THE INFLUENCE OF ONLINE SHOPPING ACCESSIBILITY ON FOOD INSECURITY IN VIETNAM DURING THE COVID-19 PANDEMIC

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Abstract

The COVID-19 pandemic caused widespread disruptions to food systems and livelihoods, intensifying food insecurity, particularly in developing countries such as Vietnam. This study examines the impact of online shopping accessibility on food insecurity during the pandemic, using primary data from 3,922 respondents across all provinces and cities in Vietnam in 2021. Employing the propensity score matching (PSM) method, the analysis assesses the relationship between online shopping accessibility and key food security dimensions, including four food insecurity experience scale. The results show that greater access to online shopping is associated with a significant reduction in food insecurity. These findings highlight the potential of digital food access as a strategy to mitigate food insecurity during crises. The study offers policy recommendations to expand digital infrastructure and promote inclusive access to online food retail services, thereby enhancing the resilience of food systems in Vietnam and similar settings.

Key words: *Online shopping accessibility, food insecurity, propensity score matching, Vietnam.*

ẢNH HƯỞNG CỦA KHẢ NĂNG TIẾP CẬN MUA SẮM TRỰC TUYẾN ĐẾN TÌNH TRẠNG MẤT AN NINH LƯƠNG THỰC Ở VIỆT NAM TRONG ĐẠI DỊCH COVID-19

Tóm tắt

Đại dịch COVID-19 đã gây ra sự gián đoạn rộng rãi đối với hệ thống lương thực và sinh kế, làm trầm trọng thêm tình trạng mất an ninh lương thực, đặc biệt là ở các nước đang phát triển như Việt Nam. Nghiên cứu này xem xét tác động của khả năng tiếp cận mua sắm trực tuyến đối với tình trạng mất an ninh lương thực trong đại dịch, sử dụng dữ liệu chính từ 3.922 người trả lời trên tất cả các tỉnh và thành phố tại Việt Nam vào năm 2021 và phương pháp so sánh điểm xu hướng (PSM), phân tích đánh giá mối quan hệ giữa khả năng tiếp cận mua sắm trực tuyến và các khía cạnh chính của an ninh lương thực, bao gồm bốn chỉ số về đo lường. Kết quả cho thấy khả năng tiếp cận mua sắm trực tuyến lớn hơn có liên quan đến việc giảm đáng kể tình trạng mất an ninh lương thực. Những phát hiện này làm nổi bật tiềm năng của khả năng tiếp cận thực phẩm kỹ thuật số như một chiến lược để giảm thiểu tình trạng mất an ninh lương thực trong các cuộc khủng hoảng. Nghiên cứu đưa ra các khuyến nghị chính sách để mở rộng cơ sở hạ tầng kỹ thuật số và thúc đẩy khả năng tiếp cận toàn diện đối với các dịch vụ bán lẻ thực phẩm trực tuyến, qua đó tăng cường khả năng phục hồi của các hệ thống thực phẩm tại Việt Nam và các bối cảnh tương tự.

Từ khóa: *Khả năng tiếp cận mua sắm trực tuyến, mất an ninh lương thực, so sánh điểm xu hướng, Việt Nam.*

1. Introduction

The COVID-19 pandemic has brought unprecedented disruptions to global food systems, significantly affecting food security in both developed and developing nations (Laborde et al., 2020; FAO, 2021). In Vietnam, although the country was initially praised for its swift response to the pandemic, strict lockdown measures, travel restrictions, and disruptions in supply chains exacerbated existing vulnerabilities in food access, especially among low-income and marginalized communities (Le et al., 2021; Tran et al., 2022). Food insecurity defined as limited or uncertain access to adequate food emerged as a pressing concern, underscoring the need for adaptive mechanisms to ensure the resilience of food systems (Cole et al., 2021).

One such mechanism has been the increased reliance on digital platforms and online shopping services for food procurement. As traditional food access channels were interrupted, e-commerce platforms, mobile applications, and

digital marketplaces gained prominence in providing households with essential food supplies (Aday & Aday, 2020; UNCTAD, 2021; Linh et al. 2021). However, this shift also revealed a digital divide, as disparities in online shopping accessibility created uneven benefits across different population groups (World Bank, 2021). Access to stable internet connections, digital literacy, smartphone ownership, and proximity to delivery networks became crucial determinants of whether households could adapt to the new food distribution landscape (Nguyen & Vu, 2022).

This study investigates the relationship between online shopping accessibility and food insecurity in Vietnam during the COVID-19 pandemic. It aims to explore whether improved access to online shopping platforms mitigated food insecurity and to what extent socioeconomic and demographic factors influenced this relationship. By analyzing primary data collected from Vietnamese households, the research provides empirical insights into how digital innovations intersect with food security in times of crisis. These findings contribute to the broader discourse on digital inclusion and sustainable food systems in the context of global health emergencies.

