

A Multivariate Analysis of Structural Linkages in Cross-Border E-Commerce: An Application of PLS-MGA

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ABSTRACT. This study presents a comprehensive multivariate analysis of cross-border e-commerce dynamics by developing and testing a complex structural equation model. Quantifying multifaceted socio-psychological and system-related variables requires robust analytical frameworks. Utilizing Partial Least Squares Multi-Group Analysis (PLS-MGA), this research analyzes multidimensional datasets representing two major supply markets (the United States and China). The conceptual model evaluates structural pathways between consumer affinity, ethnocentrism, e-service parameters, and terminal purchasing behaviors. The multivariate analysis rigorously establishes measurement invariance and validates the measurement model before unearthing significant direct, indirect, and heterogeneous structural linkages across the groups. Statistical findings demonstrate that trust and product judgments serve as critical mediating variables, with distinct structural variations identified between the examined cohorts. By empirically validating these complex interrelations through PLS-MGA, the study advances the application of advanced multivariate analytical methods in behavioral modeling.

1. Introduction

In the era of globalization and rapid digital transformation, consumer behavior has expanded beyond national borders. Cross-border e-commerce (CBEC), defined as online transactions between buyers and sellers located in different countries, has become a dominant trend in international trade [1]. CBEC enables consumers to access diverse products, compare prices, and evaluate quality, while at the same time creating new challenges for businesses in terms of competitiveness, marketing, and customer experience [2]. Evaluating these multifaceted

Received Mar. 30, 2026

2020 *Mathematics Subject Classification.* 62H25, 62P20, 91B42, 91C05.

Key words and phrases. quality metrics; trust constructs; multivariate analysis; PLS-MGA; behavioral modeling; cross-border e-commerce.

variables, however, requires robust quantitative models to capture the underlying structural dynamics.

Globally, CBEC has attracted increasing academic and practical attention, yet research in Vietnam remains limited. Although the country's digital economy is projected to reach 43 billion USD by 2025 [3], its widespread adoption is still hindered by challenges common to emerging economies, such as limited technological readiness, resource constraints, and insufficient institutional support. In practice, China and the United States are Vietnam's two main supply markets, each with distinctive characteristics. Chinese products are associated with affordability and variety through platforms such as Taobao, Tmall, and Alibaba [4], while U.S. products are valued for their quality, durability, and design, accessible through platforms such as Amazon, Walmart, and eBay. The strong trade partnership between Vietnam and the United States, exceeding 100 billion USD annually, further underscores the importance of these two markets, necessitating the use of comparative multivariate analysis to detect structural heterogeneities between them.

Although CBEC offers many opportunities for Vietnamese consumers, little is known about the determinants that shape their purchasing behavior, particularly when comparing products from the United States and China. Previous studies have seldom examined these differences in depth through advanced multi-group statistical frameworks, leaving a methodological and empirical gap in understanding how consumers perceive and evaluate foreign products from distinct markets.

This study seeks to address this methodological gap by developing a comprehensive analytical framework to investigate the determinants of cross-border purchasing behavior. Initially, Partial Least Squares Structural Equation Modeling (PLS-SEM) is utilized to evaluate the complex socio-psychological and platform-related structural pathways. To rigorously examine the heterogeneous effects between the two primary supply markets (the United States and China), we apply Partial Least Squares Multi-Group Analysis (PLS-MGA). Crucially, prior to the multi-group comparisons, the Measurement Invariance of Composite Models (MICOM) procedure is strictly executed to establish compositional invariance across the cohorts. Furthermore, comprehensive robustness checks are conducted to validate the stability, predictive relevance, and unobserved heterogeneity of the structural model. By empirically validating these complex interrelations through advanced multivariate techniques, the findings are expected to contribute both theoretical insights into behavioral modeling and practical implications for CBEC strategies.

The remainder of this paper is structured as follows. Section 2 reviews the relevant literature and develops the research hypotheses. Section 3 outlines the analytical framework and methodology. Section 4 presents the statistical results. Section 5 discusses the theoretical and managerial implications, along with limitations and directions for future research.

2. Literature review and hypotheses development

2.1. From consumer behavior to cross-border consumer purchasing behavior

Consumer behavior refers to the processes through which individuals or groups select, purchase, use, and dispose of goods, services, or experiences to satisfy their needs and desires [5]. Understanding these behaviors is critical for businesses to design appropriate strategies in product development, pricing, distribution, and customer engagement.

In the digital era, this concept extends beyond domestic boundaries to include cross-border e-commerce (CBEC). CBEC refers to online transactions between buyers and sellers located in different countries, facilitated by digital platforms [1]. These platforms operate under various models, including business-to-business (B2B), business-to-consumer (B2C), consumer-to-consumer (C2C), and hybrid forms such as B2B2C [6].

China and the United States dominate the CBEC landscape with extensive ecosystems. China offers platforms such as Alibaba and 1688 for B2B, Tmall, WeChat, and Jingdong for B2C, and Taobao for C2C. The U.S. market is represented by Amazon and ThomasNet for B2B, Walmart, Target, and BestBuy for B2C, and eBay for C2C. These platforms have reshaped international trade by connecting global consumers with diverse product offerings, lowering transaction barriers, and encouraging both developed and emerging economies to engage in cross-border commerce [7].

Prior studies suggest that consumer participation, trust in platforms, and psychological factors strongly influence CBEC behavior. Trust in particular reduces uncertainty and fosters willingness to purchase [2, 8]. Consumer engagement, information search, and product evaluation are also central to shaping online cross-border transactions [9, 7]. These findings indicate that CBEC purchasing behavior is driven not only by functional evaluations but also by psychological and relational factors.

2.2. Theoretical framework

To elucidate the drivers of cross-border consumer purchasing behavior, this study integrates four complementary theoretical perspectives: Social Identity Theory (SIT), Perceived Value Theory (PVT), the Information Systems Success (ISS) model, and the Stimulus-Organism-Response (SOR) framework. Together, these perspectives provide a comprehensive foundation linking socio-psychological and technological determinants directly to consumer decision-making.

