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Effects of Portion Number and Marital Status on Decision-Making Dependence When Using Food Delivery Applications

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Abstract: Delivery applications represent more than just substitutes for phone calls when ordering food. Unlike phone calls, delivery applications not only facilitate orders and payments, but also assist users in narrowing down the multiple options to a final choice. This research focused on the extent to which users rely on delivery applications to make food-ordering decisions and examined how two factors—portion number and marital status—affect this dependence. The empirical results supported our prediction that (i) single-portion users depend more heavily on delivery applications than multiple-portion users, as the latter have no meal companions to consult; and (ii) unmarried (vs. married) users exhibited an even greater dependence on delivery applications in a single-portion-meal context, due to a weaker sense of responsibility for and agency over meal preparation. These findings illustrate how delivery applications can contribute to the expansion of delivery service markets by influencing food-ordering decision-making behavior.

Keywords: decision-making dependence; food-ordering decision; usage behavior about delivery applications; outsourcing meal preparation; intermediary

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1. Introduction

Food delivery services are relatively well-established in Asian countries, such as India [1] and Vietnam [2], where labor costs are cheaper than they are in many Western countries. Even before the advent of food delivery applications (hereinafter, *delivery apps*), there were numerous providers of food delivery services offering daily meals [3]. Delivery apps, in this regard, may appear as a mere substitute for a phone call to place a delivery order. Nevertheless, a subtle, but non-negligible, difference exists between a phone call and the use of delivery apps in terms of the manner in which the delivery services are used. While food ordering via phone calls starts only after the entire decision-making process of choosing food menus and restaurants is completed, ordering via delivery apps often begins without making such decisions. As such, the function of delivery apps is not limited to ordering and payment processing, but also facilitates and supports the decision-making process of food orders by users who may be undecided.

Inspired by this idea, the present study focuses on the conditions under which users depend more heavily on delivery apps for their decision making. A delivery app can provide information that facilitates decisions making regarding what to order and from where, thus, prompting the user to narrow down a set of alternatives to be considered for the final choice. Accordingly, a user may depend on the app to make decisions regarding ordering food in a way that is not possible through orders placed via phone calls. By introducing the concept of decision-making dependence on delivery apps, this study attempts to determine the conditions under which users rely on delivery apps to guide their food-ordering decisions.

Specifically, as the antecedents that may affect the construct, this study introduces two factors—the number of portions and marital status. This study proposes that users increase their dependence on delivery apps when they order single-portion rather than multiple-portion meals, and then predicts that the proposed effect is more pronounced for unmarried users than for married users. As there are no other human meal companions to consult when ordering a single-portion meal, users would be more likely to depend on nonhuman agents, such as delivery apps, to complete their order. Moreover, as unmarried users do not normally consider meal preparation as their responsibility and, thus, lack a sense of agency over it compared to married users, they may be more vulnerable to the absence of meal companions to consult in the context of ordering a single-portion meal. Namely, in the context of ordering multiple-portion meals, unmarried users may more willingly delegate their food-ordering decisions to other individuals. However, in the context of ordering a single-portion meal, they have no choice but to take charge of such decisions themselves. Thus, they may feel a greater need for support when ordering food, owing to the absence of meal companions to consult. Therefore, unmarried users would exhibit a greater dependence on delivery apps compared to their married counterparts in the context of ordering single-portion meals.

In brief, this study aims to address the call for research on what subtle transformations have been brought to the food delivery market by the emergence of delivery apps. Unlike traditional phone-call-based food orders, delivery apps empower users with the ability to make quick, spontaneous, and well-informed decisions about their food orders. This transformation effectively converts potential customers, who might have otherwise abstained from ordering, into active purchasers. Our focus is on elucidating this role of delivery apps as decision-making facilitators, revealing how they encourage users to engage more deeply in the food ordering process. This endeavor offers significant implications, as it provides a microscopic understanding of the growth of the food delivery market by shedding light on the behavioral mechanisms underlying the individual usage of delivery apps.

To empirically address these inquiries, we analyzed survey data from the actual users of delivery apps in South Korea, with an emphasis on the users' methods of ordering meals at home. This empirical study can provide a more nuanced understanding of the conditions under which delivery apps facilitate decision making when ordering food. It also highlights the important aspects of the changes that the rise in single-person households bring to dietary habits.

2. Literature Review and Hypotheses Development

2.1. Role of Delivery Apps as an Intermediary

Intermediaries refer to human or nonhuman agents that facilitate transactions between buyers and sellers by promoting their successful match [4–6]. Conventional examples of human agents include real estate agents, car dealers, and insurance brokers, whereas examples of nonhuman agents include Airbnb and Grab. For buyers who have not yet finalized their choice, these intermediaries provide utility by facilitating the exclusion of alternatives that are not likely to meet their needs [7]. Therefore, if intermediaries are expected to help to screen out ineligible options, they are more likely to be consulted and relied upon, due to their contribution to the final choice [8–10]

One typology of intermediaries comprises information vs. transaction intermediaries [4,5]. Information intermediaries refer to entities designed to assist buyers in processing information for purchasing decisions by creating, integrating, and delivering information [5,11,12] Transaction intermediaries are agents that support and complete transaction activities on behalf of the buyers or sellers, such as purchasing agents or stockbrokers [5]. Another typology distinguishes between human and nonhuman agents according to whether the intermediaries use human- or artificial intelligence (AI)/machine learning-based approaches [5,12]. Taken together, the categorization of intermediaries can be described along the following two dimensions: whether the agents are human or nonhuman and whether they are information or transaction intermediaries. Table 1 presents the four types of intermediaries.

Table 1. Typology of intermediaries.