2. Literature review

The COVID-19 pandemic has sparked considerable academic attention on food insecurity and the evolving role of digital technologies in food access. According to the Food and Agriculture Organization (FAO, 2020), food insecurity defined as limited or uncertain access to sufficient and nutritious food intensified globally during the pandemic. In developing countries such as Vietnam, this issue was exacerbated by socioeconomic vulnerabilities and disruptions in food supply chains.

An expanding body of literature has examined the intersection between digital technology and food access during the pandemic. Lockdowns and mobility restrictions accelerated a shift from traditional food procurement to digital platforms (Aday & Aday, 2020). E-commerce and online food delivery services emerged as essential mechanisms for ensuring continued food access,

particularly in urban areas. Chenarides et al. (2021) highlight that digital platforms mitigated the effects of physical supply chain disruptions by facilitating contactless delivery and expanding consumer reach.

However, digital adoption remains uneven due to the persistent "digital divide," especially in developing contexts (van Dijk, 2020). Internet accessibility, smartphone ownership, digital literacy, and geographic proximity to services significantly influence households' ability to benefit from online food systems. In Vietnam, Nguyen et al. (2021) found that rural, elderly, and low-income populations faced greater challenges in accessing online services, thereby increasing their vulnerability to food insecurity during lockdowns.

Moreover, while online platforms can improve food access, they do not guarantee food security for all. Martin-Storey et al. (2022) argue that affordability, cultural food preferences, and limitations in payment methods can hinder equitable access. Regional disparities in the availability of essential goods also limit the potential of online shopping to comprehensively address food insecurity.

To strengthen food system resilience, research advocates for integrating digital innovations with inclusive public policy. For instance, Béné et al. (2021) emphasize the importance of expanding digital infrastructure and targeting support toward marginalized groups to enhance food security outcomes, particularly in urbanizing but digitally fragmented societies such as Vietnam.

A number of recent studies have adopted the propensity score matching (PSM) method to examine the causal impact of online food shopping on food security. Gosa et al. (2024) applied the Generalized Propensity Score Matching (GPSM) approach to evaluate the effects of vegetable commercialization on household food security in Ethiopia, finding both positive and negative outcomes. Similarly, Ma et al. (2022) employed PSM to analyze the impact of online food shopping on dietary diversity, reporting a 7.34% increase in diversity among

households that engaged in online shopping. They also identified education, asset ownership, and awareness of government dietary guidelines as key factors influencing online shopping adoption.

Building on this, Nanang et al. (2025) used PSM to assess how online shopping behavior influenced healthy food consumption patterns in East Java, Indonesia, using data from 12,514 households. The study found that urban residence, higher education, income, and mobile phone ownership were positively associated with online shopping adoption, whereas larger household size, being male, and older age had negative effects.

In summary, although online food shopping became an important strategy during the COVID-19 crisis, its ability to mitigate food insecurity is conditioned by broader socioeconomic and infrastructural factors. A nuanced understanding of how digital access interacts with household-level determinants is essential for designing inclusive, responsive food security policies in the post-pandemic context.

3. Data and methodology

3.1. Data

This study utilizes data from Round 5 (2021) of the World Bank's COVID-19 High Frequency Phone Survey of Households. The survey was designed to collect nationally representative household-level data to enable ongoing assessment and monitoring of the socio-economic impacts of COVID-19 on households and family-operated businesses in Vietnam. The dataset offers comprehensive insights into key areas such as food insecurity, employment status, income shocks, and digital access.

The sampling for the 2020/21 Vietnam COVID-19 High Frequency Phone Survey (VHFPS) is based on a nationally representative 2018 household survey covering 46,980 households across 3,132 communes. In each commune, one enumeration area (EA) was randomly selected, followed by 15 randomly

chosen households per EA. Households were divided into a main sample (large module) and a reserve sample (small module) for replacements. After data processing, the final sample size for Round 5 of the VHFPS was 3,922 households. The survey captures respondents' demographic characteristics (e.g., age, gender, education), economic conditions (e.g., income change), and digital behaviors (e.g., online shopping frequency and accessibility). The primary outcome variable food insecurity is measured using the Food Insecurity Experience Scale (FIES), an internationally standardized 8-item scale designed to assess access to adequate food.

Based on the online shopping accessibility survey, we define the treatment group as households that are aware of and have access to online shopping locations. In contrast, the control group includes households that are not aware of such locations (coded as yes = 1, otherwise = 0). Key outcome variables include online shopping accessibility (measured on a probability that any adult member in the household had to skip a meal, consumed only a limited variety of foods, or was unable to eat healthy and nutritious/preferred foods and went a whole day without eating). Following the aforementioned literature, we select observable variables to compare and evaluate the impact of online shopping accessibility on food insecurity. These variables include household characteristics, respondent attributes, regional location, and any events since last month related to the COVID-19 pandemic that have negatively affected the household's economic situation.