SIT explains how individuals form positive self-concepts through group membership, which may extend to symbolic identification with foreign countries, thereby increasing their willingness to purchase imported products [10]. Meanwhile, PVT is applied to evaluate the trade-off between perceived benefits and sacrifices, focusing on how competitive pricing, unique product offerings, and reliable services collectively shape consumer purchasing intentions [11].

Furthermore, this study integrates the ISS model into the SOR framework to establish a robust mechanism for decoding technological influences. While the ISS model evaluates platform effectiveness through system, information, and service quality [12], the SOR framework provides the essential psychological pathway linking these technical metrics to behavioral outcomes. In this research, the platform quality dimensions derived from the ISS model function as external stimuli (S) that influence consumers' internal cognitive and emotional states (O), such as trust and product judgments, which ultimately drive their purchasing responses (R).

By synthesizing the socio-psychological and economic perspectives of SIT and PVT with the technologically integrated ISS-SOR framework, this research constructs a multidimensional model. This unified approach offers a highly robust theoretical foundation for analyzing Vietnamese consumers' purchasing behavior toward cross-border e-commerce products from the United States and China.

2.3. Antecedents of cross-border consumer purchasing behavior

The socio-psychological perspective highlights how consumer behavior is shaped by both psychological and social influences [13]. Within this view, consumer ethnocentrism, reflecting beliefs about the morality and rationality of buying foreign goods, can directly affect purchasing decisions [14]. In contrast, consumer affinity motivates consumers to prefer products from a specific foreign country, defined as feelings of liking, empathy, or attachment toward that nation [15]. Together, ethnocentrism and affinity represent key socio-psychological factors that shape cross-border purchasing behavior.

Drawing on the Information Systems Success (ISS) model, this study conceptualizes platform quality through three dimensions: information quality, system quality, and e-service quality. Information quality reflects the accuracy, timeliness, completeness, relevance, and consistency of the provided content [12]. System quality refers to the technical performance of platforms, measured by usability, reliability, adaptability, and response time [16]. E-service quality captures consumers' evaluations of online services, including responsiveness, delivery speed, and the ability to meet shopping needs [17]. In the e-commerce context, service quality additionally encompasses the service environment, product handling, and supplementary services [18].

Perceived benefits constitute another critical determinant of cross-border shopping, encompassing product uniqueness and price competitiveness. Product uniqueness refers to the degree of differentiation in features or design compared with domestic offerings, which generates added value, encourages a willingness to pay, and strengthens consumer perceptions of superiority [19]. Price competitiveness reflects a product's ability to offer fair value relative to alternatives [20]. When products combine reasonable pricing with reliable quality, consumers are inherently more likely to view them as worthwhile investments.

Finally, internal organism factors capture consumers' cognitive and emotional responses within the SOR framework. These include product judgments, representing comprehensive evaluations of goods based on design, durability, innovation, technology, and quality [21], and consumer trust, defined as confidence in a seller's reliability and fulfillment of promises [22]. Both constructs are critical in forming purchase intentions and driving actual cross-border buying behavior [8, 23].

2.4. Hypothesis development

Consumers often associate certain countries with high-quality, reliable products [15]. This trust reflects both cognitive beliefs about product standards and emotional connections with the country of origin [24]. Prior studies across diverse markets, such as the U.S. and Norway [25], Austria [10], and the U.S. [26], consistently highlight the role of consumer affinity in shaping product judgments and trust.

Consumer affinity is commonly defined as an affective construct reflecting sympathy and attachment toward a foreign country [10]. This definition was extended by conceptualizing affinity as a higher-order construct with four dimensions: culture/landscape, music/entertainment, people, and politics [25]. Their confirmatory factor analysis showed that this model explained 92% of the variance in consumer affinity.

Affinity encourages consumers to maintain ties with countries they feel connected to by purchasing products from those origins, reinforcing perceptions of quality and reliability [15, 27]. This emotional bond becomes part of consumer identity, fostering trust and willingness to buy [10]. Moreover, consumer experiences further strengthen affinity [26]. Given its significant role, this study adopts a specific higher-order measurement scale to evaluate products from the U.S. and China [25].

H1. (a) Consumer affinity has a positive relationship with consumer trust, (b) product judgments for products originating from the U.S./China.

The phenomenon of consumer ethnocentrism, defined as consumers' belief that purchasing domestic products is more appropriate and morally right than buying foreign ones [28, 29], often leads to biased product judgments that favor domestic goods. This tendency has been documented across diverse markets, including Saudi Arabia [30], Indonesia [31], Malaysia [32], China [33], and Vietnam [34, 35]. Prior studies consistently show that higher levels of ethnocentrism reduce the likelihood of purchasing foreign products [30]. Moreover, consumer trust may also be affected by ethnocentrism [27].

Research has further identified patriotism and nationalism as key antecedents of ethnocentrism [14]. A substantial body of global evidence indicates a negative relationship between consumer ethnocentrism and product judgments [36]. However, some studies found no robust statistical support [37, 38], whereas other research reported a positive effect of

ethnocentrism on product judgments in the Indian market [39]. Despite such inconsistencies, the dominant view suggests that consumer ethnocentrism negatively influences product judgments, particularly for foreign products. Based on this, we propose the following hypothesis:

H2. (a) Consumer ethnocentrism has a negative relationship with consumer trust, and (b) product judgments for products originating from the U.S./China.

Previous research highlights that both information quality and system quality significantly influence consumer trust by effectively addressing higher-level consumer needs [40]. During the ordering process, high-quality systems and accurate information not only fulfill fundamental transaction requirements but also act as catalysts for enhancing consumer satisfaction and building robust trust. In the context of cross-border e-commerce (CBEC) platforms, clear and comprehensive product information directly empowers consumers to make informed purchasing decisions and perceive greater value, while simultaneously reducing cognitive effort and perceived risks. Supporting this broader perspective, evidence indicates that information, service, and system quality collectively shape positive organizational outcomes [16], with tailored information and personalized services further enhancing perceived value [41]. Specifically within CBEC environments, a strong positive relationship has been confirmed between website information quality and consumer trust [23]. Based on these insights, we propose the following hypotheses:

H3. (a) Information quality has a positive relationship with consumer trust, and (b) product judgments for products originating from the U.S./China.