		Transaction Intermediary	
		Human	Nonhuman
Information intermediary	Human	A. Traditional intermediaries Real estate agents Car dealers Insurance brokers	C. Application platform providers Application to an insurance of rental deposit - Naver financial corporation (South Korea) Application of portfolios to universities or museums - SlideRoom (US)
	Nonhuman	B. Information intermediaries Proptech apps - Zigbang, Dabang, Hogangnono (South Korea) - Suumo, AtHome, homes (Japan) - Trulia, Realtor.com, Homelight (US) - Lianjia (China)	D. Typical O2O service providers Food delivery apps—Baemin, Yoggio (South Korea); Doordash, Grubhub, Uber Eats (US); Deliver hero (Germany); Medituan-Dianping (China) Restaurants reservations—Catchtable (South Korea); Yelp (US); Omakase, Pocket Concierge, Table all (Japan) Local clinics—ddocdoc (South Korea); Zocdoc, Doctor on Demand (US); Clinics, Linedoctor (Japan) Local professionals—Soomgo (South Korea); TaskRabbit (US) Hair shop—Kakaohairshop (South Korea); Hot Pepper Beauty (Japan) Babysitting services—Tictoccroc (South Korea); UrbanSitter, Sittersity (US); Carefinder (Japan) Laundry services—Rewhite (South Korea); Rinse, Laundryheap (US); Edaixi (China) Wedding photography services—Famarry (Japan) Used items transaction—Danggeun market (South Korea); Facebook marketplace, OfferUp, Poshmarket (US) Limited edition of fashion goods—Kream (South Korea) Golf course reservation—Kakaogolf, Xgolf.com (South Korea); TeeOff, Supreme Golf (US); JapanGolf (Japan) Used car dealers—KBchachacha (South Korea); CarMax (US); Goo-net (Japan); Guazi (China) Insuretech apps—Bomap (South Korea); Lemonade (US); Policy Pal (Singapore) Accommodation—Airbnb (US); Stay Japan (Japan); Tujia (China) Taxi—Kakaotaxi (South Korea); Uber (US); Grab (South East Asia) Rent Car—Zzimcar (South Korea); Zipcar (US)

Category A indicates traditional human agents who facilitate both information exchange and transaction closure for real estate, cars, or insurance. Category B comprises nonhuman agents that engage in the facilitation of information sharing but do not directly participate in the transactions between buyers and sellers, or lessees and lessors. For instance, real estate apps, also known as proptech (property and technology) apps (for example, Zigbang, Suumo, or Trulia), provide integrated information concerning the current real estate properties for sale, but do not directly intervene in the transaction as a broker. Next, Category C includes online application websites that serve as platforms to submit applications regarding portfolios or insurance. For example, people first select which colleges or insurance providers to apply for according to offline reputation before they log into the application website. If these institutions designate a particular platform to submit portfolios or registration documents, applicants access the platform and submit them. These websites, in this vein, serve as the designated platform to submit application materials. Finally, Category D epitomizes the emerging online-to-offline (O2O) service providers who support the entire process of information exchange and transaction closure. Examples in this category are abundant in sectors such as food delivery (e.g., Uber Eats), taxis (e.g., Grab), local clinics (e.g., Ddocdoc), and local professional services (e.g., TaskRabbit).

It is notable that Category A contains businesses characterized by high margins per transaction, such as real estate agents or insurance brokers, whereas Category D includes businesses associated with relatively low margins per transaction, such as food delivery or taxi services. Furthermore, businesses included in Category A have been long-established in the market, even preceding the Internet era, while most of the businesses in Category D have emerged following the advent of the Internet and the widespread use of mobile gadgets.

The presence of intermediaries between buyers and sellers does require an amount of economic surplus per transaction large enough to cover the cost of intermediation. With intervention by an intermediary, more parties are to be considered when allocating the surplus.

Thus, a level of margin per transaction high enough to cover the cost of intermediation constitutes a necessary condition that ensures the presence of intermediaries. The recent emergence of businesses in Category D appears to have occurred owing to the reduction in costs associated with intermediation. Information and communication technology based on AI and big data has contributed to lowering the cost of intermediation by substituting expensive human agents and, thus, has made it possible to involve a third party beyond the buyer and seller, which was inconceivable in the past, due to narrow margins.

2.2. Role of the Number of Portions

In this context, the present study focuses on Category D and, in particular, food delivery apps. The context of meal preparation is closely intertwined with the daily life of the general population [13,14]. The need to eat exposes people to this context at least once daily. Moreover, it explicitly reveals the impact of group dynamics on the usage behavior of delivery apps in terms of the food-ordering decision process [15,16]. Specifically, it provides a comprehensive picture of how the number of people engaged in decision making changes the way that delivery apps are consulted to reach a final decision [17]. Compared to the meal preparation for a single portion, the preparation for multiple portions involves two or more people choosing menus and restaurants [18]. Namely, ordering multiple portions entails meal companions to be consulted for a user to make his or her ordering decision. Thus, the role of delivery apps in this situation is likely to be reduced to a mere substitute for a phone call to place an order.

In the context of ordering a single portion, however, there are no such meal companions or human agents to consult, and, therefore, users may instead refer to non-human agents—specifically, delivery apps—more closely in order to finalize their decisions. The utility of delivery apps arises from their contribution to narrowing down the scope of alternatives to be considered for the final choice [7]. If a user does not have an adequate idea about an impending meal preparation and must commence the ordering decision de novo, the user may consult nearby meal companions closely to refine his or her options regarding restaurants and menus items. The absence of meal companions indicates a lack of such human agents to consult [15,16]. The users in this situation may more closely refer to, and more heavily depend on, delivery apps to cope with the absence of meal companions when they order a single-portion meal, while exhibiting lesser dependence on delivery apps in the presence of meal companions when ordering a multiple-portion meal.