Descriptive statistics for these variables are presented in Table 1. The data was divided into two subgroups: the control group and the treatment group. Descriptive statistics revealed a statistically significant difference in food insecurity indicators, suggesting that households in the treatment group were less affected by food insecurity compared to those in the control group.

Table 1: *Descriptive statistics*

	Treatment group	Control group	Diff.
Food insecurity experience scale			
Probability that any adult member in the household had to skip a meal	0.032 (0.177)	0.054 (0.226)	-0.021***
Probability that any adult member in the household consumed only a limited variety of foods	0.252 (0.434)	0.332 (0.471)	-0.079***
Probability that any adult member in the household was unable to eat healthy and nutritious/preferred foods	0.234 (0.423)	0.294 (0.455)	-0.060***
Probability that any adult member in the household went a whole day without eating	0.003 (0.062)	0.008 (0.090)	-0.004**
Independent variables			
Respondent's gender (Female = 1, otherwise = 0)	0.494 (0.500)	0.416 (0.493)	0.078***
Respondent's ethnicity (Kinh=1, otherwise =0)	0.852 (0.355)	0.750 (0.432)	0.102***
Household belongs to the bottom 40% income group (Yes=1, otherwise=0)	0.309 (0.462)	0.476 (0.499)	-0.167***
Urban residence (Urban = 1, otherwise = 0)	0.387 (0.487)	0.268 (0.443)	0.119***
Household size	4.170 (1.488)	4.040 (1.744)	0.131
Regional location (Reference category not specified)			
Red River Delta	0.237 (0.425)	0.199 (0.399)	0.038*
Midlands and Northern Mountainous Areas	0.261 (0.439)	0.273 (0.445)	-0.012
Northern and Coastal Central Region	0.194 (0.395)	0.209 (0.407)	-0.015
Central Highlands	0.082 (0.275)	0.075 (0.264)	0.007
Southeastern Area	0.111 (0.314)	0.088 (0.284)	0.022
Household experienced any events negatively affecting its economic situation since last month:			
Job loss	0.019 (0.138)	0.033 (0.179)	-0.013*
Reduced salary/wage income	0.090 (0.287)	0.079 (0.270)	0.011
Household business closure	0.009 (0.094)	0.007 (0.086)	0.001
Reduced earnings from household business	0.085 (0.279)	0.052 (0.223)	0.032***
Disruption of farming, livestock, fishing activities	0.019 (0.138)	0.029 (0.170)	-0.010
Fall in the price of farming/business output	0.032 (0.177)	0.037 (0.189)	-0.005
Health reasons	0.036 (0.187)	0.029 (0.168)	0.007
Movement restrictions due to COVID-19	0.024 (0.155)	0.021 (0.146)	0.002
Observations	**772**	**3,150**	**3,922**

*Note: Diff is t statistics; * significant at 0.1 level; ** significant at 0.05 level; *** significant at 0.01 level; Standard deviation is in parentheses.*

Source: Word bank (2021).

3.2. Methodology

To estimate the causal impact of online shopping accessibility on food insecurity in Vietnam during the COVID-19 pandemic, this study adopts the Propensity Score Matching (PSM) method, following the approaches of Ma et al. (2022), Gosa et al. (2024), and Nanang et al. (2025). Since access to online shopping is not randomly distributed and may be influenced by household or individual characteristics such as urban residence, education level, and income direct comparisons between users and non-users of online platforms may yield biased results due to potential confounding factors. PSM helps address this issue by constructing a matched sample of households with similar observable characteristics, thereby improving the validity of causal inference.

PSM addresses this selection bias by constructing a counterfactual framework: for each individual with high online shopping accessibility (treatment group), a counterpart with similar observable characteristics but low or no online shopping accessibility (control group) is identified. This matching allows for a more reliable estimation of the average treatment effect on the treated (ATT).

The empirical strategy involves the following steps: (i) Propensity Score Estimation A logistic regression model is used to estimate the propensity score, i.e., the probability of having high online shopping accessibility, as a function of covariates such as age, gender, education, urban residence, and income loss due to COVID-19; (ii) Matching Algorithm Individuals in the treatment group are matched with individuals in the control group based on similar propensity scores. Several matching techniques are considered such as nearest-neighbor matching, radius matching, and kernel matching to ensure robustness of the results; (iii) Balancing Test: After matching, a balancing test is conducted to verify that the distribution of covariates is statistically similar between the treatment and control groups, confirming that the matching process successfully reduces selection bias; (iv)Treatment Effect Estimation Finally, the ATT is estimated by comparing the average food insecurity score between matched treated and control individuals. A negative ATT would suggest that better access to online shopping reduces food insecurity during the pandemic.

