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The influence of scarcity on brand equity: An investigation on co-branded product

稀缺性對品牌權益的影響：聯名品牌產品之研究

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Abstract: The purpose of this study is to examine the influence of scarcity on brand equity, particularly through the lens of limited-quantity co-branded products. This research aims to integrate two distinct models—scarcity and consumer-based brand equity (CBBE) facets—to investigate the effects of co-branding in the context of Taiwan. The study collects data through 400 valid questionnaires from residents in Taiwan, utilizing structural equation modeling (SEM) to analyze the data. The research focuses on assessing how a limited-quantity co-branding strategy influences various components of brand equity, such as perceived quality, perceived value, and perceived uniqueness. The empirical findings indicate that a limited-quantity co-branding strategy has a positive effect on brand equity. Specifically, perceived scarcity positively influences the CBBE facets—perceived quality, perceived value, and perceived uniqueness. Additionally, the study finds that assumed expensiveness positively impacts perceived value and perceived uniqueness, although it does not significantly affect perceived quality. Furthermore, the mediation effect of willingness to pay a price premium between perceived quality, perceived uniqueness, and purchase intention is evident. The findings offer valuable

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insights for marketers and brand managers, particularly in the use of scarcity as a strategy to enhance brand equity. The positive impact of limited-quantity co-branding on perceived quality, value, and uniqueness suggests that companies can effectively leverage scarcity to increase consumer willingness to pay a price premium and to drive purchase intentions. This study contributes to the literature by integrating the scarcity model with CBBE facets to explore the effects of co-branding in Taiwan. The research offers a novel approach by empirically testing the relationship between scarcity, brand equity, and consumer behavior, providing both theoretical and practical implications for branding strategies in the context of limited-quantity products.

Keywords: Scarcity, co-branding, consumer-based brand equity, perceived quality, perceived value, perceived uniqueness.

摘要：本研究的目的是探討稀缺性對品牌權益的影響，尤其是透過數量有限的聯名品牌產品進行研究。本研究旨在整合兩種不同的模型--稀缺性和消費者品牌權益（CBBE）--來探討聯名品牌在台灣的影響。本研究透過 400 份有效問卷收集台灣居民的資料，並利用結構方程式模型 (SEM) 分析資料。研究的重點在於評估有限數量的聯名品牌策略如何影響品牌權益的各個組成部分，如認知品質、認知價值和認知獨特性。實證研究結果顯示，數量有限的聯名品牌策略對品牌權益有正面影響。具體來說，感知到的稀缺性對 CBBE 的認知品質、認知價值和認知獨特性有正面影響。此外，研究也發現預期昂貴性會對認知價值和認知獨特性產生正向影響，但對認知品質沒有顯著影響。願意支付溢價在認知品質、認知獨特性和購買意圖之間的中介效應也很明顯。研究結果為行銷人員和品牌經理提供了寶貴的洞見，尤其是使用稀缺性提升品牌權益的策略上。有限數量的聯名品牌對認知品質、價值和獨特性的正面影響表明，企業可以有效地利用稀缺性來提高消費者支付溢價的意願，並推動購買意願。本研究結合稀缺性模型與 CBBE，探討台灣企業聯名品牌的影響，對文獻研究有所貢獻。本研究提供了一個嶄新的方法，透過實證測試稀缺性、品牌權益與消費者行為之間的關係，為有限數量產品的品牌策略提供理論與實踐上的啟示。

關鍵詞：稀缺性、聯名品牌、消費者基礎品牌權益、認知品質、認知價值、認知獨特性。

1. Introduction

Thanks to the effects of globalization, business organizations have been competing on the local, national, and global levels. In such a business environment, companies may adopt diversification strategies. Besides, they can either develop new products for existing markets or to use a market development strategy to offer existing products to new markets and generate profit to sustain competitive advantages (Jayawardena et al., 2024; Peng et al., 2024). Thus, an increasing number of firms seek to co-brand their products with other companies with the intention of utilizing positive connotations of the partner brand and developing new markets (Spethmann and Benezra, 1994; Washburn et al., 2000; Qiao, 2023). Co-branding happens when two or more brands collaborate to launch new products and participate concurrently in marketing activities (Guiltinan, 1987). The use of co-branding has been growing worldwide, with the understanding that it would help companies break out of the existing markets and create a win-win strategy for the involved brands. Co-branded products usually have quantity and/or time limits, and these limits lead to co-branded products' scarcity (Cialdini, 1985; Goldsmith et al., 2024). Lynn (1989) made an observation that consumers prefer products that are difficult to obtain, compared to readily available products. For example, a collaboration between Louis Vuitton and Supreme in 2017 purposefully created a limited supply of co-branded products, and those products sold out in a very short period (Leitch, 2017). Therefore, scarcity might be one of the important factors driving the success of the co-branding strategy. This research adopts Lynn's (1992) scarcity-expensiveness-desirability (S-E-D) model to explain the effects of co-branding strategy.

Consumers always want what they cannot have. If some products seem scarce, consumers crave it even more. Because when companies make some

products feel like they are in short supply, their demands go up. Therefore, perceived scarcity plays tricks on consumers' minds. It is one of the most useful ways to increase sales for companies. Asuncion (2024) argues there are six ways to use the perceived scarcity effect to increase demand, and they include: limit the quantity available; generate time-sensitive offers; demonstrate how fast your products are selling; provide exclusive access; apply pre-orders or waiting lists; and make your products seem rare or new. Thus, perceived scarcity deserves special attention in this study.