High system quality ensures stability, responsiveness, and functionality, which are critical for building trust in digital environments [40]. It is generally understood that while weak system performance and poor information naturally undermine trust, effective return policies and risk reduction measures can significantly enhance it [42]. Similarly, transparent website policies in foreign markets have been demonstrated to positively influence trust [43]. Furthermore, improving system quality strengthens perceptions of supplier reliability, with a direct positive effect of 13% on customer trust [40].

Beyond trust, system design inherently contributes to the overall consumer experience and value: aesthetically pleasing and functional systems naturally increase perceived value, whereas unstable or slow systems inevitably reduce user satisfaction. Cross-border e-commerce consumers, often less familiar with platform operations, are particularly sensitive to these system qualities [44]. In this context, system quality has been shown to significantly improve value perceptions among African university students [23]. Based on these insights, we propose the following hypotheses:

H4. (a) System quality has a positive relationship with consumer trust, and (b) product judgments for products originating from the U.S./China.

Fundamentally, e-service quality plays a direct role in shaping consumer emotions and behaviors, ultimately influencing their perceived value. It is widely recognized that a better service environment, higher product quality, and robust service guarantees naturally foster positive emotions, thereby increasing perceived value. In today's competitive marketplace, exceptional service quality has inherently become a key differentiator for businesses, directly driving overall consumer experience and shopping intentions on foreign websites. Specifically, in the context of cross-border shopping in South Korea, service quality has been found to significantly influence consumer attitudes and drive purchase behavior [45]. Moreover, it has been demonstrated that service quality has a positive impact on perceived product value [23]. Based on these findings, we propose the following hypothesis:

H5. (a) E-service quality has a positive relationship with consumer trust, and (b) product judgments for products originating from the U.S./China.

Price competitiveness is a critical determinant of consumer product judgments, directly balancing perceived value against cost. In the context of cross-border purchasing, this factor becomes even more vital. Consumers must evaluate not only the product's intrinsic attributes but also the total landed cost, which includes the base price alongside additional expenses such as shipping and import duties [46]. Consequently, when assessing foreign products from markets like the U.S. and China, price competitiveness strongly influences whether consumers perceive sufficient value to justify a purchase. Based on this rationale, we propose the following hypothesis:

H6. Price competitiveness has a positive relationship with product judgments for products originating from the U.S./China.

Numerous studies have highlighted that the desire for product uniqueness is a significant motivator for consumers in various countries, including South Korea [45] and China [33], etc.. Consumers often seek products that stand out from what is available in the local market, believing that unique products enhance their personal identity and social status. In the context of cross-border purchasing, the desire for uniqueness may become even more pronounced. Consumers are particularly attracted to foreign products from the U.S. and China, which are often perceived as offering novel features, innovative designs, or cultural appeal that local products cannot match. This perception of uniqueness can significantly influence consumer product judgments, leading them to perceive foreign products as more desirable or of higher value compared to domestic alternatives. Therefore, as consumers evaluate foreign products, their desire for uniqueness may lead them to assign higher value to these products and make more favorable judgments about them, which, in turn, influences their purchasing decisions. In light with this discussion, we posit that:

H7. Product uniqueness has a positive relationship with product judgments for products originating from the U.S./China.

In this study, trust refers to consumers' recognition of the reputation of cross-border e-commerce platforms, the service capabilities of sellers, and the quality of the products they offer. Previous research has shown that consumer value perceptions positively influence trust [47, 48], highlighting the importance of how consumers perceive the overall value provided by the platform and its products. When consumers perceive high value, they are more likely to trust the platform and engage in transactions.

Product judgments are fundamentally shaped by various factors, including product features, quality, design, and price, all of which play a crucial role in influencing consumers' purchase intentions [29]. Naturally, as consumers evaluate these factors, their resulting judgments not only affect their perceptions of product quality but also contribute to their overall trust in the platform or seller. Building on this, we argue that positive product judgments are likely to foster greater trust in the platform, as consumers associate the platform's offerings with quality and reliability. Furthermore, trust in the platform is a key determinant of cross-border purchasing behavior, as consumers are more inclined to engage in international transactions when they feel confident in the products being offered. Given these considerations, we propose the following hypothesis:

H8. (a) Product judgments have a positive relationship with consumer trust, and (b) cross-border purchasing behavior of Vietnamese consumers.

In the context of CBEC and online shopping, consumer trust plays a crucial role in reducing uncertainty during transactions, which is essential for encouraging consumers to make purchases [29]. Previous studies have consistently shown that consumer trust positively affects consumers' intentions to purchase products, as trust helps mitigate concerns about product quality, delivery, and potential risks associated with online shopping [8, 47]. When consumers trust the platform, the seller, and the product being offered, they are more likely to proceed with a purchase. In particular, trust in sellers and products directly influences consumers' confidence in making cross-border purchases, as it alleviates concerns about product quality, delivery reliability, and customer service. Consequently, the greater the trust consumers have in foreign sellers and the products they are offering, the more likely they are to engage in cross-border purchasing behavior. This relationship is especially relevant in the case of Vietnamese consumers, who may face challenges such as unfamiliarity with foreign sellers and concerns about product authenticity, shipping delays, or customs issues. Therefore, we propose that consumer trust has a positive relationship with cross-border purchasing behavior among Vietnamese consumers, as trust helps reduce these uncertainties and encourages purchase intentions. Based on these observations, we propose the following hypothesis:

H9. Consumer trust has a positive relationship with cross-border purchasing behavior among Vietnamese consumers.

3. Multi-method approach

This study adopts a multi-method research design following an exploratory sequential approach [49], in which qualitative insights serve as the foundation for subsequent quantitative analysis. By integrating both qualitative and quantitative methods, the study aims to comprehensively explore the factors influencing Vietnamese consumers' cross-border purchasing behavior. The research process is structured into three main stages: (1) a preliminary qualitative phase to refine constructs and develop measurement instruments, (2) a large-scale quantitative survey analyzed using partial least squares structural equation modeling (PLS-SEM), and (3) a post-hoc predictive assessment through robustness checks to validate the findings.

3.1. Measurement instruments

The qualitative phase aimed to develop a survey questionnaire with measurement scales tailored to the Vietnamese market context. The study primarily adopted validated scales from prior English-language research. These scales were translated into Vietnamese, and their accuracy was ensured through a rigorous back-translation procedure [50].