This empirical approach allows the study to infer the potential protective role of digital platforms in maintaining food access, especially when traditional supply chains are disrupted. Figure 1 shows the flowchart of the research methodology.
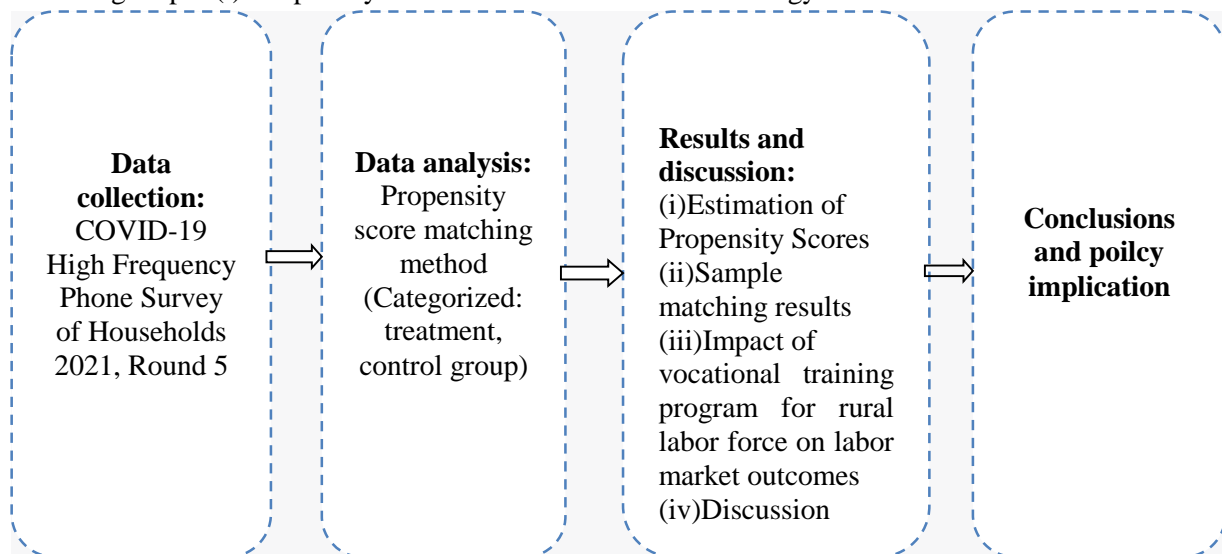

Fig 1. The flowchart of the research methodology

4. Results and discussion

4.1. Results

4.1.1. Estimation of Propensity Scores

Table 2 presents the results of a probit regression analyzing the likelihood of households accessing online shopping services, using a binary dependent variable (1 = access, 0 = no access). The model demonstrates a good fit, as indicated by a statistically significant p-value and LR chi2 (18), making it suitable for identifying the determinants of online shopping access.

The results indicate several key factors influencing access. Respondents of Kinh ethnicity are about 7.76 percentage points more likely to access online shopping services compared to those from other ethnic groups. Households in the bottom 40% income bracket are 8.03 percentage points less likely to have such access. Interestingly, if the respondent is female, the probability of accessing online shopping services increases by 4.01 percentage points.

Households residing in urban areas show a higher likelihood of accessing online shopping platforms. Regionally, households in the Red River Delta, Midlands and Northern Mountainous Areas, Central Highlands, and Southeastern Area are more likely to access these services compared to other regions.

Among the negative economic events experienced since the previous month, only job loss is associated with a reduced likelihood of accessing online shopping. In contrast, households reporting reduced earnings from household business activities are more likely to access online shopping services—possibly because these households are already engaged in market-oriented activities and thus more familiar with online platforms.

***Table 2:** Estimation of the propensity scores*

VARIABLES	Online shopping accessibility
Respondent's gender (Female = 1, otherwise = 0)	0.0401** (0.047)
Respondent's ethnicity (Kinh=1, otherwise =0)	0.0776** (0.075)
Household belongs to the bottom 40% income group (Yes=1, otherwise=0)	-0.0803** (0.052)
Urban residence (Urban = 1, otherwise = 0)	0.0548** (0.052)
Household size	0.0126** (0.014)
Red River Delta	0.0595* (0.082)
Midlands and Northern Mountainous Areas	0.0990** (0.086)
Northern and Coastal Central Region	0.0370 (0.083)
Central Highlands	0.0819** (0.106)
Southeastern Area	0.0575* (0.099)
Job loss	-0.0744* (0.154)
Reduced salary/wage income	0.0146 (0.084)
Household business closure	-0.0064 (0.253)
Reduced earnings from household business	0.0528* (0.093)
Disruption of farming, livestock, fishing activities	-0.0336 (0.156)
Fall in the price of farming/business output	-0.0061 (0.129)
Health reasons	0.0449 (0.131)
Movement restrictions due to COVID-19	0.0136 (0.159)
LR chi2(18)	155.92
Prob > chi2	0.0000
Pseudo R2	0.0401
Observations	3,922

*Standard errors in parentheses; ** p<0.01, * p<0.05, + p<0.1*

Source: Word bank (2021)

4.1.2. Sample matching results

To ensure consistency in the analysis and evaluation results, it is essential to verify the balance of the propensity scores before assessing the impact of online shopping accessibility on food insecurity using the PSM model. This step confirms whether the treatment and control groups share similar characteristics across each value of the propensity score. Table 3 presents the results of this balance check.