Why do we introduce brand equity? Brand equity is a theory defined as "a brand's name adding value to its products (Farquhar, 1989), and those so-called elements, factors, constructs, or dimensions attributing to a brand's value. Brand equity is driven by consumer perceptions of the brand. Thus, brand equity reveals the overall value of the brand, which is mainly a function of consumer's trust and confidence in the brand to deliver the expected performance, as well as consumers' willingness to favor the brand (Koschate-Fischer et al., 2019; Huang, 2024). While examining Lynn's (1992) S-E-D model and its extended works, it is found that scarcity could be one of the antecedents that explains brand equity. Accordingly, brand equity could be part of the scarcity model, but there is very little research on the connection between the two. Scarcity is also a characteristic of co-branded products. Most works on the co-branding effects on brand equity focus on the individual brands' effect on the formation of the brand equity of the co-brands (e.g., Tasci and Guillet, 2011; Washburn et al., 2000; Washburn et al., 2004). Yudha et al. (2023) explore the influences of customer-based brand-equity and packaging respectively on purchase decision, and Cengiz and Şenel (2024) find that perceived scarcity directly increases impulse-buying tendencies (IBT) and that fear of missing out (FOMO) partially mediates this relationship. There is no research which discusses the relationship between perceived scarcity and consumer-based brand equity (CBBE). Although Qiao et al. (2022) explore the influences of perceived product value on CBBE, there is no prior research discussing the relationship between perceived scarcity and CBBE. Once understanding the relationship between perceived scarcity and brand equity,

firms would know better how to design their products and in turn, enhance their brand equity in the competitive global market. This study combines two distinct models – Chen and Sun's (2014) scarcity model derived from Lynn's (1992) S-E-D model, and CBBE model derived from various brand equity models initiated by Aaker (1991) – to study the co-branding effect. This study would like to fill the first research gap. Besides, as mentioned, most co-branding and brand equity studies do not focus on the nature of co-branding concept, but the attributes of the individual brands. There seems to be a gap in literature in this aspect. Co-branding can result in spillover effects on each partner brand's equity (Turan, 2021). By employing the S-E-D model, this study likes to explore how the nature - perceived scarcity and assumed expensiveness - of co-branding products would affect brand equity. This study would like to fill the second research gap. Therefore, this study proposes a model that allows combining S-E-D model and CBBE model to study the co-branding effect, contributing to the field of brand equity and offering suggestions for co-branding strategies for companies.

2. Literature review

2.1 Co-branding

Co-branding is when two or more brands and companies collaborate to build strategic partnerships and achieve strategic goals (Boone, 1997). It is a marketing and branding strategy that assists firms in creating competitive advantages in fast-paced markets (Besharat, 2010; Mohan et al., 2018; Yu et al., 2021). It can create a greater synergy effect between brands, and enable the involved brands to benefit from the halo effect of affection (Shen et al., 2014). It can also attract more attention from existing consumers (Desai and Keller, 2002; Zhu et al., 2024), and establish new relationships with various groups of consumers (Walchli, 2007). Co-branded products are usually released in limited quantity and/or timeframe, which makes them scarce. This research focuses on co-branded products with scarce quantity, as it has been discussed more

prominently in the literature than the timeframe constraint (Gierl et al., 2008; Gierl and Huettl, 2010).

2.2 Scarcity-expensiveness-desirability (S-E-D) model

Lynn (1989) explains that scarcity is a fundamental concept of economics that indicates the limited availability of a resource or a product. Moreover, the concept of scarcity has also been used in a number of other disciplines, e.g. psychology, sociology, and anthropology (Oruc, 2015). Lynn (1989) proposes a S-E-D model, that demonstrates how the assumed expensiveness of scarce products mediates these products' desirability by consumers, and later on, he adds more mediators - attributed quality and perceived status - to form scarce products' desirability (Lynn, 1992). Few extended works of Lynn's (1992), for example, Wu and Hsing (2006) and Chen and Sun (2014), try to find out more variables to explain the relationships between scarcity and desirability. Wu and Hsing (2006) adapt the S-E-D model, and divide desirability into three stages: purchase intention as the representation of customers' responses, attributed by perceived values of the scarce products, and the perceived values that are formed by perceived quality, perceived monetary sacrifice, and perceived symbolic benefits. Chen and Sun (2014) use perceived uniqueness in a different product context instead of Wu's perceived symbolic benefits. This paper adapts Chen and Sun's (2014) scarcity model, with the main elements being the mediators of scarcity: perceived quality, perceived uniqueness, and perceived values. This model echoes one of the consumer-based brand equity models, which is discussed next.