The scale adaptation process engaged two groups of experts. The academic group, consisting of researchers and educators, assessed the conceptual relevance of the constructs and the overall research model. The practitioner group, composed of professionals in Vietnam's e-commerce sector, refined the wording and contextual alignment of the scales. Beyond evaluating construct validity, the experts also provided feedback on the clarity and appropriateness of individual survey items. A preliminary version of the questionnaire was reviewed by 14 professionals across diverse sectors including CBEC platforms, logistics, retail technology, branding, trade law, payments, and international business research. A focus group discussion was subsequently held to resolve discrepancies and achieve consensus, ensuring that the final survey items were comprehensible and contextually appropriate.

Specifically, the measurement items for all variables were adapted from established literature to reflect the specific context of cross-border e-commerce (CBEC). Consumer Affinity (CAF) was operationalized as a second-order construct comprising four dimensions: Culture/Landscape (5 items, CAF1.1-CAF1.5), Music/Entertainment (3 items, CAF2.1-CAF2.3), People (6 items, CAF3.1-CAF3.6), and Politics (3 items, CAF4.1-CAF4.3) [25]. Similarly, Consumer Ethnocentrism (CET) was modeled as a second-order construct consisting of Nationalism (5 items, CET1.1-CET1.5) and Patriotism (3 items, CET2.1-CET2.3) [36].

Regarding platform quality and behavioral outcomes, the scales for Information Quality (4 items, INQ1-INQ4), System Quality (5 items, SYQ1-SYQ5), E-Service Quality (5 items, ESQ1-

ESQ5), Consumer Trust (3 items, CT1-CT3), and Cross-border Purchasing Behavior (4 items, CBB1-CBB4) were all adapted from a unified source [23]. Furthermore, measures for perceived benefits, including Price Competitiveness (4 items, PCN1-PCN4) and Product Uniqueness (3 items, PUQ1-PUQ3), were drawn from existing studies [43]. Finally, Product Judgments (PJ) were evaluated using a six-item scale (PJ1-PJ6) [39].

The final questionnaire measured Vietnamese consumers' cross-border purchasing behavior toward goods from the United States and China. All constructs were assessed using a five-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree). Additionally, the survey incorporated socio-demographic control variables (e.g., gender, age) to account for heterogeneity in consumer behavior across different market contexts. This comprehensive approach ensured the robustness and accuracy of the quantitative analysis in the subsequent research phase.

3.2. Data collection and analysis procedures

Selecting an appropriate sample size is crucial in structural equation modeling (SEM). A recommended guideline is that the minimum sample size should be at least ten times the maximum number of structural paths converging on any single construct [51]. Furthermore, tabulated calculations incorporating different characteristics of measurement and structural models provide an additional method to determine adequate sample requirements [52]. Given the need for a sufficient number of observations to ensure model stability in SEM, the current study opted for a substantially large sample of 2,061 respondents, which far exceeds minimum thresholds, thereby maximizing the robustness and reliability of the results.

Data for the study were collected through an online survey using a seven-point Likert scale to measure seven component constructs, with items adapted from previously validated scales. A non-probability sampling strategy, combining convenience and snowball techniques, was employed. The survey link was administered via Google Forms and distributed through social media and email to consumers in Vietnam with experience in cross-border e-commerce (CBEC). To broaden the reach, respondents were encouraged to share the survey with their acquaintances. Given the absence of a comprehensive sampling frame of CBEC consumers in Vietnam, this approach was deemed appropriate to secure a sufficiently large sample for structural equation modeling (SEM). To prevent duplicate submissions, participants were required to provide their email addresses. Data collection took place between December 2023 and August 2024, yielding 2,061 valid responses. Descriptive statistics of the demographic variables are presented in Table 1.

Table 1. Summary of survey sample

Demographics	Category	Full sample (N = 2,061)	U.S products (N = 1,044)	Chinese products (N = 1,017)
Gender	Male	955 (46.3%)	483 (46.3%)	472 (46.4%)
	Female	1,106 (53.7%)	561 (53.7%)	545 (53.6%)
Education	Below university	448 (21.7%)	317 (30.4%)	131 (12.9%)
	University	1,296 (62.9%)	515 (49.3%)	781 (76.8%)
	Above university	317 (15.4%)	212 (20.3%)	105 (10.3%)
Experience in CBEC	Less than 1 month	295 (14.3%)	179 (17.1%)	116 (11.4%)
	1–6 months	536 (26.0%)	319 (30.6%)	217 (21.3%)
	6–12 months	638 (31.0%)	304 (29.1%)	334 (32.8%)
	More than 1 year	592 (28.7%)	242 (23.2%)	350 (34.4%)

Following the guidelines outlined in [53], the partial least squares structural equation modeling (PLS-SEM) analysis was conducted in two main stages. In Stage 1, the measurement model was evaluated by examining: (1) Reflective indicators: factor loadings, Cronbach's alpha, composite reliability, average variance extracted (AVE), and heterotrait-monotrait (HTMT) ratios. (2) Formative indicators: redundancy analysis, variance inflation factors (VIF), and significance of indicator weights. In Stage 2, the structural model was assessed by considering VIF values, explanatory power (R²), predictive relevance (Q²), and the significance and relevance of path coefficients. Competing structural configurations were also compared to ensure the model's robustness. PLS-SEM was chosen due to its capacity to handle both direct and interaction effects while extending traditional multivariate regression capabilities.

4. Results

4.1. Assessment of measurement model

Data for this study were analyzed using SmartPLS 4.1.0 with the PLS-SEM approach. Two higher-order constructs consumer affinity and consumer ethnocentrism were specified as hierarchical component models. The reflective measurement model was evaluated for reliability, convergent validity, and discriminant validity.

Reliability was assessed using both Cronbach's alpha and composite reliability. Values above 0.70 indicate good reliability [52]. As shown in Table 2, all constructs met this criterion, with Cronbach's alpha values ranging from 0.706 to 0.893, confirming high internal consistency. Indicator loadings were also assessed against the recommended threshold of 0.7 [53]. Items that did not meet this requirement were removed to improve model fit. Specifically, 4 items were discarded for not meeting the threshold: CAF – Culture, landscape (item CAF1.2); CAF – Music, entertainment (item CAF2.2); CET – Nationalism (item CET1.2); and CET – Patriotism (item CET2.1). After re-specification, the reliability indices for all constructs remained high, as shown in Table 2.