Specifically, this study defines the state of being maximally dependent on delivery apps by logging into them with a "blank slate" as zero-base, and the state of being minimally dependent on the apps by using them as a simple substitute for a phone call to order and pay as order-only [19,20]. The likelihood of choosing zero-base over order-only thus serves as a proxy for the decision-making dependence on delivery apps. Based on this conceptualization, this study hypothesized the following:

Hypothesis 1. *Compared to the context of ordering multiple portions, the context of ordering a single portion would lead to a greater dependence on delivery apps during decision making (i.e., a greater likelihood of zero-base over order-only).*

2.3. Moderating Role of Marital Status

The decision-making dependence on delivery apps can be predicted to increase in the context of ordering a single- rather than multiple-portion meal. If so, under what conditions would such a tendency be more pronounced? This study posits that a single-portion-meal user would exhibit a greater dependence on delivery apps in the absence of meal companions (Hypothesis 1). Those who have no human agents (that is, meal companions) to consult with during decision making rely on the help of non-human agents (that is, delivery apps) to cope with such an absence. Specifically, we highlight the sense of responsibility for meal preparation as the key factor that influences a user's vulnerability to the absence of meal companions. A sense of responsibility has been reported to reinforce the sense of agency, which draws on the feelings of autonomy over a focal task [21,22]. Thus, it is presumed that a decline in the sense of responsibility for meal preparation weakens the feeling of agency and autonomy over one's food choices, leading to a greater propensity for indecisiveness when ordering single-portion meals in the absence of meal companions.

To elaborate, the enhancement of the sense of agency accompanies an increase in the sense of responsibility [23–25]. Since the person in charge of a task is responsible for its progress and outcome, he or she is more likely to perceive the task as his or her "own business." That is, taking responsibility for a task implies that the task falls within the sphere of the personal jurisdiction of the concerned person [24,26]. Moreover, the enhancement of the sense of agency can be achieved only when autonomy over the task is properly ensured [22,23,27]. To encourage people to assume the responsibility more willingly for the outcomes from the focal task, autonomy over the decision-making process needs to be guaranteed [23,27,28]. Therefore, those who are equipped with a sense of responsibility may make decisions with a greater degree of independence from external sources.

As a proxy variable for the sense of responsibility, the present study focuses on marital status. In a typical modern family, decision-making responsibilities are shared between partners and include matters such as mortgage payments and meal planning. Unlike in traditional agricultural societies, where families typically comprised three or more generations living together, the modern family structure that emerged after industrialization is commonly centered around a nuclear family unit consisting of a couple and their children [29,30]. In industrialized societies, married individuals typically make important decisions, as well as day-to-day choices, regarding family matters. This study proposes that married individuals may have a stronger sense of responsibility for decision making related to meal preparation, which is a casual context for decision making.

Based on this line of reasoning, the present study proposes that married users exhibit a lower dependence on delivery apps when ordering single-portion meals compared to unmarried users. Married users tend to view food-ordering decisions as their own responsibility, regardless of the portion number, and, thus, take charge of the decision-making process. Conversely, unmarried users may exhibit a different pattern in their food-ordering decisions. In the context of ordering multiple-portion meals, they may defer to other individuals for the decision-making process; however, in the context of ordering a single-portion meal, they may have no choice but to take charge of the decision themselves. As a result, unmarried users who do not normally consider meal preparation as their responsibility, and, thus, lack a sense of agency and autonomy over it, may need to rely more heavily on delivery apps when ordering single-portion meals where there are no other meal companions available for consultation. In summary, due to their greater vulnerability to the absence of meal companions in the context of ordering single-portion meals, unmarried users may have a greater reliance on delivery apps compared to their married counterparts (Figure 1).

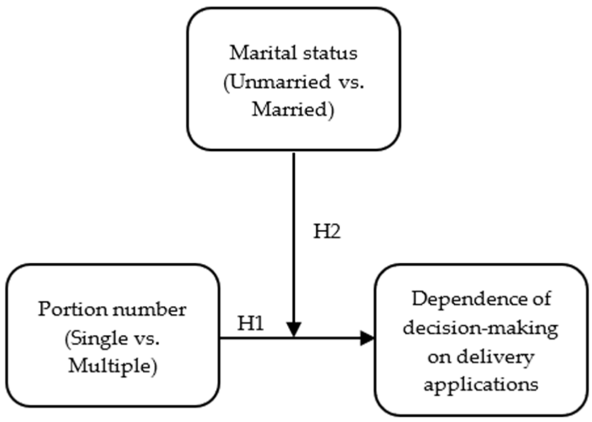

Figure 1. Theoretical Model.

Hypothesis 2. *The effect predicted in Hypothesis 1 would be more pronounced for unmarried vs. married users. Thus, the greater dependence on delivery apps (that is, the greater likelihood to choose zero-base over order-only) in the context of ordering a single- rather than multiple-portion meal would be more pronounced for unmarried users than for married users.*

3. Materials and Methods

3.1. Dataset and Sampling Description

This study drew on the dataset from the 2022 Delivery Service Trend Report, which was collected by Opensurvey, a consumer data platform in South Korea [31]. The dataset comprised 915 responses from users who had used delivery apps to order meals for household consumption. Among the samples, 43 responses were excluded, due to missing values in the contingency table (that is, between 4 or 5 portions (portion numbers) and divorce or separation by bereavement (marital status)). Including these responses in the analyses may have caused problems in estimating parameters when attempting the maximum likelihood approach to logistic regression [32]. Therefore, the final sample size was 872.

3.2. Measures

3.2.1. Dependent Variable

The focal dependent construct was the users' decision-making dependence on delivery apps. The extent to which a user depends on delivery apps to guide his or her decisions varies from no dependence to complete dependence. A user might prefer to use a delivery app as a simple tool for placing an order after completing all of the decisions on main dishes, portion number, and restaurant. In such cases, delivery apps apparently function as a mere substitute for a phone call to place an order. Alternatively, a user may start using an app from a complete-zero-base without making any prior decisions. This user may choose food menus and restaurants only after he or she has screened through candidates appearing in the application, and then exclude the perceived inferior candidates. In short, the former user hardly bases his or her decisions on the information in delivery apps, whereas the latter almost entirely depends on delivery apps to order food.