2.3 Consumer-based brand equity

Brand equity refers to "a set of brand assets and liabilities linked to a brand, its name and symbol that adds to or subtracts from the value provided by a product or service to a firm and/or to that firm's consumers" (Aaker, 1991, p. 27). According to prior research, brand equity is regarded as a valuable marketing asset that can raise financial performance, maintain brand support, increase

market share, and overall enhance competitive advantages (Aaker, 1991; Yoo et al., 2000; Hyun et al., 2022; Koçan and Yıldız, 2025). There have been a number of studies attempting to conceptualize brand equity, or, more precisely, CBBE, as these two terms are considered to be interchangeable (Netemeyer et al., 2004). CBBE is defined as "the differential effect of brand knowledge on consumer response to the marketing of the brand" (Keller, 1993; Satar et al., 2023). CBBE focuses on aspects of cognitive psychology and processes of consumer cognition (Aaker, 1996; Keller, 1993; Akın and Gürbüz, 2024). Existing brand literature conceptualizes CBBE as a composite of many consumer perception aspects, such as brand association, brand image, perceived quality, brand familiarity, and brand awareness (Aaker, 1991; Keller, 1993). It also incorporates consumer behavior aspects, such as preferences, loyalty, and purchase intention (Aaker, 1991).

Two major frameworks by Keller (1993) and Aaker (1996) are still the foundations of CBBE research. Netemeyer et al. (2004) integrate these two frameworks and categorize the brand equity constructs into the core or primary CBBE aspects and related brand associations. Both contribute to the brand response, i.e. purchase intention and actual purchase. Netemeyer et al.'s (2004) primary CBBE facets consist of perceived quality, perceived uniqueness, perceived values, and willingness to pay a price premium. As discussed earlier, Chen and Sun's (2014) scarcity model includes perceived quality, perceived uniqueness, and perceived values to explain the purchase intention, and these variables are part of the Netemeyer et al.'s (2004) primary CBBE facets. Therefore, this research adopts Netemeyer et al.'s (2004) CBBE facets, to be part of the scarcity model. This study focuses on the core and primary CBBE aspects; thus, CBBE includes perceived quality, perceived uniqueness, perceived values, and willingness to pay a price premium.

2.4 The research model and research hypotheses

The variables of Chen and Sun's (2014) scarcity model and Netemeyer et al.'s (2004) CBBE facets are perceived quality, perceived value, and perceived uniqueness. These three variables are the desirability part of the S-E-D model

and the antecedents of the willingness to pay a price premium within the CBBE facets. The proposed scarcity model theoretically includes the whole CBBE facets. The research model is based on Chen and Sun's (2014) scarcity research model derived from Lynn's (1992) S-E-D model and Netemeyer et al.'s (2004) CBBE model initiated by Aaker (1991). This study explains the mediation effect of assumed expensiveness on the relationship between perceived scarcity and three factors — perceived quality, perceived uniqueness, and perceived value — from two aspects. Firstly, consumers usually associate perceived scarcity with assumed expensiveness (Atlas and Snyder, 1978; Lynn, 1989). Secondly, assumed expensiveness enhances perceived quality, perceived uniqueness, and perceived value, because high priced products are status symbols (Lynn, 1991) and high price is often used as a cue to perceived quality, perceived uniqueness, and perceived value (Monroe and Petroshius, 1981; Lynn, 1992). Based on the above statement, assumed expensiveness is considered as a mediator in the research model in this study. Figure 1 below demonstrates the research model of this study.

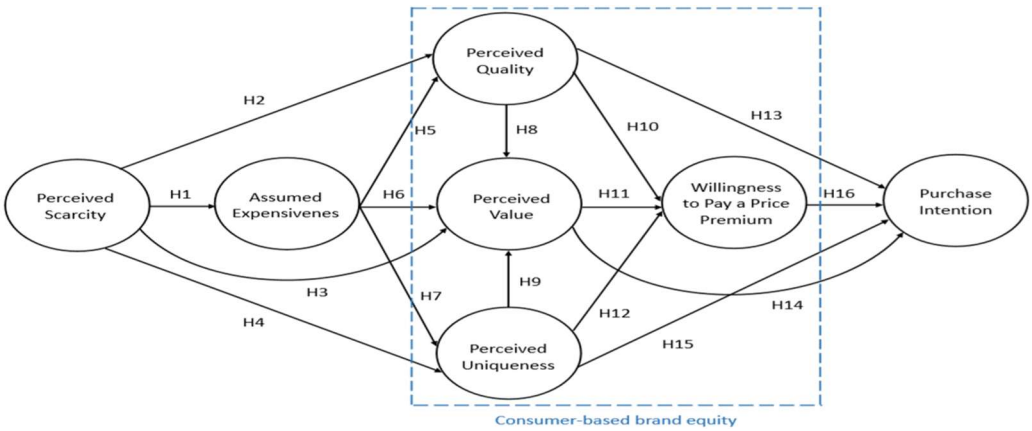

Figure 1

Research model

2.4.1 Influences of perceived scarcity on assumed expensiveness, perceived quality, perceived value, and perceived uniqueness

Goldsmith et al. (2024) underscores resource scarcity as a critical antecedent that fosters a heightened desire for self-improvement. By creating a state of vulnerability, resource scarcity drives individuals to seek ways to enhance their capabilities and improve their personal or professional circumstances. This relationship between scarcity and the motivation for self-betterment highlights the psychological impact of limited resources on consumer behavior, suggesting that scarcity can be a powerful catalyst for self-improvement initiatives.

Perceived scarcity is regarded to be a type of psychological effect, i.e., consumer perception of a given scarce product (Worchel et al., 1975). Grierl et al. (2008) create a scarcity classification: the limitation in quantity and limitation in time. Quantity limitations are caused by restrictions of the supply, or the higher demand over quantity supplied; while limitation is time is the result of the supply side decisions. Gierl et al. (2008) and Gierl and Huettl (2010) state that the effect of scarcity is more clearly demonstrated by quantity limitations. Current research follows this proposition.