Convergent validity was evaluated using the average variance extracted (AVE). According to [54], an AVE value of 0.50 or higher indicates that a construct explains more than half of the variance in its indicators. In this study, all constructs had AVE values above 0.60,

thereby satisfying the recommended guidelines [53]. These results confirm that the scales exhibit strong convergent validity.

Table 2. Reliability and convergent validity of the constructs

Construct	Cronbach's alpha	Composite reliability	AVE
CAF – Culture/ Landscape	0.843	0.869	0.622
CAF – Music/ Entertainment	0.706	0.775	0.631
CAF – People	0.892	0.892	0.649
CAF – Politics	0.802	0.802	0.716
CET – Nationalism	0.707	0.738	0.632
CET – Patriotism	0.866	0.886	0.660
Information Quality (INQ)	0.870	0.870	0.720
E-Service Quality (ESQ)	0.890	0.891	0.694
System Quality (SYQ)	0.861	0.861	0.643
Price Competitiveness (PCN)	0.809	0.809	0.636
Product Uniqueness (PUQ)	0.765	0.765	0.681
Consumer Trust (CT)	0.748	0.748	0.665
Product Judgments (PJ)	0.870	0.870	0.605
Cross-border Purchasing Behavior (CBB)	0.850	0.850	0.690

Discriminant validity was assessed using the Fornell-Larcker criterion and the heterotrait-monotrait (HTMT) ratio. First, the square root of each construct's AVE exceeded its correlations with other constructs (see Table 3), satisfying the Fornell-Larcker criterion. Additionally, the HTMT values for all construct pairs were below the recommended threshold of 0.85–0.90, with none exceeding 0.85 [54]. These findings confirm that the constructs are empirically distinct.

Table 3. Discriminant validity assessment

Constructs	ESQ	SYQ	INQ	CET	PCN	CBB	CT	CAF	PUQ	PJ
<i>Correlation and the square root of AVE (Fornell-Larcker criterion)</i>										
E-Service Quality	0.833									
System Quality	0.124	0.802								
Information Quality	0.240	0.348	0.848							
Consumer Ethnocentrism	-0.091	-0.132	-0.401	0.955						
Price Competitiveness	0.167	0.344	0.469	-0.377	0.797					
Cross-border Purchasing	0.219	0.337	0.472	-0.419	0.554	0.831				
Consumer Trust	0.363	0.449	0.576	-0.466	0.574	0.659	0.816			
Consumer Affinity	0.139	0.155	0.314	-0.344	0.341	0.380	0.489	0.890		
Product Uniqueness	0.224	0.172	0.406	-0.399	0.446	0.464	0.430	0.308	0.825	
Product Judgments	0.291	0.322	0.604	-0.528	0.688	0.659	0.688	0.470	0.652	0.778
<i>Heterotrait-monotrait (HTMT criterion)</i>										
E-Service Quality										
System Quality	0.141									
Information Quality	0.272	0.402								
Consumer Ethnocentrism	0.102	0.148	0.451							
Price Competitiveness	0.196	0.412	0.559	0.440						
Cross-border Purchasing	0.251	0.393	0.549	0.475	0.668					
Consumer Trust	0.444	0.560	0.713	0.564	0.738	0.826				
Consumer Affinity	0.153	0.176	0.351	0.377	0.397	0.430	0.590			
Product Uniqueness	0.271	0.212	0.498	0.479	0.566	0.575	0.569	0.369		
Product Judgments	0.329	0.371	0.695	0.595	0.820	0.766	0.853	0.525	0.799	

Moreover, including the same indicators in both lower-order and higher-order constructs may compromise discriminant validity, which is often revealed by elevated HTMT values or a failure to meet the Fornell-Larcker criterion [51]. In this study, no such violations were observed. Overall, the measurement model demonstrates satisfactory reliability, convergent validity, and discriminant validity. The constructs are shown to be both consistent and distinct, enabling confidence in subsequent structural model analyses.

The findings from the variable quality assessment, as well as the evaluation of reliability, convergent validity, and discriminant validity for both first-order and second-order constructs, confirm that the constructs meet the reliability requirements for hypothesis testing using PLS-SEM. In addition, the measurement model shows acceptable fit indices. Specifically, the SRMR value is 0.033, which is less than the 0.08 cutoff. Both d_{ULS} (0.915) and d_G (0.438) are relatively small. The chi-square to degrees of freedom ratio (χ^2/df) is 4.148, which is below 5, and the NFI is 0.882 exceeding 0.80.