Decision-making dependence on a reference increases as one makes more use of the reference to guide his or her decision [19,20]. Accordingly, dependence on delivery apps in the present context is conceptualized as the extent to which a user utilizes delivery apps to guide his or her decisions on ordering food to reach a final choice [20,33]. In the aforementioned two scenarios, the present study treats the former case as the state of minimum dependence (which is referred to as the "zero-base" state), while treating the latter case as the state of maximum dependence (which is referred to as the "order-only" state; coded as 0 = order-only and 1 = zero-base).

The actual measure used to assess dependence on delivery apps comprised the following 5 categorical responses: (1) menu-only (making decisions on food menus only, and thereafter accessing delivery apps/websites through which decisions on restaurants and whether to use delivery or takeout services are made), (2) restaurant-only (making decisions about restaurant choice only, and thereafter accessing delivery apps/websites through which decisions on food menus and whether to use delivery or take-out services are made), (3) delivery- or takeout-services-only (making decisions on whether to use delivery or takeout services only, and thereafter accessing delivery apps/websites though which decisions on food menus and restaurants are made), (4) order-only (minimum dependence; accessing delivery apps/websites only after making decisions on food menus, restaurants, and whether to use delivery or takeout services), and (5) zero-base (maximum dependence; making decisions on food menus, restaurants, and whether to use delivery or take-out services only after accessing delivery apps/websites). Among these, the last two categories—order-only and zero-base—constituted the key categories for the dependent variable.

3.2.2. Independent Variables

"Portion number" was measured using "the average number of portions per order while using delivery apps" (1 = 1 portion, 2 = 2 portions, and 3 = 3 portions [34]. "Marital status" was derived from the demographic data on marital status (1 = unmarried and 2 = married).

3.2.3. Control Variables

Gender and age served as demographic covariates (age decile: 20s = 2, 30s = 3, 40s = 4, and 50s = 5; gender: male = 1 and female = 2). As an additional covariate, the frequency of dining out was based on the measure of "the average occurrence of dining out." It was reverse-coded and, thus, higher scores indicated rarer occurrences of dining out, and vice versa (1 = more than twice per day, 2 = once per day, 3 = once every two or three days, 4 = once every four-to-six days, 5 = once per week, 6 = once every two or three weeks, 7 = once per month, 8 = once every two or three months, 9 = once every four-to-six months, and 10 = less than once every six months).

3.3. Sampling Composition

The primary goal of this study was to contrast users' level of dependence on delivery apps while making decisions about ordering food. To properly capture the variability of the dependence, this study attempted to focus on two categories of outcome variables—zero-base and order-only. The sample size accordingly reduced to 354 responses after excluding the other three categories (Table 2). The focal analysis using the two categories (Table 3) exhibited no systematic differences compared to the analysis using all five categories (Appendix A).

Table 2. Demographic profile of respondents.

	Frequency	**Percentage (%)**
Gender		
Male	183	51.7
Female	171	48.3
Age decile in years		
20–29	79	22.3
30–39	86	24.3
40–49	104	29.4
50–59	85	24.0
Marital status		
Single	129	36.4
Married	225	63.6

Table 3. Results of the logistic regression analyses.

DV: Choice Likelihood of Zero-Base over Order-Only	**Model 1**			**Model 2**		
	Odds Ratio	***SE***	**z**	**Odd Ratio**	***SE***	**z**
Portion number [3 portions]						
1 portion	4.78	2.95	2.54 *	0.75	0.72	−0.30
2 portions	1.32	0.34	1.10	1.41	0.41	1.19
Marital status [Married]						
Unmarried	2.08	0.76	2.03 *	1.99	1.07	1.29
Portion number × Marital status						
Unmarried × 1 portion				25.38	38.53	2.13 *
Unmarried × 2 portions				0.87	0.52	−0.23
Gender [Male]						
Female	0.94	0.22	−0.25	0.92	0.22	−0.35
Age deciles in years [50s]						
20s	1.74	0.83	1.18	1.71	0.82	1.12
30s	2.47	0.86	2.59 *	2.41	0.84	2.52 *
40s	0.85	0.26	−0.52	0.86	0.27	−0.50
Frequency of dining out (reverse-coded)	0.81	0.059	−2.89 **	0.78	0.06	−3.18 **
Constant	1.32	0.53	0.68	1.54	0.64	1.05
Number of observations	354			354		
Log likelihood	−210.37			−207.25		
Likelihood ratio chi-square (df)	65.01(8) **			71.25(10) **		
McFadden's Pseudo R^2	0.134				0.147	

Note: * $p < 0.05$, ** $p < 0.01$; reference categories are noted in square brackets.

4. Results

The analysis of this study proceeded as follows: First, multicollinearity checks were conducted to detect extreme correlations among the predictors. Next, hypothesis testing was performed using logistic regression modeling. Marginal tests were then added to parse out the proposed interaction between the portion number and the marital status. A separate analysis was performed using only married people to corroborate that the results from the preceding analyses were consistent with the hypotheses. STATA (MP 17.0) software was used as an analytical tool for running a series of analyses.

4.1. Multicollinearity Checks

The explanatory variables in the logistic regression analysis included categorical variables. A conventional diagnosis based on the variance inflation factor (VIF) may not constitute an appropriate approach to detect multicollinearity. The condition index from the colldiag2 command of STATA served as an alternative criterion to detect multicollinearity [35]. The results indicated that the condition indices were lower than 10, indicating that multicollinearity was not a major issue in our data [35,36].

4.2. Hypotheses Testing

To test the hypotheses, this study performed a logistic regression analysis using the likelihood of choosing zero-base over order-only as the dependent variable. Model 1, in Table 3, illustrates the results from the analysis, which only incorporates the main effects of the explanatory variables. The likelihood of choosing zero-base over order-only was 4.78 times higher for a single portion than that for three portions (z = 2.54, $p < 0.05$). This supports the prediction of Hypothesis 1.