Lynn (1992) refers to scarcity as associated with expensiveness due to the naïve economic theories, and consumers assuming that a scarce product is more expensive than the easily available one (Lynn, 1989). Scarcity could be achieved by the superior quality of the product (Groth and McDaniel, 1993), so scarce products are presumed to be of high quality. Many studies also reveal that scarcity has a positive relationship with high quality (e.g., Cialdini, 1985; Lynn, 1992; Chen and Sun, 2014). Brock's (1968 p. 246) commodity theory claims that "any commodity will be valued to the extent that it is unavailable". In other words, the scarcity of a commodity enhances the value of a product (Cialdini, 1985; Lynn, 1991), so consumers value a scarce commodity more compared to an easily available commodity. People like to own scarce products because such products are distinctive and unique (Amaldoss and Jain, 2005; Cengiz and Şenel,

2024), as well as popular, fashionable, original, and novel (Lynn, 1991). Therefore, in the limited-quantity co-branded product context in this research, it is plausible to posit that:

H1: Perceived scarcity has a positive impact on assumed expensiveness.

H2: Perceived scarcity has a positive impact on perceived quality.

H3: Perceived scarcity has a positive impact on perceived value.

H4: Perceived scarcity has a positive impact on perceived uniqueness.

2.4.2 Influences of assumed expensiveness on perceived quality, perceived value, and perceived uniqueness

Jacoby and Olson (1977) describe prices as consisting of two parts: objective and perceived prices. Objective prices are the actual numerical prices of products, while perceived prices are the subjective view of the prices by consumers. Prices act as an indicator for evaluation of the performance of the product or service in the consumption experience (Dodds et al., 1991). The actual prices are usually seen by the consumers as low or high, or cheap and expensive, through subjective perceptions that form a memory of perceived prices later on (Kashyap and Bojanic, 2000). Therefore, assumed expensiveness can be explained as a price perceived by the consumers to be high, and scarce products are normally assumed to be expensive due to the Law of Supply in economics (Lynn, 1992).

Both the S-E-D model by Lynn (1992) and the price-perceived quality model by Monroe and Krishnan (1985), note that assumed expensiveness positively influences perceived quality. Consumers' perception of value is based on the cognitive trade-off between the sacrifice (e. g., prices), and product or service quality (Dodds et al., 1991). When consumers perceive a product that has a higher price, they also perceive this product to be of higher quality (Groth and McDaniel, 1993; Wu and Hsing, 2006). Since high price is usually applied as a cue to perceived quality, perceived uniqueness, and perceived value (Monroe and Petroshius, 1981; Lynn, 1992) and high priced products represent status symbols (Lynn, 1991), price and assumed expensiveness are highly related. Dodds and

Monroe (1985) note that the perception of prices has a negative impact on the perception of value. Besides, when consumers consider the price of a product to be high, they recognize the product as distinct from other products (Groth and McDaniel, 1993; Wu and Hsing, 2006; Maharani and Hidayat, 2023). Therefore, in the co-branded product context in this study, it is plausible to posit that:

H5: Assumed expensiveness has a positive impact on perceived quality.

H6: Assumed expensiveness has a negative impact on perceived value.

H7: Assumed expensiveness has a positive impact on perceived uniqueness.

2.4.3 Influences of perceived quality and perceived uniqueness on perceived value

Previous studies emphasize the difference between perceived quality and objective quality (Dodds and Monroe, 1985). Objective quality is measurable and possesses technical superiority or excellence on some predetermined ideal standards of the products (Hjorth-Anderson, 1984). Perceived quality is therefore not a specific attribute of a product but an abstraction. In other words, it is the subjective judgment of a consumer on the overall excellence or superiority of a product (Zeithaml, 1988).

The perceived uniqueness is the consumer's evaluation of elements that differentiate brands from their competitors (Netemeyer et al., 2004). Uniqueness allows the brand to avoid being copied from me-too brands (Anselmsson et al., 2007). Dhar and Sherman (1996) reveal that consumers prefer to focus on the unusual or unique attributes of a given brand or product and tend to ignore the general attributes of similar products or brands. Uniqueness makes for an expressive memory of a brand, and it can maximize the effectiveness of brand marketing (Hyun and Park, 2016). Therefore, unique brands or products can have a strong point of difference and stand out from other brands. It can be easily noticed, recognized, and remembered by consumers, compared to its counterparts (Netemeyer et al., 2004).

The price-perceived quality model demonstrates that perceived value increases when perceived quality increases (Monroe and Krishnan, 1985;

Maharani and Hidayat, 2023). In the same vein, perceived quality is recognized as an important driver of perceived value (Parasuraman and Grewal, 2000; Konuk, 2019). Consumers' perception of uniqueness increases their positive evaluations of the product value (Amaldoss and Jain, 2005; Suttikun and Meeprom, 2021). When the perceived uniqueness is greater, the perceived value becomes higher (Jonah and Chip, 2008). Therefore, in the co-branded product context in this research, it is plausible to posit that:

H8: Perceived quality has a positive impact on perceived value.