The findings in Table 3 support the balance hypothesis, as the differences between variables

are minimized following the matching process, indicating that the treatment and control groups are comparable. Table 4 reports the statistical evaluations used to assess the quality of the matching, including k-Nearest Neighbors, Radius Matching, Kernel Matching, and Local Linear Regression Matching methods. The trend test shows that both the Mean Bias and Median Bias are significantly reduced across all four methods after matching. Likewise, the pseudo R² from the initial probit model remains consistent post-matching.

Table 3: *Balancing hypothesis test showing the variable characteristics before and after matching*

Variable	Unmatched Matched	Mean		Bias (%)	t-Value	p-Value
		Treated Group	Control Group			
Respondent's gender (Female = 1, otherwise = 0)	U	0.4948	0.4168	15.7*	3.93	0.000
	M	0.4948	0.5207	-5.2	-1.02	0.309
Respondent's ethnicity (Kinh=1, otherwise =0)	U	0.8523	0.7501	25.8*	6.07	0.000
	M	0.8523	0.8432	2.3	0.50	0.620
Household belongs to the bottom 40% income group (Yes=1, otherwise=0)	U	0.3095	0.4768	-34.7*	-8.46	0.000
	M	0.3095	0.3212	-2.4	-0.49	0.622
Urban residence (Urban = 1, otherwise = 0)	U	0.3873	0.2682	25.6*	6.56	0.000
	M	0.3873	0.3911	-0.8	-0.16	0.876
Household size	U	4.171	4.0403	8.1*	1.92	0.055
	M	4.171	4.1736	-0.2	-0.03	0.973
Red River Delta	U	0.2370	0.1990	9.2*	2.34	0.019
	M	0.2370	0.2344	0.6	0.12	0.905
Midlands and Northern Mountainous Areas	U	0.2616	0.2736	-2.7*	-0.67	0.502
	M	0.2616	0.2862	-5.6	-1.08	0.279
Northern and Coastal Central Region	U	0.1943	0.2098	-3.9	-0.96	0.339
	M	0.1943	0.1878	1.6	0.32	0.746
Central Highlands	U	0.0829	0.0758	2.6	0.66	0.512
	M	0.0829	0.0829	0.0	-0.00	1.000
Southeastern Area	U	0.1114	0.0885	7.6*	1.96	0.050
	M	0.1114	0.0997	3.9	0.75	0.456
Job loss	U	0.0194	0.0333	-8.7*	-2.01	0.044
	M	0.0194	0.0077	7.3	1.98	0.048
Reduced salary/wage income	U	0.0906	0.0796	3.9	1.00	0.318
	M	0.0906	0.0854	1.9	0.36	0.720
Household business closure	U	0.0090	0.0076	1.6	0.41	0.684
	M	0.0090	0.0064	2.8	0.58	0.562
Reduced earnings from household business	U	0.0854	0.0527	13.0*	3.47	0.001
	M	0.0854	0.0790	2.6	0.46	0.644
Disruption of farming, livestock, fishing activities	U	0.0194	0.0298	-6.7	-1.58	0.115
	M	0.0194	0.0194	0.0	-0.00	1.000
Fall in the price of farming/business output	U	0.0323	0.0374	-2.8	-0.67	0.500
	M	0.0323	0.0233	4.9	1.08	0.279
Health reasons	U	0.0362	0.0292	4.0	1.02	0.307
	M	0.0362	0.0272	5.1	1.02	0.310
Movement restrictions due to COVID-19	U	0.0246	0.0219	1.8	0.45	0.649
	M	0.0246	0.0207	2.6	0.51	0.608

*Note: k-Nearest neighbors matching was used for the balancing test. It performed relatively well across samples in terms of matching quality. * indicates that the difference between unmatched and matched variables was statistically significant at the 90% level. U and M are abbreviations of unmatched and matched samples, respectively.*

Source: Word bank (2021)

Figure 2 illustrates the test results for the common support assumption by comparing the kernel density functions of the propensity scores before and after matching. Prior to matching, the density functions of the two groups differ notably.

After matching, the distributions align closely, with a marked reduction in variance, confirming that the common support assumption holds in this analysis.