Regarding the effect of marital status, the unmarried users were 2.08 times more likely to choose zero-base over order-only compared to the married users (z = 2.03, $p < 0.05$). The users in their thirties were 2.47 times more likely to select zero-base over order-only compared to those in their fifties (z = 2.59, $p < 0.05$). An increase in one unit of frequency of dining out contributed to a decrease in the likelihood of choosing zero-base over order-only by 19% (odds ratio = 0.81, z = −2.89, $p < 0.01$). Given the reverse-coded variable, those users who tended to dine out frequently were more likely to choose zero-base over order-only.

Model 2, in Table 3, captures the results of the analysis of the interaction between the portion number and marital status. In the context of ordering a single-portion meal, the unmarried users were 25.38 times more likely to choose zero-base over order-only compared to the married users (z = 2.13, $p < 0.05$). The validity of this result was further strengthened in the marginal test results (Table 4 and Figure 2). With the unmarried users, the likelihood of choosing zero-base over order-only increased when ordering a single-portion (vs. double-portion) meal (contrast = 0.31, z = 4.20, $p < 0.01$); however, such a difference was not observed with the married users (contrast = −0.14, z = 0.67, $p > 0.50$). Therefore, the prediction of Hypothesis 2 was supported.

Table 4. Margin Test results.

	Contrast	*SE*	z
Unmarried users			
1 portion vs. 2 portions	0.31	0.07	4.20 *
2 portions vs. 3 portions	0.04	0.11	0.39
Married users			
1 portion vs. 2 portions	−0.14	0.21	0.67
2 portions vs. 3 portions	−0.08	0.07	−1.19

Note: * $p < 0.05$; reference categories are noted in square brackets.

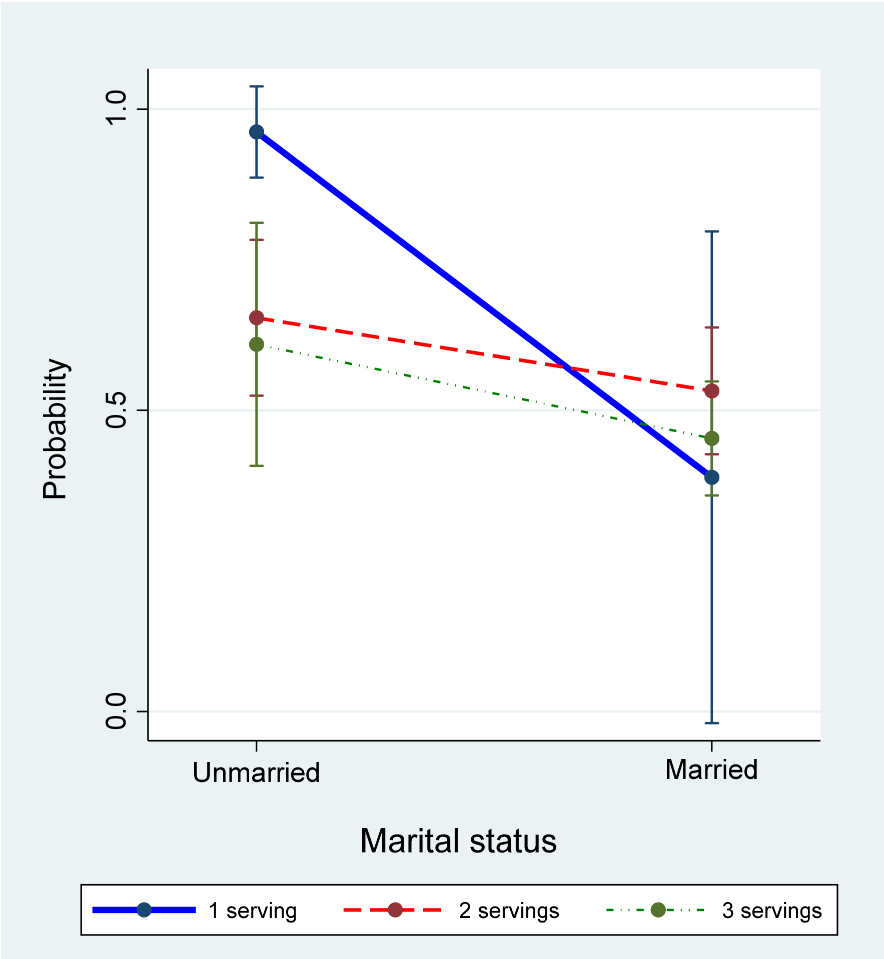

Figure 2. Interaction effect of portion number and marital status on decision-making dependence on delivery apps.

4.3. Ancillary Analysis: Comparison of Married Users with and without Children

To further examine the role of the sense of responsibility for meal preparation, the present study performed a separate analysis focusing only on married individuals. The presence of children can impose a higher sense of responsibility as a caregiver on married people [37,38]. The dependence on delivery apps may decrease with married users who have children, because they are more greatly governed by a sense of responsibility for and autonomy over meal preparation and are thus less likely to be distracted during decision making by third-party information sources such as delivery apps. The presence of children can, therefore, decrease the dependence on delivery apps, whereas the absence of children increases such dependence. The presence of children was, thus, taken into account during separate logistic regression analyses focusing only on the married users.

Table 5 summarizes the results of the analysis. The absence of children exerted a positive impact on the likelihood to choose zero-base over order-only (z = 2.30, $p < 0.05$). That is, the married users without children were 2.64 times more likely to choose zero-base over order-only than those with children. A further marginal analysis confirmed that the choice likelihood of zero-base over order-only was higher for the married users without children than those with children (contrast = 0.22, z = 2.40, $p < 0.05$; Figure 3).

Table 5. Results of logistic regression analyses for married people.