H9: Perceived uniqueness has a positive impact on perceived value.

2.4.4 Influences of perceived quality, perceived value, and perceived uniqueness on willingness to pay a price premium

When consumers perceive the high quality of a specific product, they are more likely to pay more for this product (Aaker, 1996), so perceived quality is suggested to be a strong antecedent of willingness to pay a price premium (Kirmani and Zeithaml, 1993; Netemeyer et al., 2004). The perceived value appears in multiple academic disciplines, such as service marketing, psychology, sociology, and economics (Boksberger and Melsen, 2011). It is a crucial factor in business practice and strategic management (Sanchez-Fernandez and Iniesta-Bonillo, 2006; Boksberger and Melsen, 2011), and it is recognized as a powerful indicator for the prediction and analysis of consumer behavior and purchase intention. Perceived value is considered as a personal judgment or evaluation of the benefits or utility obtained from a product, service, or relationship, as well as sacrifices and costs (Teas and Agarwal, 2000; Lin and Zhou, 2022; Yu and Zheng, 2022). Monroe (1990) states that willingness to pay a particular price for a given brand or product is an effect of the total high perceived value of the brand or product, and studies have produced empirical results to support this relationship (e.g., Kirmani and Zeithaml, 1993; Netemeyer et al., 2004). In addition, perceived uniqueness is also a strong predictor of people's willingness to pay more for a product (Kalra and Goodstein, 1998; Netemeyer et al., 2004), which is consistent with Aaker's (1996) research that

shows the uniqueness of products prompting consumers' willingness to pay more for them (Oppong et al., 2023). Therefore, in the co-branded product context in this study, it is plausible to posit that:

H10: Perceived quality has a positive impact on willingness to pay a price premium.

H11: Perceived value has a positive impact on willingness to pay a price premium.

H12: Perceived uniqueness has a positive impact on willingness to pay a price premium.

2.4.5 Influences of perceived quality, perceived value, perceived uniqueness, and willingness to pay a price premium on purchase intention

A price premium is an additional sum that a consumer is prepared to pay for a given brand or product over a similar brand or product (Netemeyer et al., 2004). The willingness to pay a price premium demonstrates a brand's ability to extract higher monetary gain from consumers compared to its competitors (De Chernatony and Segal-Horn, 2003), and is the representation of effective brand management. When a consumer is willing to pay a price premium for a brand or product, a consumer sees this brand or product in a more favorable light than others. When consumers recognize a particular product as having better quality, they are more likely to purchase this brand or product (Monroe and Krishnan, 1985; Dodds et al., 1991; Yoo et al., 2000). Consumers' purchase intention is generated when they perceive a higher value from a given product (Zeithaml, 1988; Chang and Wildt, 1994). Furthermore, consumers' perception of uniqueness positively correlates to their intention to purchase (Shukla, 2012; Srinivasan et al., 2014), as well as their willingness to pay a price premium has the same effect on purchase intention (Aaker, 1996; Netemeyer et al., 2004). Therefore, in the co-branded product context in this research, it is plausible to posit that:

H13: Perceived quality has a positive impact on purchase intention.

H14: Perceived value has a positive impact on purchase intention.

H15: Perceived uniqueness has a positive impact on purchase intention.

H16: Willingness to pay a price premium has a positive impact on purchase intention.

3. Research methodology

3.1 Target population

The target population of this study is people aged 16 and above, who are residing in Taiwan. The reason for the inclusion of senior high school students, who are considered to have less spending or purchase power, is based on a research finding. Wu (2019) conducts a research project on senior high school students' education in managing their money, and their consumption behavior. It reveals that this group of consumers have a high tendency in impulse and conspicuous consumption (Wu, 2019). Based on this, this research considers that senior high school students should also be included in this research.

This research does not require respondents to have experience in purchasing co-branded products before, as perceptions and intentions can be formed based on prior knowledge and information (Sharifpour et al., 2014). Before respondents fill in the online questionnaires, they have to read the information with respect to co-branded products online. Their responses can represent their actual feeling with regards to purchasing co-branded products.

3.2 Measurement scales and data collection

An online questionnaire is designed to collect data. To ensure the reliability and validity of the measurement scales, existing scales are adapted from extant literature. To measure perceived scarcity, the scale is adapted from the studies of Lynn and Bogert (1996) and Swami and Khairnar (2003); for the assumed expensiveness construct, Wu and Hsing's (2006) scale is adapted; to measure perceived quality, Dodds et al.'s (1991) scale is adapted; to measure perceived values, Netemeyer et al.'s (2004) and Dodds et al.'s (1991) scales are adapted; for the constructs of perceived uniqueness and willingness to pay a price

premium, Netemeyer et al.'s (2014) scales are adapted; to measure purchase intention, Dodds et al.'s (1991) scale is adapted. The scales of this study are based on a seven-point Likert scale (1: strongly disagree to 7: strongly agree).

As the penetration rate of the social media in Taiwan has reached 89% of the total population by 2018 (Thomala, 2021), the online questionnaire is distributed via social media (e.g., Facebook, Line).