Table 4: Test of selection bias after matching

Matching Algorithm	Sample	Pseudo R²	LR chi2	p>chi2	Mean Bias	Med Bias
k-Nearest neighbors matching	Unmatched	0.040	155.92	0.000	9.9	7.2
	Matched	0.004	9.58	0.945	2.8	2.5
Radius matching	Unmatched	0.040	155.92	0.000	9.9	7.2
	Matched	0.004	7.60	0.984	1.8	1.0
Kernel matching	Unmatched	0.040	155.92	0.000	9.9	7.2
	Matched	0.004	8.59	0.968	2.0	1.0
Local linear regression matching	Unmatched	0.040	155.92	0.000	9.9	7.2
	Matched	0.009	19.05	0.389	4.1	3.0

* if B>25%, R outside [0.5; 2]
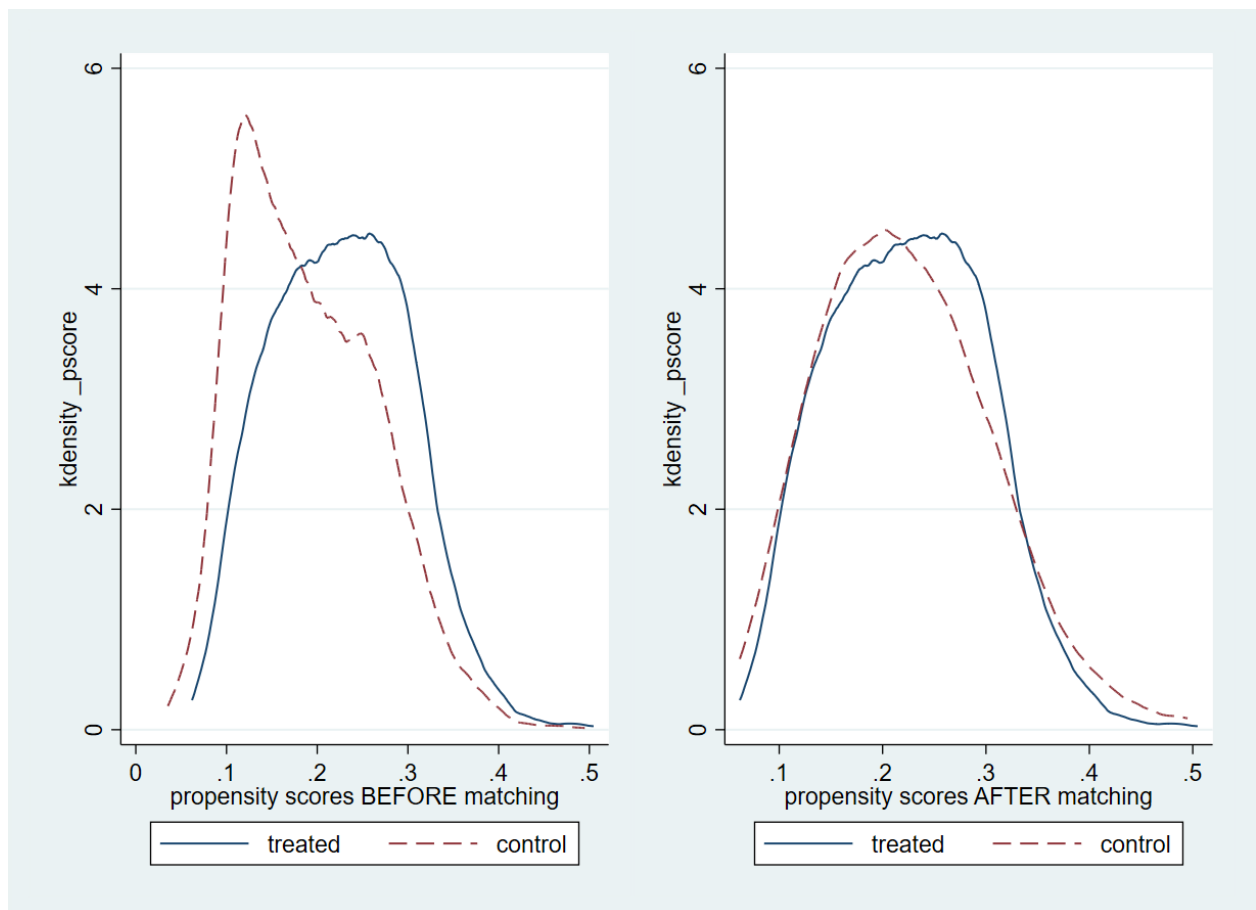
Source: Word bank (2021)

Figure 2. Test of the common support assumption to determine the densities of pre- and post-matching p-scores.

Source: Word bank (2021)

4.1.3. Impact of online shopping accessibility on food insecurity

To assess the impact of online shopping accessibility on food insecurity using the Propensity Score Matching (PSM) method and ensure the robustness of the estimation results, this study employs four matching techniques simultaneously: k-Nearest Neighbors Matching, Radius Matching, Kernel Matching, and Local Linear Regression (LLR) Matching. Each method offers unique strengths that help compensate for the limitations of the others, enhancing the overall reliability of the analysis.