DV: Choice Likelihood of Zero-Base over Order-Only	Odds Ratio	*SE*	z
Portion number [3 portions]			
1 portion	0.31	0.33	−1.10
2 portions	1.09	0.35	0.25
Presence of children [with children]			
Without children	2.64	1.12	2.30 *
Gender [Male]			
Female	1.08	0.32	0.26
Age decile in years [50s]			
20s	0.30	0.37	−0.97
30s	2.79	1.08	2.65 **
40s	0.89	0.29	−0.36
Frequency of dining out (reverse-coded)	0.78	0.08	−2.34 *
Constant	3.37	2.19	1.87
Number of observations	225		
Log likelihood	−141.15		
Likelihood ratio chi-square (df)	27.26(8) **		
McFadden's Pseudo R^2	0.088		

Note: * $p < 0.05$, ** $p < 0.01$; reference categories are noted in square brackets.

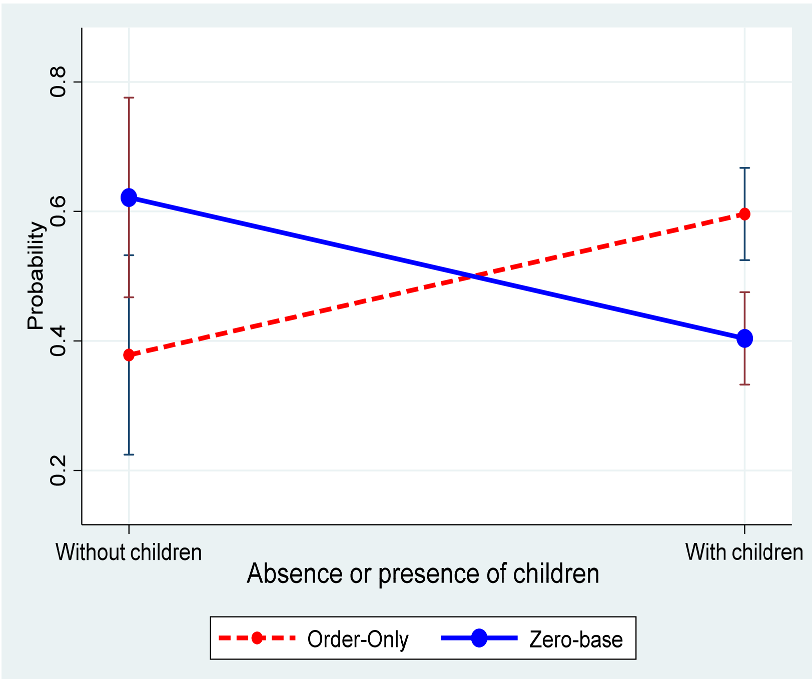

Figure 3. Effect of the presence of children on decision-making dependence on delivery apps.

5. Discussion

The study findings demonstrate that users increased their dependence on delivery apps during decision making when they ordered single- rather than multiple-portion meals (Hypothesis 1). This result implies that single-portion users consult delivery apps more closely than multiple-portion users when making their decisions. As the absence of meal companions forces a single-portion user to place a food order without the aid or consultation of meal companions, the user is more likely to depend on delivery apps to compensate for human absence.

Another noteworthy finding is that the decrease in the sense of responsibility underpins an increase in decision-making dependence on delivery apps. Unmarried users exhibited a stronger dependence on delivery apps for single-portion meals compared to married users (Hypothesis 2). The ancillary analysis focusing on married users confirmed that such a tendency was more pronounced for those without children than their counterparts with children. Being without a spouse or children may diminish the sense of responsibility and agency over meal preparation [23–25] and, thus, increase their vulnerability to the absence of meal companions to consult with when they have to make their own ordering decisions. The perception of difficulty in making one's own decisions can cause a stronger dependence on delivery apps.

Finally, although not specified as a formal hypothesis, the finding that more frequent experiences of dining out lead to stronger dependence on delivery apps is intriguing. Users who often dined out consulted delivery apps more closely during decision making compared to those who rarely dined out. This implies that the frequent outsourcing of daily meals to third parties may result in a closer online interaction with delivery apps. The repeated use of third-party services to obtain meals reflects a dilution of the traditional significance of dining out as a special or celebratory ritual [39–41]. The use of third parties, instead, seems to have become an increasingly common substitute for home-cooked meals. The present result, in this vein, indicates that the habit of frequently dining out can contribute to a reduction in the reluctance to adopt newly emerging sources of delivery apps as an alternative way to source daily meals [42].

5.1. Theoretical Implications

The present study has several theoretical implications. First, the study demonstrates that the shift from multi- to single-person households has induced not only a reduction in the number of portions ordered but also a crucial change in the way home meals are prepared. The current results indicate that a single-portion-meal user, presumably belonging to a single-person household, tends to proceed with his or her decisions regarding food ordering almost entirely dependent on the information provided by delivery apps. The current study highlights the role of delivery apps in providing information and facilitating decision making for users living in single-person households who lack meal companions for consultation. It suggests that the rise in online intermediaries should be examined from a broader social perspective, accounting for changes in underlying social structures, such as the increase in single-person households, rather than just the emergence of mobile technology [43,44].

Second, this study introduces the concept of decision-making dependence, which can be applied to various contexts of human and computer/machine interactions. This construct could be used to build a generalizable model to understand how users evaluate the effectiveness of computer/machine assistance in decision making. Similar constructs have been used to evaluate the effectiveness of mobile apps and artificial intelligence, including the perceived usefulness or helpfulness of customer reviews [45,46], functional value [47], and performance expectancy [48] of mobile apps, as well as competence perception [49], overall reward [50], customer knowledge creation [51], and perceived usefulness [52], to capture the effectiveness of artificial intelligence as assistant tools. While there may be variations in the nomenclature and the contexts used, all of these constructs are based on the idea of measuring the extent to which computers/machines assist users in making informed decisions and, thus, the extent to which users rely on them to reach final decisions. This study adds a theoretical foundation to the literature on human and computer/machine interactions by proposing a universally applicable construct of decision-making dependence, which helps to prompt the establishment of a generalizable model across various contexts.

