Shi et al. (Shi et al., 2020). Conformity theory predicts that consumers follow group norms and rely on others' behavior, in particular popularity cues, to determine the value of a product (or the nature of a threat, when considering risk). The prominent effect of scarcity on popularity is directly aligned with this explanation, although it is not inconsistent with commodity theory. Uniqueness theory (Fromkin, 1970; Snyder and Fromkin 1977) instead predicts that consumers are firstly motivated by seeking exclusivity, which may explain the effect of supply-based scarcity cues on experiential and hedonic products, and those consumed in a highly visible manner (Van Herpen et al., 2009).

The regret framework can help explain the effect of time-based scarcity on purchase intentions for experiences and high involvement products. From a consumer's perspective, when encountering a situation where product scarcity exists, a consumer will try to make sense of the situation and attribute the scarcity either internally (e.g., to self-induced inaction in obtaining a product 'quick enough') or externally (e.g., to the supplier or to outside factors such as the market or the wider environment). Whereas the scarcity itself will signal popularity and quality, it is the inferred reasons for the scarcity that will invoke particular attitudes and that also may arouse particular emotions. Regret in terms of fear of missing out or in terms of regret of engaging with a particular supplier – including the extent to which a scarcity situation is considered as 'fair' – is not considered in the commodity or conformity frameworks but may play a significant role in determining consumer responses. Even more so, reactance may play a role where consumers feel forced or limited in their freedom to choose or more generally perceive a lack of agency (Brehm, 1989). While not the focus of this research, reactance may shed insight into the effects of scarcity in the context of generalized restrictions such as pornographic materials, illicit substances, and more recently, vaccination uptake in response to the Covid-19 pandemic. Our meta-analysis did not include variables that relate to these frameworks as too few studies included such variables. This is not to mean these variables are not relevant. There are many examples which can demonstrate the role of consumer emotions and the importance of primal responses to situations of scarcity, including aggression towards retailers for lack of stock during a pandemic. The many anecdotal examples versus relative lack of studies including such variables indicates their importance for future research.

Implications

The evidence presented here is relevant to marketing practitioners who utilize scarcity cues and tactics in their marketing campaigns. For marketers of experiential products, supply-based scarcity cues have the largest effect on purchase intentions. Practically speaking, communicating restricted op-

portunities to obtain and participate in an experience is almost three times as effective in lifting purchase intentions than utilizing demand-based scarcity cues. For marketers of hedonic and high involvement products, for example online booking of hotel rooms, supply-based and time-based scarcity cues have the greatest influence on purchase intentions. For these product types, marketing communications highlighting the restricted supply or time window to purchase, for example "only X rooms available for the next X hours" have the greatest effect on consumer purchase intentions. For marketers of utilitarian products, cues indicating demand-based scarcity are the most effective at influencing consumer purchase intentions. Marketing campaigns highlighting strong prior consumer demand, for example empty grocery aisles void of toilet paper, will help drive consumer inference of product popularity, extending through to further increases in demand, and in turn, preference and purchase intentions. For both low and high familiarity brands, supply-based scarcity has the largest influence on purchase intentions and there is no evidence that the effect of scarcity type varies with brand familiarity. Finally, for products consumed in a conspicuous manner, campaigns featuring supply-based scarcity cues that highlight the exclusivity of the product will lead to greater purchase intentions, compared with campaigns featuring demand-based scarcity cues.

In sum, marketers may consider communicating the most appropriate source of scarcity according to whether the innovation material or experiential, hedonic or utilitarian, low or high involvement, or even if a product is consumed in a more or less visible manner. For example, a marketer of a utilitarian washing powder would do best utilizing demand-based scarcity cues communicated via partially depleted shelves, as evidence of prior consumer demand. This would stimulate an informational cascade, such that consumers infer the product's popularity and quality and consider purchasing. On the other hand, a hedonic experience such as a theatre performance would best be marketed under restricted supply cues, communicating its exclusivity and stimulating snob effects and greater purchase intentions. Paying close attention to how these product and consumption level characteristics influence purchase intentions will guide marketers in developing the most effective scarcity campaign according to their product portfolios.

Limitations and future research

This research integrated 416 effect sizes from 131 studies published over 50 years, and offers insight into the differential impact of scarcity on purchase intentions according to product, consumer, and consumption context characteristics. Our analysis did not include unpublished studies but Rosenthal's Failsafe *N* shows that between 30 and 6985 studies would be required to reduce the significant results to non-significance. By synthesizing the breadth and diversity of scarcity findings, we uncovered a number of research gaps that can guide future research (Table 5).