3.3 Sampling

As it is unlikely to get a list of the population of Taiwan, this research employs a non-probability sampling technique. Due to the nature and limitations of the non-probability sampling, this study is designed to include three sampling techniques to make the samples more representable: quota sampling, convenience sampling, and snowballing sampling. The quota sampling technique enhances the resemblance to the whole population, and the proportions (quotas) of the populations are based on the Taiwan Department of Household Registration (2024). This research sets to include gender and region, representing demographic and geographical variables for quota sampling. To help increase the sample size in a short period of time, convenience and snowballing sampling techniques are also set to serve this purpose.

4. Empirical results

4.1 Sample profile

The data collection lasted for five weeks in 2020. Originally, 430 valid responses were collected. To fit the purpose of the quota sampling, 30 responses were randomly deleted based on the set gender and region quotas. Table 1 also shows the latest figures for the proportions for the gender and region in Taiwan in 2024 (Taiwan Department of Household Registration, 2024), and they are very similar to the collected data.

Table 1

Results of quota sampling

		Collected data		Planned (Quota) data		*Proportion in 2024
Gender	Male	198	(49.60%)	198	(49.50%)	49.25%
	Female	202	(50.40%)	202	(50.50%)	50.74%
	Total number	400	(100%)	400	(100%)	
Region	North	183	(45.53%)	185	(46.40%)	45.89%
	Center	98	(24.57%)	88	(22.10%)	24.57%
	South	106	(26.49%)	115	(28.80%)	26.15%
	East and Offshore Islands	16	(3.42%)	12	(3.10%)	3.38%
	Total number	400	(100%)	400	(100%)	

Source: Taiwan Department of Household Registration (2024)

Table 2

Other descriptive data of the samples (n=400)

Demographical variable	Descriptions	Frequency	Percentage (%)
Age	16-19	25	6.3
	20-29	85	21.3
	30-39	89	22.3
	40-49	86	21.5
	50-59	76	19.0
	60 and above	39	9.9
Education	High school or lower	68	17.1
	Junior college	57	14.2
	Bachelor	189	47.3
	Master	83	20.8
	Doctor	3	0.8
Occupation	Students	50	12.5
	Information and Technology	29	7.3

Manufacturing	83	20.7
Commercial services	31	7.8
Service industry	101	25.2
Agriculture	7	1.8
Government Employees	59	14.7
Others	40	10.0

4.2 Data analysis

4.2.1 Testing: Measurement and structural model

This research employs structural equation modeling (SEM) to analyze the data. It is required to specify the measurement model and structural model to see whether the observed model fits the research model (Hair et al., 2014). Reliability, validity, collinearity, and goodness-of-fit of the measurement model are tested for this purpose. Once the measurement model is specified and acceptable, the structural model can be evaluated, and hypothesis testing can be performed.

Cronbach's α and composite reliability (CR) are employed to measure construct reliability. According to Hair et al. (2014), the acceptable values for Cronbach's α and CR are both above 0.7. Convergent and discriminant validity are examined to ensure construct validity. Convergent validity is demonstrated when the average variance extracted (AVE) values are greater than 0.5, and the CR is greater than 0.7; whilst discriminant validity is demonstrated when the AVE of each construct is greater than the inter-construct correlation coefficients between two constructs (Hair et al., 2014). Table 3 below shows the results of assessing reliability, convergent validity, and discriminant validity for the measurement model. All the measurements mentioned above are satisfactory.

Table 3

Assessment of reliability, convergent validity, and discriminant validity

Construct	Cronbach's α	AVE	CR	PS	AE	PQ	PV	PU	WTP	PI
PS	0.875	0.591	0.878	0.769						
AE	0.923	0.706	0.923	0.424	0.840					
PQ	0.937	0.794	0.939	0.363	0.218	0.891				
PV	0.901	0.698	0.902	0.445	0.181	0.634	0.835			
PU	0.853	0.662	0.854	0.467	0.300	0.425	0.591	0.814		
WTP	0.876	0.729	0.888	0.359	0.249	0.542	0.621	0.473	0.854	
PI	0.961	0.890	0.960	0.274	0.024	0.509	0.667	0.455	0.742	0.943

*CR = Composite Reliability; AVE = Average Variance Extracted; PS = Perceived Scarcity; AE = Assumed Expensiveness; PQ = Perceived Quality; PV = Perceived Value; PU = Perceived Uniqueness; WTP = Willingness to Pay a Price Premium; PI = Purchase Intention.

** The diagonal figures in bold are the square root of the AVEs, the lower diagonal figures are the correlation coefficients between constructs

Collinearity is the linear relationship when two or more independent variables in the statistical model are highly correlated, which violates the assumptions of regression analysis (Hair et al., 2014). The variance inflation factor (VIF) is calculated to identify multi-collinearity among the independent variables (Vu et al., 2015). Multi-collinearity exists in the regression model when any of the VIF values is greater than 3.0 (Hair et al., 2014). Table 4 below shows the VIF values of the model. None of the values are greater than 3.0, demonstrating a satisfactory result.