4.2. Structural model and hypotheses testing

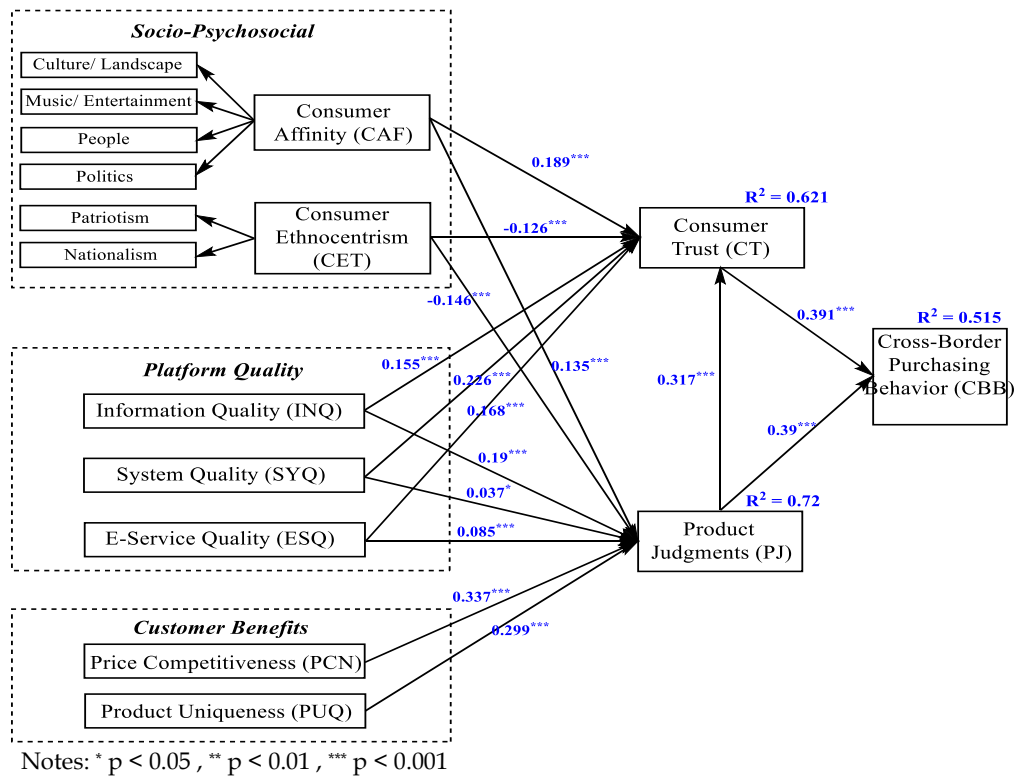
Table 4 shows that the structural model explains the endogenous constructs satisfactorily, as reflected by the high R^2 and adjusted R^2 values of 51.5% and 51.4%. Given that this research focuses on consumer behavior, an R^2 value exceeding 0.20 is considered strong [55]. Moreover, these values exceed the recommended 50% threshold [54]. To ensure the absence of multicollinearity, variance inflation factor (VIF) values must fall below the recommended threshold of 5.00; in this study, the highest VIF among the latent variables is 2.85, confirming that multicollinearity is not an issue [51]. Additionally, the Durbin-Watson statistic (d) is approximately 1, indicating no autocorrelation in the model, thus confirming the reliability of the results. The structural equation modeling meets the stated criteria, and additional out-of-sample predictive assessments, such as the Bayesian information criterion (BIC), have also been conducted (see Table 4).

The f^2 coefficient indicates the extent to which a construct influences the model when it is removed. According to [51], the change in the R^2 value is obtained by estimating the PLS path model twice: once with the independent variable included and once with it excluded, which allows calculation of the f^2 value. Following [56], f^2 values of 0.02, 0.15, and 0.35 correspond to small, medium, and large effect sizes, respectively. The results presented in Table 4 show that the majority of exogenous latent variables (ESQ, SYQ, INQ, CET, PCN, CT, CAF, PUQ, PJ) have f^2 values greater than 0.02, indicating small to medium effects on the endogenous latent variables. The only exceptions are e-service quality and system quality, which both exhibit f^2 values below 0.02 with respect to the product judgments variable.

Table 4. The results of R^2 , construct cross validated redundancy, BIC and total impact of f^2

Evaluation	Construct	Cross-Border Purchasing	Consumer Trust	Product Judgments
f^2	E-Service Quality		0.067	0.024
	System Quality		0.115	0.004
	Information Quality		0.038	0.082
	Consumer Ethnocentrism		0.029	0.055
	Price Competitiveness			0.258
	Consumer Trust	0.166		
	Consumer Affinity		0.072	0.053
	Product Uniqueness			0.221
	Product Judgments	0.165	0.122	
R^2		0.515	0.621	0.720
R^2 adjusted		0.514	0.620	0.719
Q^2 predict		0.353	0.409	0.432
Bayesian information criterion (BIC)		-1,467.955	-1,948.475	-2,559.890

The predictive relevance of the endogenous constructs was assessed using the cross-validated redundancy (blindfolding) technique to calculate the Q^2 index. For a specific endogenous construct, Q^2 values greater than zero indicate the predictive accuracy of the structural model. As a general guideline, Q^2 values above 0, 0.25, and 0.50 represent small, medium, and large predictive relevance, respectively [53]. The endogenous latent variables show the following Q^2 values: consumer trust at 40.9%, product judgments at 43.2%, and cross-border purchasing at 35.3%.

**Figure 1.** Results of the full measurement model test (PLS results visualization)

To further evaluate the model, Partial Least Squares Structural Equation Modeling (PLS-SEM) was employed to assess both the path coefficients and the overall structural model. This was done by applying the PLS algorithm in SmartPLS version 4.1.0 with significance levels determined via a bootstrapping procedure using 5,000 samples.

The analysis of the structural model and hypothesis testing indicated that all proposed hypotheses were supported (see Table 6 for details). Figure 1 illustrates the standardized path coefficients and R^2 values for the study, along with the corresponding path coefficients, p-values, and other model information. Significance levels of 0.1%, 1%, and 5% are indicated by ***, **, and *, respectively.

4.3. Robustness checks

To conduct a robustness check, this study employed covariance-based structural equation modeling (CB-SEM) with maximum likelihood estimation via AMOS 27 [57]. While CB-SEM and partial least squares SEM (PLS-SEM) differ technically, they serve as complementary analytical approaches. Although CB-SEM is a well-established technique, it demands stringent data conditions, making PLS-SEM a more appropriate alternative in many situations [51]. A comparison of the results from both methods (using AMOS and SmartPLS, respectively) demonstrated consistent findings regarding the significance and direction of parameter estimates. Furthermore, a hierarchical component model was tested by incorporating a second-order structure to capture the three dimensions of social media capabilities alongside the primary constructs.

To evaluate the CB-SEM fit, several goodness-of-fit indices were assessed. Following Confirmatory Factor Analysis (CFA), the RMR (0.041) and RMSEA (0.060) fell well within their respective acceptable ranges of < 0.05 and ≤ 0.08 . Furthermore, incremental fit indices, including GFI (0.817), TLI (0.881), CFI (0.891), and NFI (0.848), consistently exceeded the minimum 0.80 cutoff, indicating a satisfactory fit to the data [58]. With p-values at 0.000, the statistical significance, validity, and reliability of the proposed framework are confirmed.