For instance, k-Nearest Neighbors (k-NN) Matching is straightforward to implement and interpret. It matches each treated unit with the most similar control units and allows flexibility by adjusting the number of neighbors (*k*) to manage the trade-off between bias and variance. It is widely used in empirical research due to its transparency and comparability. Radius Matching improves the quality of matches by pairing treated units only with control units within a predefined caliper (radius), thus avoiding poor matches. This approach reduces bias by excluding distant matches and increases precision by allowing multiple suitable matches within the radius.

Kernel Matching utilizes all available control observations by assigning weights based on their distance from each treated unit. This method ensures efficient data use, produces smoother estimates, and avoids arbitrary cutoffs by applying a continuous weighting function—

such as a Gaussian kernel. Finally, Local Linear Regression (LLR) Matching addresses local biases by fitting a linear regression model in the neighborhood of each treated unit. It adjusts for small differences in covariates and is especially useful when the relationship between treatment and covariates is nonlinear. By combining elements of regression and matching, LLR enhances both the accuracy and precision of the estimates. By applying all four techniques, the study ensures comprehensive, balanced, and reliable results in evaluating the effect of online shopping accessibility on food insecurity.

The analysis results indicate that online shopping accessibility has a negative effect on food insecurity across all four measured indicators. Specifically, it reduces the probability that any adult in the household had to skip a meal by approximately 3.88 percentage points; consumed only a limited variety of foods by about 7.25 percentage points; was unable to eat healthy, nutritious, or preferred foods by around 3.62 percentage points; and went an entire day without eating by roughly 0.12 percentage points. These findings are consistent across all four matching techniques used in the analysis. This underscores the important role of online shopping in enhancing household food security in Vietnam, particularly during the COVID-19 pandemic, when strict public health measures such as social distancing, travel restrictions, and bans on in-person activities were in place.

Table 5: Estimated the impact of online shopping accessibility on food insecurity

Variable	Sample	Treated group	Control group	Difference
k-Nearest neighbors matching:				
Probability that any adult member in the household had to skip a meal	Unmatched	0.0323	0.0542	-0.0219***
	ATT	0.0323	0.0712	-0.0388***
Probability that any adult member in the household consumed only a limited variety of foods	Unmatched	0.2525	0.3323	-0.0797**
	ATT	0.2525	0.3251	-0.0725*
Probability that any adult member in the household was unable to eat healthy and nutritious/preferred foods	Unmatched	0.2344	0.2946	-0.0601***
	ATT	0.2344	0.2707	-0.0362**
Probability that any adult member in the household went a whole day without eating	Unmatched	0.0038	0.0082	-0.0043**
	ATT	0.0038	0.0051	-0.0012**
Radius matching:				

Variable	Sample	Treated group	Control group	Difference
Probability that any adult member in the household had to skip a meal	Unmatched	0.0323	0.0542	-0.0219**
	ATT	0.0323	0.0440	-0.0116**
Probability that any adult member in the household consumed only a limited variety of foods	Unmatched	0.2525	0.3323	-0.0797**
	ATT	0.2525	0.3107	-0.0581*
Probability that any adult member in the household was unable to eat healthy and nutritious/preferred foods	Unmatched	0.2344	0.0542	-0.0601**
	ATT	0.2344	0.0440	-0.0367*
Probability that any adult member in the household went a whole day without eating	Unmatched	0.0038	0.0082	-0.0043*
	ATT	0.0038	0.0045	-0.0006*
Kernel matching:				
Probability that any adult member in the household had to skip a meal	Unmatched	0.0323	0.0542	-0.0219**
	ATT	0.0323	0.0443	-0.0119**
Probability that any adult member in the household consumed only a limited variety of foods	Unmatched	0.2525	0.3323	-0.0797**
	ATT	0.2525	0.3115	-0.0589*
Probability that any adult member in the household was unable to eat healthy and nutritious/preferred foods	Unmatched	0.2344	0.2946	-0.0601**
	ATT	0.2344	0.2716	-0.0372*
Probability that any adult member in the household went a whole day without eating	Unmatched	0.0038	0.0082	-0.0043**
	ATT	0.0038	0.0048	-0.0009*
Local linear regression matching:				
Probability that any adult member in the household had to skip a meal	Unmatched	0.0323	0.0542	-0.0219***
	ATT	0.0323	0.0465	-0.0141**
Probability that any adult member in the household consumed only a limited variety of foods	Unmatched	0.2525	0.3323	-0.0797***
	ATT	0.2525	0.3203	-0.0677***
Probability that any adult member in the household was unable to eat healthy and nutritious/preferred foods	Unmatched	0.2344	0.2946	-0.0601**
	ATT	0.2344	0.2802	-0.0458**
Probability that any adult member in the household went a whole day without eating	Unmatched	0.0038	0.0082	-0.0043**
	ATT	0.0038	0.0057	-0.0018*

*Notes: * Significant at 10%; ** significant at 5%; *** significant at 1%.*

Source: Word bank (2021).