Strategic implementation of scarcity cues

First, a broad theme emerging from our analysis is the extent to which a distinction can indeed be made between more utilitarian or material products, for which demand-based scarcity tactics are more effective, and more hedonic or experience-based products, for which supply based tactics are more effective. The four theories discussed in this paper still only provide a partial understanding of these differences and how and why they operate. In particular, the role of emotions and fundamental group behavior such as herding deserves more attention, an example being the recent study by Coker (Coker, 2020). Relatedly, the phenomenon of fear of missing out (e.g., (Hodkinson, 2019)) is widely referred in the media but has been relatively little studied in terms of its role in driving scarcity effects and how it applies for different sources of scarcity. Based on our analysis it can be expected that visibility will play a role in creating FOMO especially for time-based scarcity; however, it can also be expected to play an important role in reinforcing the effects of exclusivity in generating scarcity effects for hedonic products and experiences.

Further understanding of scarcity effects and how they can be managed could also be gained from investigating the role of perceptions and attributions of the causes of scarcity. Despite a long tradition of attribution research (Weiner, 2000), relatively little attention seems to have been paid to how scarcity effects are moderated by attribution and other perceptual factors, such as framing. In many cases, there is a duality and ambiguity as to whether a particular instance of scarcity should be, or will be, perceived as demand based or supply based, or both. For example, a new product or service may be launched as a limited edition and may be perceived as scarce because it is clear there is only limited production capacity. For the same token, if there is a good initial uptake, it may be perceived as being popular and in high demand, which may be evidenced by a high sales number or by extensive social media coverage. A new restaurant will seek to manage these perceptions and limit its capacity to what is manageable and (seemingly) exclusive but will also ensure there are enough bookings for the opening week to quickly establish a perception of popularity. Time based scarcity is even more complex as it will overlap and may interact with either of the other two types. The restaurant may have a different strategy for bookings for weekends than for weekdays, and may decide to open only on particular evenings in order to maintain not only their profitability but also their perceived popularity. Little research has investigated these complex interactions. We hope our analysis will help researchers navigate where to put their research efforts.

Demand-based scarcity

More research is needed into how scarcity can be strategically used, including how scarcity principles should be implemented, as also noted by Shi et al. (2020). In the case of demand-based scarcity, what is the optimum level of empty shelf-space in order to stimulate bandwagon effects? Is there a negative impact of leaving shelf-space empty? Leaving shelf-

Table 5
Future research questions.

Issue	Comment	Research questions
Strategic implementation of scarcity cues	Many scarcity cues are ambiguous and can be interpreted as demand, supply, and/or time-based restrictions by consumers.	What role does attribution play when consumers interpret, make sense of, and act on scarcity cues?
Demand-based scarcity	Consumer may infer as popularity signals from evidence of prior consumer demand, leading to further increases in demand. However, disorganized shelves can lead to perceptions of product contamination or poor stock management.	What is the optimal level of shelf-based scarcity that will stimulate bandwagon effects? What is the impact of stock display (e.g. number of facings) versus empty shelf space on popularity and quality perceptions and purchase intention? Will consumers attribute increased demand to popularity or to poor organization and planning on behalf of the retailer?
Supply-based scarcity	Supply-based scarcity has traditionally been a feature of the luxury, high involvement segment but limited-edition cues are now seen in the marketing of lower involvement products such as Barbie Dolls and chocolate. By definition, a limited-edition product has a restricted absolute number of units produced, whether that be 10 or 10,000,000. These products are particularly desired by those with a high need for uniqueness. Uniqueness theory predicts that consumption decreases amongst this segment once a product gains popularity with the masses.	Is there a minimum/maximum number of stock-keeping units that optimizes snob-effects among consumers? Beyond which stock level does product interest start to decrease, and does this vary across consumption contexts and product characteristics? Does increasing popularity and consumption of products limited in supply dilute the exclusivity of these products? Is there a spill-over effect for the brand? Will these effects be different for different types of products?
Time-based scarcity	Products constrained by natural time windows, such as seasonal availability have the option of being marketed as being available for a "limited time" or through "limited supply". Is there an optimal window to stimulate demand and urgency in these situations. Time-based scarcity requires deadlines to be met by consumers. Consumers seek to beat these deadlines and seek to avoid regret from missing out. However, most time-based scarcity is combined with sales promotions, which often have their deadlines extended by retailers.	How does the interval of time impact consumer behavior? Is there a negative impact from extending the time-frame or from a consumer missing the deadline, for example through reactive behaviors or perceptions of unfairness? What is the impact of time-based scarcity on a consumer's urgency to buy? Does this change a consumer's processing of information related to the product, brand, and message? How does this relate to effects of time pressure and possible consumer time-based constraints? How effective is time-based scarcity without the use of sales promotions?
Dependent variables	Our dataset comprised only 24 effect sizes measuring actual behavior, and only 6 effect sizes from field based studies, with the balance ($k = 384$) measuring hypothetical situations. Field based studies or panel data exploring the effect of different scarcity cues in real shopping environments are needed to ensure that the effects of scarcity are generalizable outside lab-based environments.	Under what conditions do purchase intentions translate into actual purchases?
	Since perceptions of popularity and quality are important inferences drawn from scarcity cues, more research is needed to uncover nuances in these relationships.	How does scarcity influence perceptions of enjoyment, exclusivity, popularity, quality, and willingness-to-pay? How does it impact on attributions?
Other factors	Demand-based scarcity cues are particularly effective when communicated via physical displays, such as empty shelves, however these cues cannot be directly communicated over e-commerce channels. This is similar for experiential purchases, which have stronger effects when marketed with time-based scarcity cues. Thus, it is important to understand how online retailing interacts with scarcity cues and consumer behaviors.	How does the digital retail environment impact the effectiveness of scarcity cues?
	While our meta-analysis found no overall effect of age or sex, we were unable to explore nuances in these relationships to ascertain whether there are differences by source of scarcity, or for different product and context characteristics. For example, much of the millennial generation favor experiences over material goods, but it is unknown if these consumers respond to scarcity cues with more urgency, higher willingness-to-pay, or enjoy their scarce purchases more compared to purchases that are not scarce.	Do different types of consumers perceive and respond to scarcity differently?