Third, this study demonstrates that delivery apps do not simply substitute phone calls for food orders, but rather facilitate the use of food delivery services by providing concrete information for food-ordering decisions. The present findings indicate that, unlike situations in which users have to choose food menus and restaurants before placing a call, delivery app users can open apps without having made any prior decisions. Even users who have no idea what they want to order can make a choice by utilizing the information provided by such apps. In situations where the only method of placing a delivery order is through a phone call, users may drop out of the purchase process due to a lack of information and the inability to make a final decision. However, thanks to the introduction of delivery apps, users have the opportunity to fully engage in the purchase decision process for food-ordering, even with insufficient information. In this sense, this research makes a unique contribution to the literature by demonstrating how delivery apps have expanded the food delivery market by attracting users who might have dropped out of the purchase process due to a lack of information.

5.2. Practical Implications

This study has two practical implications. First, app interfaces need to be designed to help single-person-household users to narrow down their consideration set to make a final choice. The present results indicate that individuals ordering single-portion home meals, who are likely to be single-person-household users, tend to start their food-ordering decisions de novo, thus, making them more reliant on delivery apps. As single-person households have no companions to share the time and effort required for cooking, outsourcing meal preparation to delivery apps may appear to be a convenient option [53–56]. Therefore, in order to capitalize on the profit-making potential of this emerging segment [57], delivery app providers need to develop an application that guides such users to more readily narrow down their options to reach a final decision. For example, providing interfaces that can interact more closely with the user based on AI chatbot systems can help to ease the burden of information overload on single-person-household users. Developing an app that assists single-person-household users to make their final decisions can prevent them from dropping out of the food-ordering process.

Second, it is important to consider whether the number of app users is single or multiple when developing various mobile apps for travel reservations, accommodation bookings, or car rentals. The present study demonstrates that single-portion users rely more on apps to make their final decisions compared to multiple-portion users. The absence of meal companions characterizes the context of individual (vs. collective/group) decision making. Various other contexts of using mobile apps alone may also require application developers to pay attention to the difficulties that single users may face. For example, a solo traveler may exhibit a similar decision-making pattern to that observed in the single-portion users in this study. The entire decision-making process regarding accommodation, transportation, and activity booking for solo travelers may depend more heavily on the information provided by travel apps, such as TripAdvisor. Therefore, app developers should design interfaces that enable solo travelers to finalize their trip plans, even without the aid of other travel companions.

6. Limitations and Avenues for Further Research

The present study has some limitations. First, the context of empirical investigation was confined to a South Korean market, and, thus, the generalizability of the findings may be limited. The present study focuses on the factor of portion number, with the basic assumption that ordering a single-portion meal at home is more common in single-person households. The increasing numbers of single-person households may drive the growth of the O2O service market by catering to the yet-unmet needs of this demographic. In the past, marketing efforts were mostly focused on attracting users from multi-person households, either in terms of purchase amount or usage duration. However, O2O service providers are now adopting more unconventional approaches to appeal to the newly emerging segment of single-person-household users. For instance, car rental services, such as *Zipcar* (U.S.) or *Youcar* (South Korea), offer rental services in intervals of 30 or 10 min, enabling users without private cars to rent and use a car even for short durations. Given that car ownership is typically lower among single-person households compared to that of multi-person households [58,59], this strategy of offering rental services in short intervals could be seen as an attempt to address the needs of single-person households for short-to-middle range transportation within urban areas.

In this regard, the changing demographic structure, specifically the rise in single-person households, may act as a catalyst for the emergence and evolution of O2O business models, alongside the expansion of the digital infrastructure. Future research could investigate whether the findings of the present study hold in other countries experiencing a similar increase in the number of single-person households as that observed in South Korea, where the proportion of single-person households was reported to be 33.4% in 2021 [60].

Second, it would be worthwhile to investigate the effect of the portion number on the dependence on food delivery apps in other food-ordering contexts, such as takeout services. In South Korea, following a recent surge in delivery fees, users are increasingly opting for takeout services as a cost-effective alternative to delivery services. As the minimum wage in South Korea is expected to increase from KRW 9160 (USD 7.06) to KRW 9620 (USD 7.41) per hour in 2023 (https://www.minimumwage.go.kr/english/main.do accessed on 12 January 2023), the high delivery fees, which typically range from KRW 4000 (USD 3.08) to KRW 6000 (USD 4.62), may force users to switch to a less-expensive option, such as takeout services. Thus, future research could investigate whether the greater dependence on delivery apps for single-portion meals also holds true in the case of takeout services.

Lastly, this study primarily focuses on the conventional marriage relationship. However, it is crucial to acknowledge the potential for exploring various alternative family arrangements in future research. One such alternative is civil partnership, which was initially introduced to legalize the unions between same-sex couples, but has been increasingly recognized as a viable legal union for heterosexual couples as well [61]. In order to further our understanding of delivery apps, future studies could include samples of delivery apps users who are in civil partnerships, alongside those used in the current study. This addition would enable an investigation into whether the observed decrease in decision-making dependence on delivery apps among married people also applies to the users in civil partnerships. Specifically, by comparing the sense of responsibility for meal preparation and the decision-making dependence on delivery apps among the individuals who are married, have civil partnerships, or are single, future research could shed light on whether the differences in decision-making dependence arise from a varying sense of responsibility or the mere difference in the type of legal relationship. This endeavor could provide a foundation for extending the current findings to diverse relationship types.

7. Conclusions

This study is based on the premise that delivery apps are not simply a replacement for placing an order via phone calls. When ordering food via phone calls, the decision to order is typically made after the selection of food menus and restaurants. However, with delivery apps, the users may begin the ordering process without having made any prior decisions. Specifically, while phone users do not place a call until they have selected restaurants and food menus, delivery app users often begin by opening the app and perusing the available options before making a decision.