Crucially, the standardized regression weights and hypothesis outcomes derived from the CB-SEM analysis aligned perfectly with those obtained via PLS-SEM. This consistency confirms that the primary PLS-SEM findings are not overly sensitive to specific data conditions or analytical techniques, thereby reinforcing the overall validity of the study. Consequently, this established robustness provides a solid methodological foundation for subsequent multigroup analyses to examine potential variances in relational pathways across different consumer segments.

4.4. Multi-group analysis

Building on this foundation, the study applied partial least squares multi-group analysis (PLS-MGA) using permutation and Welch-Satterthwaite tests to evaluate differences between

goods originating from the United States and China. Prior to conducting the MGA, measurement invariance was assessed via the measurement invariance of composite models (MICOM) procedure. Following the three-step MICOM protocol outlined in Table 5 assessing configural invariance, establishing composite invariance, and evaluating equal means and variances partial measurement invariance was confirmed between the two groups. Establishing this invariance is a crucial prerequisite, ensuring that any observed group-specific variations in the PLS-SEM results are genuinely attributable to structural differences rather than measurement discrepancies [59].

Table 5. Measurement invariance test using MICOM (permutation test)

Constructs	Compositional invariance			Equal mean value			Equal variances		
	C-value	p-value permutation test	Result	Mean original difference	p-value permutation test	Result	Variance original difference	p-value permutation test	Result
ESQ	1.000	0.803	Yes	-0.090	0.042	No	-0.020	0.682	Yes
SYQ	0.999	0.122	Yes	-0.060	0.175	Yes	-0.211	0.000	No
INQ	1.000	0.007	No	-0.317	0.000	No	0.208	0.000	No
CET	1.000	0.151	Yes	0.027	0.553	Yes	0.137	0.001	No
PCN	1.000	0.892	Yes	-0.050	0.257	Yes	-0.018	0.711	Yes
CBB	1.000	0.963	Yes	-0.004	0.919	Yes	-0.042	0.400	Yes
CT	1.000	0.856	Yes	-0.073	0.103	Yes	-0.031	0.499	Yes
CAF	0.995	0.000	No	-0.329	0.000	No	0.254	0.000	No
PUQ	1.000	0.461	Yes	-0.055	0.219	Yes	0.114	0.060	Yes
PJ	1.000	0.963	Yes	-0.094	0.045	No	-0.038	0.480	Yes

Following the establishment of measurement invariance, the PLS-MGA test was conducted to evaluate bootstrap estimates across the compared groups [54]. Path coefficient differences between the two datasets were then tested, with the comprehensive outcomes presented in Table 6. This assessment details both the group-specific path coefficients and the variations in composite mean values. Relying on standard statistical criteria, permutation p-values below the 0.05 threshold were utilized to indicate significant divergence between the two groups. Consequently, the findings reveal statistically significant differences in the structural relationships between goods originating from the United States and China.

The results from the multigroup analysis and permutation method demonstrate significant differences in the impact of system quality (H_{4b}) and e-service quality (H_{5b}) on product judgments. Specifically, the relationship between system quality and product judgments shows a significant difference between products from the United States and China. Furthermore, the study results do not support the influence of e-service quality on product judgments for U.S. products, but do support this relationship for Chinese-origin products.

Table 6. Results of hypothesis testing and comparison analysis

Hypothesis Relationship		Full model results	Results	Assessment of group differences			
				U.S products	Results	Chinese products	Results
H _{1a}	CAF → CT	0.189***	Supported	0,327***	Supported	0,126***	Supported
H _{1b}	CAF → PJ	0.135***	Supported	0,168***	Supported	0,137***	Supported
H _{2a}	CET → CT	-0.126***	Supported	-0,131***	Supported	-0,119***	Supported
H _{2b}	CET → PJ	-0.146***	Supported	-0,154***	Supported	-0,145***	Supported
H _{3a}	INQ → CT	0.155***	Supported	0,155***	Supported	0,176***	Supported
H _{3b}	INQ → PJ	0.190***	Supported	0,200***	Supported	0,184***	Supported
H _{4a}	SYQ → CT	0.226***	Supported	0,160***	Supported	0,267***	Supported
H _{4b}	SYQ → PJ	0.037**	Supported	0,041*	Supported	0,031	Not supported
H _{5a}	ESQ → CT	0.168***	Supported	0,178***	Supported	0,154***	Supported
H _{5b}	ESQ → PJ	0.085***	Supported	0,028	Not supported	0,139***	Supported
H ₆	PCN → PJ	0.337***	Supported	0,294***	Supported	0,365***	Supported
H ₇	PUQ → PJ	0.299***	Supported	0,289***	Supported	0,301***	Supported
H _{8a}	PJ → CT	0.317***	Supported	0,213***	Supported	0,362***	Supported
H _{8b}	PJ → CBB	0.390***	Supported	0,381***	Supported	0,402***	Supported
H ₉	CT → CBB	0.391***	Supported	0,401***	Supported	0,380***	Supported

Notes: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

5. Discussion and conclusion

To conclude, this study aimed to explore the factors influencing Vietnamese consumers' cross-border shopping behavior for U.S. and Chinese goods. The results reveal that the factors influencing Vietnamese consumers' behavior vary in their importance depending on the country of origin. Specifically, for U.S. products, consumer trust and competitive pricing play a particularly significant role in shaping purchase decisions. In contrast, for Chinese products, product judgments and product uniqueness emerge as stronger drivers. Other factors, including information quality, consumer affinity, ethnocentrism, system quality, and online service quality, also exert notable but varying effects depending on the product's origin.

5.1. Discussion of the findings

The findings indicate that Vietnamese consumers' cross-border shopping behavior is shaped by multiple factors, with their relative influence varying according to the product's country of origin (the United States versus China). Beyond examining trust and product judgments within the context of cross-border consumer behavior, this study further contributes by identifying the antecedents of trust and product judgments, which can be grouped into perceived benefits, platform quality, and socio-psychological factors.

Perceived benefits play a significant and positive role in shaping customers' cross-border shopping behavior. More specifically, competitive pricing exerts the strongest influence ($\lambda = 0.337$) on both product judgments and purchasing decisions for products from both countries, aligning with the consensus that attractive pricing is a major driver of online shopping behavior [43]. In addition, product uniqueness emerges as an important determinant ($\lambda = 0.299$),

particularly for Chinese and U.S. goods, as consumers perceive uniqueness as a key benefit that drives their motivation to engage in cross-border shopping [9, 45].