Table 4

VIF values

	PS	AE	PQ	PV	PU	WTP	PI
PS		1.397	1.542	1.501	1.481	1.545	1.545
AE	1.239		1.364	1.368	1.341	1.293	1.273
PQ	1.801	1.796		1.575	1.807	1.764	1.803
PV	2.663	2.738	2.393		2.505	2.729	2.477
PU	1.673	1.709	1.748	1.595		1.744	1.763

WTP	2.697	2.545	2.636	2.684	2.694		1.798
PI	2.880	2.676	2.879	2.603	2.865	1.920	

For the goodness-of-fit indices, three types of indices are included for testing the measurement and structural model: absolute fit indices, including χ2, χ2/df, GFI and RMSEA; incremental fit indices, including NFI, CGI, and TLI; and parsimonious fit indices, including AGFI. The thresholds for the respective indices suggested by Hair et al. (2014) and Doll, Xia, and Torkzadeh (1994) are shown in Table 5 below. In Table 5, the values of these indices for the measurement and structural model for this research are listed, and proved that this model has a good fit.

Table 5

Results of goodness-of-fit

Indices	Measurement model	Structural model	Thresholds	Achieved	References
p-value (χ2)	0.000 (839.240)	0.000 (912.344)	≥0.05	×	Doll et al. (1994) Hair et al. (2014)
χ2/df	2.770	2.962	≤ 3	✓	
GFI	0.860	0.851	≥0.8	✓	
RMSEA	0.067	0.070	≤ 0.08	✓	
NFI	0.913	0.905	≥0.9	✓	
CFI	0.942	0.935	≥0.9	✓	
TLI	0.933	0.926	≥0.9	✓	
AGFI	0.826	0.818	≥0.8	✓	

4.2.2 Hypothesis testing

There are 16 hypotheses in this study. Once the structural model is confirmed, the hypothesis testing is completed, and the results are shown in Table 6below.

Table 6
Results of hypothesis testing

Hypothesis	Hypothesis relationship	Standardized path coefficient	t-value	Result
H1	PS → AE	0.463	8.078***	Supported
H2	PS→ PQ	0.394	6.378***	Supported
H3	PS → PV	0.127	2.261*	Supported
H4	PS→ PU	0.495	7.692***	Supported
H5	AE → PQ	0.048	0.848	Not Supported
H6	AE→ PV	-0.143	-3.099**	Supported
H7	AE → PU	0.126	2.201*	Supported
H8	PQ → PV	0.491	9.964***	Supported
H9	PU → PV	0.447	7.542***	Supported
H10	PQ → WTP	0.205	3.419***	Supported
H11	PV → WTP	0.430	5.542***	Supported
H12	PU → WTP	0.182	2.912**	Supported
H13	PQ→ PI	-0.056	-1.160	Not Supported
H14	PV → PI	0.373	5.640***	Supported
H15	PU→ PI	-0.079	-1.543	Not Supported
H16	WTP→ PI	0.606	10.119***	Supported

(*P<0.05, **P<0.01, ***P< 0.001)
(PS = Perceived Scarcity, AE = Assumed Expensiveness, PQ = Perceived Quality, PV = Perceived Value, PU = Perceived Uniqueness, WTP = Willingness to Pay a Price Premium, PI = Purchase Intention)

Three hypotheses are not supported; those are H5: assumed expensiveness' positive impact on perceived quality, H13: perceived quality's positive impact on purchase intention, and H15: perceived uniqueness' positive impact on purchase intention. The results of the research hypotheses are discussed in the next section.

5. Conclusion and discussion

Three hypotheses are not supported in this research. The first one demonstrated the insignificant result of the assumed expensiveness (AE)'s positive impact on perceived quality (PQ, H5), which is inconsistent with the extant research, particularly the naïve economic theories (Lynn, 1992). It is likely that the price-quality perception relationship may differ by different types of products, different experimental processes, and uncontrolled or unmeasured individual response variations (Lichtenstein and Burton, 1989). For example, durable products and nondurable products show different results in price-quality perception relationships (Lichtenstein and Burton, 1989). This study does not specify the nature of the co-branded products, as the researchers only considered testing the concept of limited-quantity co-branded products through CBBE context, instead of particular types of products or industries. Based on the research results, it is sensible to further investigate by categorizing co-brandings products into dichotomous products (e.g., durable/nondurable products) or products from different industries. However, such inconsistent results may imply an important message on the positive but very weak relationship between AE and PQ of co-branded products. Rao and Ruekert (1994) assert that co-branded products, formed by at least a well-known brand, signal a certain level of quality, so it may explain that when consumers assumed co-branded products could be expensive, they would not necessarily expect the quality of products to be high. In Lynn's (1992) S-E-D model, attributed quality (PQ in this research) and perceived status (PV and PU in this research) are the mediators of scarcity's effect on desirability (WTP/PI). This study confirms that only the perceived status (shown by perceived value and perceived uniqueness) of the co-branded products is the important mediator of scarcity's effect on desirability (PI).

The second and the third insignificant results are the perceived quality (PQ, H13) and perceived uniqueness's (PU, H15) hypothesized positive impact on purchase intention (PI). The relationships between the PQ/PU and the PI are not only insignificant but also negative, which is inconsistent with the extant

literature. Although the relationships between purchase intention (PI) and both of perceived quality (PQ) and perceived uniqueness (PU) are not significant (H13 and H15), the significant positive impacts of PQ and PU on willingness to pay a price premium (WTP) (H10 and H12), and WTP's significant impact on purchase intention (PI) (H16), make WTP is a full mediator between PI and both of PQ and PU. In the CBBE model of Netemeyer et al. (2004), the mediation role of the WTP was not highlighted, nor did the indirect influences of PQ and PU on PI were discussed. Therefore, when hypothesizing H13 and H15 based on the extant literature on consumer behavior, the present research only focuses on the new possible relationships between the existing CBBE variables. Based on the present research results, it implies that the higher the perceived quality/uniqueness of the products, only the consumers who are willing to pay a higher price for the products would have higher intention to purchase them, which is consistent with the research results of Netemeyer et al. (2004), who did not consider the mediating role of WTP in their model.