Inspired by this observation, this study introduces the concept of “decision-making dependence on delivery apps” to capture the extent to which the apps seemingly contribute to guiding the user’s food-ordering decisions and, thus, affect his or her reliance on the apps to finalize their decisions. If a delivery app is expected to be useful in narrowing down the available options for a final choice, the users are more likely to rely on it during decision making. Specifically, this study has confirmed our hypothesis that users’ dependence on delivery apps is higher when ordering single- as opposed to multiple-portion meals, and this effect is more pronounced among unmarried users than married users. As there are no other human agents or meal companions to consult in a single-portion-meal-ordering context, users are likely to rely more heavily on nonhuman agents (that is, delivery apps) to fill the void. Additionally, unmarried users may feel less responsible for and autonomous over meal preparation than married people, thereby exhibiting a greater vulnerability to the absence of meal companions to consult and, consequently, a heavier reliance on delivery apps when ordering single-portion meals. This empirical finding and its theoretical underpinnings could pave the way for examining the usage behavior associated with delivery apps in terms of the decision-making process of food-ordering, rather than only the apparent convenience associated with using mobile apps.

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Appendix A

Table A1. Results of pilot analysis using a multinomial regression model.

DV: Choice Likelihood of Each Option over Order-Only [Reference = Order-Only] [a]			Model 1			Model 2		
			Odds Ratio	***SE***	**z**	**Odds Ratio**	***SE***	**z**
Menu only	Portion number [3 portions]	1 portion	1.88	1.12	1.06	0.38	0.35	−1.04
		2 portions	1.14	0.24	0.63	1.30	0.31	1.11
	Marital status [Married]	Unmarried	1.63	0.53	1.53	2.08	0.95	1.60
	Portion number × Marital status	Unmarried × 1 portion	-	-	-	14.23	20.59	1.83
		Unmarried × 2 portions	-	-	-	0.58	0.30	−1.06
	Gender [Male]	Female	1.16	0.23	0.75	1.15	0.23	0.71
	Age decile in years [50s]	20s	1.24	0.53	0.51	1.20	0.51	0.42
		30s	1.45	0.45	1.18	1.42	0.45	1.12
		40s	1.02	0.25	0.07	1.02	0.25	0.07
	Frequency of dining out (reverse-coded)		0.94	0.06	−1.00	0.92	0.06	−1.30
	Constant		1.73	0.59	1.62	1.84	0.64	1.74
Restaurant only	Portion number [3 portions]	1 portion	0.46	0.54	−0.66	0.00	0.00	−0.01
		2 portions	1.32	0.42	0.87	1.68	0.62	1.40
	Marital status [Married]	Unmarried	1.68	0.75	1.15	2.67	0.68	1.56
	Portion number × Marital status	Unmarried × 1 portion	-	-	-	— [b]	—	—
		Unmarried × 2 portions	-	-	-	0.40	0.29	−1.26
	Gender [Male]	Female	0.90	0.27	−0.34	0.89	0.27	−0.37
	Age decile in years [50s]	20s	1.32	0.84	0.44	1.27	0.81	0.38
		30s	2.42	1.14	1.89	2.36	1.11	1.83
		40s	1.32	0.53	0.69	1.33	0.54	0.70
	Frequency of dining out (reverse-coded)		1.05	0.10	0.50	1.02	0.09	0.27
	Constant		0.19	0.11	−2.98 **	0.19	0.11	−2.91 **
Delivery or takeout only	Portion number [3 portions]	1 portion	1.54	1.02	0.65	0.00	0.00	−0.02
		2 portions	1.02	0.26	0.09	1.41	0.43	1.10
	Marital status [Married]	Unmarried	2.38	0.87	2.39 *	3.74	1.91	2.59 *
	Portion number × Marital status	Unmarried × 1 portion	-	-	-	— [b]	—	—
		Unmarried × 2 portions	-	-	-	0.38	0.22	−1.65
	Gender [Male]	Female	1.08	0.26	0.31	1.06	0.26	0.25
	Age decile in years [50s]	20s	1.24	0.62	0.43	1.17	0.59	0.31
		30s	2.50	0.94	2.45 *	2.41	0.91	2.34 *
		40s	0.93	0.31	−0.23	0.93	0.31	−0.23
	Frequency of dining out (reverse-coded)		0.77	0.06	−3.26 **	0.75	0.06	−3.50 **
	Constant		1.23	0.53	0.48	1.23	0.55	0.47
Zero-base	Portion number [3 portions]	1 portion	4.48	2.67	2.52 *	0.66	0.63	−0.44
		2 portions	1.50	0.36	1.67	1.41	0.40	1.20
	Marital status [Married]	Unmarried	1.80	0.63	1.70	1.50	0.79	0.77
	Portion number × Marital status	Unmarried × 1 portion	-	-	-	27.44	40.48	2.25 *
		Unmarried × 2 portions	-	-	-	1.05	0.61	0.09
	Gender [Male]	Female	0.86	0.19	−0.70	0.85	0.19	−0.72
	Age decile in years [50s]	20s	1.88	0.87	1.37	1.85	0.86	1.32
		30s	2.42	0.84	2.53 *	2.42	0.85	2.53 *
		40s	0.89	0.27	−0.39	0.89	0.27	−0.39
	Frequency of dining out (reverse-coded)		0.82	0.06	−2.76 **	0.80	0.06	−3.03 **
	Constant		1.25	0.49	0.56	1.47	0.59	0.96
Number of observations			872			872		
Log likelihood			−1246.46			−1239.00		
Likelihood ratio chi-square (df)			100.87(32) **			115.78(40) **		
McFadden's Pseudo R^2			0.039			0.045		

Note: [a] Condition indices were lower than 10, indicating that multicollinearity was not a problem. Reference [62] test of IIA (independence of irrelevant alternatives) indicated that there was no evidence to reject the null hypothesis of the independence of irrelevant alternatives. [b] Due to the occurrence of zero cells with the married users who chose *restaurant only* and *delivery or takeout only* for their single-portion meals, the coefficients or odds ratios from the maximum likelihood approach may have led to an inappropriate interpretation and, thus, were removed from further analyses [32,63–65]. * $p < 0.05$, ** $p < 0.01$. Reference categories are noted in square brackets.

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