space unreplenished will increase the risk of stockouts but it also may make a cluttered impression on customers, possibly undermining the customer experience and the store's image, or it may result in other items temporarily taking over the shelf space (e.g. (Koschat, 2008)). Also, as Castro et al. (2013) identified, while empty shelf space suggests popularity, products displayed in a disorganized fashion can result in perceptions of product contamination. Alternatively, they may generate perceptions of poor management of stock.

Supply-based scarcity

For supply-based scarcity, is there a minimum number of stock-keeping units that optimizes snob-effects among consumers? Das, Spence, and Agarwal (2021) recently found that showing the number of products viewed and number of products bought online have different effects on purchase intentions. Will producing 20 Hermès Birkin handbags stimulate the same sense of exclusivity as producing 100, or even 200 handbags? And how does this minimum depend on other moderating variables identified in this meta-analysis, such as consumption category and product benefits?

Time-based scarcity

For time-based scarcity, how does the time interval selected by the vendor impact consumer behavior? For example, at which point will customers feel excluded or unfairly treated, with the possibility of reactive behavior emerging? As the time-based scarcity studies included in this research combined time-based scarcity cues with sales promotions, much is unknown about how, or if, time-based scarcity influences behavior without these promotions. As previously mentioned, research has categorized time-based scarcity relating to the "offer", rather than the product, however time-based scarcity still applies to seasonal availability of products such Hot Cross Bun's at Easter, or even experiences. In these situations, retailers have the option of marketing these types of products as available for a "limited time" or as "limited supply", and little is known about whether one tactic would work better than another.

Dependent variables

A number of important dependent variables were unable to be analyzed in full, in terms of how they vary across sources of scarcity, due to a lack of studies (see Web Appendix F). Particularly lacking are studies of the effects of time-based scarcity on popularity and exclusivity. Given the managerial relevance of time-based scarcity as a tactic and the powerful behavioral effects of these two perceptions, this would seem a fruitful area for future research. Also, our moderation analysis was confined to purchase intentions. As widely accepted, purchase intentions do not always result in actual purchases, and the relative paucity of studies reporting actual rather than hypothetical behavior suggest there is room for future research to uncover exactly how scarcity cues operate in real shopping environments compared to lab-based scenarios and surveys.

Other factors

There are several consumer and consumption context variables that deserve more study. As much of the millennial generation favor experiential purchases over goods (Gleeson, 2019) the differences between age cohorts in how they respond to particular types of scarcity deserves more attention. Differences between online and offline transactions due to scarcity effects are also relevant for further study, particularly given the increased consumer reliance on online channels (Grewal, Roggeveen, and Nordfält 2017), particularly during the global pandemic.

Conclusion

This paper presented a meta-analysis that extends previous research into scarcity effects by (1) comprehensively summarizing existing research into the use of scarcity cues and tactics in marketing; (2) extending Lynn's (Lynn, 1991) meta-analysis by distinguishing different sources of market-based scarcity; and (3) identifying and testing new moderators and context effects. The results confirm that scarcity cues generally have positive and robust effects, and highlight nuances in the relationship between scarcity cues and consumer purchase intentions, depending on the source of scarcity, and across product types, purchase conditions, and consumer characteristics. Retailers should be cognizant of these factors when implementing scarcity cues and tactics in their promotional campaigns.

Declarations of Interest

None.

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