In terms of the CBBE facets, consistent with Netemeyer et al. (2004), the core/primary CBBE facets have a positive impact on the brand response variable (purchase intention), and the scarcity element has a positive impact on the perceptions of quality, uniqueness, and values of the limited-quantity co-branded products. It is to confirm that the co-branding effect, particularly in a limited-quantity context, will contribute to the brand equity which eventually enhances the intention to purchase these products. Particularly, the full mediating effect of the WTP shows its crucial role in CBBE. It is also important to address the partial mediation effect of the AE on the relationships between perceived scarcity and CBBE factors, i.e., PQ, PV, and PU. Perceived scarcity has a direct positive effect on AE, PQ, PV, and PU, and AE acts as a mediator for perceived scarcity and the CBBE factors but PQ.

This research makes two theoretical contributions. Firstly, we employ two different theories and identify the similarities between them, aiming to link two concepts together. This study combines two distinct theories and models – Chen and Sun's (2014) scarcity model derived from Lynn's (1992) S-E-D model, and

CBBE model derived from various brand equity models initiated by Aaker (1991) – to investigate co-branded products. Because there is no prior research combining the two models, this study makes the first theoretical contribution. Secondly, the relationships between the CBBE factors (perceived quality, perceived uniqueness, perceived value, and willingness to pay a price premium) and purchase intention are worth noting, as the full mediation effect of the willingness to pay a price premium (WTP) between the three perceptions (perceived quality, perceived uniqueness, and perceived value) and purchase intention has not been explored before. This study makes the second theoretical contribution.

When consumers consider limited-quantity co-branded products as scarce, they consider the quality, value, and uniqueness of these products to be higher, and they also assume these products are more expensive. While the products are perceived as more expensive, consumers' perceptions of the values and uniqueness are higher, but such is not the case with regard to quality. It does not mean that the quality of the co-branded products is not important. As discussed earlier, consumers may assume the product quality is as good as the separate brand(s), so brands should focus on maintaining their product quality for the co-branded products. When promoting the co-branded products, focusing on the values and uniqueness of the products, and quality may not be a big element to stress. In addition, as Rao and Ruekert (1994) suggest, a single brand may not be able to signal the product/brand quality by itself. This study recommends companies, whose product quality is underestimated by the public, to adopt a co-branding strategy with well-known brands as an efficient approach to promote themselves. Once the quality of the co-branded products is tested and secured, it may attract more customers from the partner brand.

According to the CBBE's effect on purchase intention of the limited-quantity co-branded products, only perceived value has a direct positive impact on it, and the impacts of perceived quality and perceived uniqueness' are indirect. Consumers who are willing to pay more for the products are the key to this limited-quantity co-branding strategy. Those who may pay more for the

co-branded products should be existing supporters/customers of the constituent/individual brands instead of new customers. Therefore, brand managers aiming for this context of co-branding strategy should know who their target audiences are, and should design appropriate marketing communication campaigns to disseminate the product information to the constituent brands' customers. The messages to their existing customers may be the same, but the channels to approach them may be different. Additionally, efforts to attract completely new customers should be reduced.

Based on the purpose of studying the influence of perceived scarcity on CBBE, two theories at the same time, this research tried to simplify the research context by using the concept of co-branding, instead of a specific type of co-branded products. This study verifies the positive relationship between perceived scarcity and consumer-based brand equity (CBBE). This study provides some practical recommendations for companies to enhance their consumers' perceived scarcity as follows. Firstly, companies can release a limited number of products to enhance their customers' perceived scarcity. Secondly, companies can create a sense of urgency, pushing their customers to believe their customers need to buy this product before someone else does. Thirdly, companies can offer exclusive access to their targeted customers, it instantly makes what you sell seem more scarce. Fourth, companies can make their products seem rare to build up a sense of scarcity for their customers. Fifth, companies can create a deadline of their product selling, their customers make quick decisions. Sixth, companies can apply pre-orders or waiting lists to create a sense of scarcity for their customers.

Speaking of future research, future research can gather a variety of data to undertake longitudinal research for the relevant topics of this study. Moreover, future study can explore how different types of limited-quantity products influence perceived scarcity, CBBE, purchase intention, brand loyalty, or online consumer behaviors. The determinant of CBBE in this study focuses on perceived scarcity, and future research can focus on other determinants, such as digital marketing factors or AI capabilities. Besides, we do not consider external

environmental factors (e.g., market growth, or environmental turbulence), and future research could investigate the influences of these external environmental factors on CBBE. Furthermore, the consequent of CBBE in this study focuses on purchase intention, and future research can focus on other consequents, such as brand loyalty or online consumer behaviors. In addition, future research can expand the sample from other countries to explore cross-cultural differences for the relevant topics of this study. Considering the parsimony of the research model, this study doesn't take control variables into account. Future research can add control variables into research models. The research results in this study can provide valuable recommendations to policy makers, managers, practitioners, experts, and scholars as reference.

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