Platform quality emerges as an important antecedent that fosters cross-border purchasing behavior. Complementing this, information quality demonstrates a strong positive effect on both product judgments ($\lambda = 0.19$) and consumer trust ($\lambda = 0.155$) for U.S. and Chinese goods. This aligns with the consensus that complete and accurate information is central to building trust and mitigating risk in online transactions [7].

Furthermore, the PLS-MGA results reveal an asymmetric role of system quality: it exerts a notable influence on product judgments for U.S. goods ($\lambda = 0.041$) but shows no significant effect for Chinese goods, underscoring the context-dependent nature of digital system attributes. Similarly, e-service quality exhibits a differentiated impact. While it significantly affects evaluations of Chinese goods ($\lambda = 0.139$), it shows no such influence for U.S. products, even though it consistently enhances consumer trust across both contexts. These behavioral divergences suggest that Vietnamese consumers place greater emphasis on accompanying services, return policies, and customer support when purchasing Chinese products. Conversely, for U.S. goods, system and online service factors have a more pronounced effect on overall trust rather than on specific product judgments [43, 60].

Socio-psychological factors significantly influence consumer behavior by shaping attitudes, trust, and purchase intentions. In particular, consumer affinity demonstrates a multi-dimensional impact, influencing product judgments ($\lambda = 0.135$) while exerting an even stronger effect on trust ($\lambda = 0.189$). The result is consistent with prior studies showing that a favorable affinity toward the country of origin contributes to increased perceived value and greater consumer trust [10]. In contrast, consumer ethnocentrism does not significantly hinder foreign product judgments; its effect is relatively weak and tends to be negative ($\lambda = -0.146$). Despite patriotic sentiment and nationalism, many Vietnamese consumers primarily consider product quality, price, and brand [14].

The study further emphasizes the significant role of consumer trust in cross-border shopping behavior. Trust has the strongest impact on cross-border purchases ($\lambda = 0.391$) for both U.S. and Chinese goods, suggesting that once consumers trust a brand or platform, they are more willing to overlook geographical barriers and concerns about product origins when making online purchases [40]. Additionally, product judgments are important factors that influence both trust ($\lambda = 0.317$) and cross-border purchasing behavior in Vietnam ($\lambda = 0.39$). This indicates that the way consumers evaluate products significantly impacts their trust and willingness to engage in cross-border purchases. This pattern reflects Vietnamese consumers' flexible approach, whereby they may place greater emphasis on specific impressions such as performance, quality, and features [35] particularly for Chinese goods, which tend to offer a broad range of styles and price points.

5.2. Theoretical contributions

This study makes several theoretical contributions. First, it is among the first to simultaneously integrate Social Identity Theory, the Stimulus-Organism-Response (SOR) framework, and the Information Systems Success (ISS) model to explain cross-border e-commerce (CBEC) behavior. By linking socio-psychological constructs (ethnocentrism, affinity, and product judgments) with platform quality dimensions, the research extends the ISS model to evaluate their combined impact on consumer trust and purchasing decisions.

Second, the findings provide novel evidence on how consumer ethnocentrism and affinity shape perceptions and trust regarding foreign products, addressing the ongoing need for deeper examinations of these dynamics in international consumption contexts. Unlike prior research that predominantly emphasized product-specific attributes, this study bridges behavioral psychology and marketing management by concurrently incorporating both attitudinal and technological determinants.

Third, as the first empirical investigation in Vietnam comparing consumer evaluations of U.S. and Chinese goods, this research offers unique insights into how buyers in emerging markets balance quality, pricing, and cultural affinity. This context-specific evidence enriches international marketing literature and establishes a robust foundation for future comparative studies.

Finally, by systematically categorizing the antecedents of CBEC into socio-psychological drivers, perceived benefits, and platform quality, the study provides a comprehensive theoretical framework for cross-border consumer behavior. These insights not only advance academic understanding but also offer strategic value for addressing trust, perceived value, and international market integration.

5.3. Managerial implications

This study highlights several critical factors that shape Vietnamese consumers' cross-border purchasing intentions for U.S. and Chinese goods. First, consumer trust remains a cornerstone of online shopping across borders. International firms must invest in brand reputation, security technologies, transparent shipping and return policies, and certifications to reduce risks and overcome geographical or cultural barriers.

Second, pricing strategies and product uniqueness strongly influence competitive positioning. Reasonable prices that align with perceived quality can enhance value and drive purchase intentions, while offering distinctive or innovative products allows firms to differentiate themselves in a crowded marketplace. For suppliers from the United States or China, leveraging cultural identity, creative design, and technological innovation provides a pathway to greater appeal in Vietnam.

Third, the quality of information, systems, and online services underscores the importance of a holistic approach to consumer experience. Beyond secure transactions and user-friendly platforms, effective post-purchase support remains essential, especially for Chinese products where trust gaps may be more pronounced. Additionally, fostering consumer affinity through cultural exchange, education, and trade promotion can reinforce positive perceptions of a product's country of origin.

Overall, these findings provide actionable insights for international businesses seeking to penetrate emerging markets while also offering guidance for policymakers in shaping frameworks that support trust, quality, and fair competition in global e-commerce.

5.4. Limitations and further research

Although this study provides meaningful insights into Vietnamese consumers' cross-border purchasing behavior, several limitations should be acknowledged. The use of non-probability sampling restricts the generalizability of findings, suggesting the need for larger and more representative samples across different countries and cultural contexts. The study's focus on fully assembled consumer goods from developed markets may also overlook variations in preferences and logistics when considering products from emerging economies, medical supplies, or high-tech categories. Moreover, cultural nuances were not fully integrated into the research design, leaving room for qualitative approaches such as interviews, focus groups, or ethnographic studies to uncover deeper emotional and psychological drivers of consumer decisions. Finally, future research should explore emerging technological and marketing trends including augmented reality, social media, influencer marketing, and blockchain that are reshaping cross-border e-commerce in an increasingly interconnected digital marketplace.

Conflicts of Interest: The author(s) declare that there are no conflicts of interest regarding the publication of this paper.

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