4.2. Discussion

The findings of this study provide empirical evidence on the determinants and impacts of online shopping accessibility on household food security in Vietnam during the COVID-19 pandemic. By employing the Propensity Score Matching (PSM) method, the study addresses potential selection bias and isolates the causal effect of online shopping on various dimensions of food insecurity.

First, the estimation of propensity scores reveals that demographic, socioeconomic, and regional factors significantly influence access to online shopping platforms. Female respondents, urban households, those of Kinh ethnicity, and those not belonging to the bottom 40% income group were more likely to engage in online food shopping. These findings are consistent with previous studies highlighting the role of digital access and socioeconomic status in shaping consumer behavior during crises (Nguyen et al., 2021; van Dijk, 2020). The results underscore the persistent digital divide that marginalizes rural, low-income, and minority households from fully benefiting from digital food systems.

Notably, the negative association between job loss and online shopping access indicates that economic shocks may simultaneously reduce both

income and digital participation, compounding food insecurity risks for vulnerable groups. Conversely, households experiencing reduced earnings from their business activities were more likely to adopt online shopping, possibly due to greater market integration and familiarity with digital platforms. This suggests that economic adaptation strategies play a role in shaping digital consumption patterns.

The matching results confirm that the treatment and control groups were statistically comparable post-matching, validating the robustness of the impact estimates. Across all four matching techniques, online shopping accessibility significantly reduced the likelihood of various food insecurity outcomes. Specifically, it lowered the probability of adults skipping meals, consuming a limited variety of foods, being unable to access nutritious or preferred foods, and going an entire day without eating. Among these, the reduction in dietary monotony (7.25 percentage points) stands out as the most substantial effect, suggesting that online food platforms may enhance not only food quantity but also food quality.

These findings align with those of Ma et al. (2022), who reported a positive impact of online shopping on dietary diversity in rural China, and Nanang et al. (2025), who found that access to online platforms supported healthier food consumption in Indonesia. Together, these studies reinforce the view that digital food access can mitigate the nutritional impacts of supply chain disruptions and movement restrictions. However, the limited effect on more severe forms of food insecurity, such as going a whole day without eating (only 0.12 percentage point reduction), suggests that while online shopping is a helpful tool, it is not a panacea. Structural constraints—including affordability, digital literacy, and regional disparities in service availability—continue to hinder equitable food access, especially among the most vulnerable. This finding is consistent with Martin-Storey et al. (2022), who emphasized that digital platforms alone cannot fully address food insecurity without supportive public policies.

In light of these insights, integrating digital solutions with inclusive policies is imperative. Enhancing mobile and internet infrastructure, subsidizing digital access for low-income groups, and promoting digital literacy could expand the reach and effectiveness of online food systems. Moreover, targeted support programs for economically affected households should incorporate digital tools to ensure that aid is accessible and adaptable to evolving needs during crises. In summary, the discussion highlights the dual role of online food shopping during the pandemic: it functioned as both a coping mechanism and an inequality amplifier. Its potential to reduce food insecurity is evident, but realizing this potential fully requires addressing the digital divide and embedding online food access into broader strategies for food system resilience.

5. Conclusions and policy implication

This study investigates the relationship between online shopping accessibility and food insecurity in Vietnam during the COVID-19 pandemic, revealing significant insights into how digital access can influence household food resilience during crises. The findings indicate that better access to online shopping platforms is associated with lower levels of food insecurity, especially in urban areas, where internet infrastructure and digital literacy are more developed. These results emphasize the growing importance of e-commerce and digital tools in supporting food security in the face of disruptions like pandemics.

In light of these findings, several public policy implications emerge: Expand digital infrastructure and connectivity, particularly in rural and underserved areas, to ensure equitable access to online food retail options. Promote digital literacy programs, especially targeting vulnerable groups such as the elderly, low-income households, and those with lower educational attainment. Support small-scale and local food vendors to participate in online marketplaces through subsidies, training, and simplified regulatory processes. Integrate online shopping platforms into national food security strategies,

recognizing their role as essential components of resilient food systems during emergencies.

This study has several limitations that must be acknowledged. First, the data were collected during a specific period of the COVID-19 pandemic, which may limit the generalizability of findings to other contexts or non-crisis periods. Second, the study relies on self-reported data, which may be subject to recall bias or social desirability bias. Third, while the study accounts for several control variables, other relevant factors such as mental health, supply chain disruptions, or informal food networks were not included.

Future studies should explore the long-term impact of online shopping accessibility on food security post-pandemic and assess how digital solutions interact with traditional food distribution systems. Comparative studies across different regions or countries could offer deeper insights into contextual factors shaping the relationship between digital access and food security. Moreover, integrating qualitative approaches could enrich the understanding of user experiences and barriers in accessing online food services.

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