

Nguyen, Trung Thanh; Do, Manh Hung

Working Paper

Female rural-urban migrants and online marketplaces in emerging economies: Evidence from Thailand and Viet Nam

ADB Working Paper, No. 1338

Provided in Cooperation with:

Asian Development Bank Institute (ADBI), Tokyo

Suggested Citation: Nguyen, Trung Thanh; Do, Manh Hung (2022) : Female rural-urban migrants and online marketplaces in emerging economies: Evidence from Thailand and Viet Nam, ADB Working Paper, No. 1338, Asian Development Bank Institute (ADBI), Tokyo, <https://doi.org/10.56506/LDWS3997>

This Version is available at:

<https://hdl.handle.net/10419/267770>

Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

Terms of use:

Documents in EconStor may be saved and copied for your personal and scholarly purposes.

You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.

If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.



<https://creativecommons.org/licenses/by-nc-nd/3.0/igo/>



ADB Working Paper Series

**FEMALE RURAL–URBAN MIGRANTS
AND ONLINE MARKETPLACES IN
EMERGING ECONOMIES: EVIDENCE
FROM THAILAND AND VIET NAM**

Trung Thanh Nguyen
and Manh Hung Do

No. 1338
August 2022

Asian Development Bank Institute

Trung Thanh Nguyen is a Privatdozent (equivalent to associate professor) at Leibniz University, Hannover, Germany. Manh Hung Do is a PhD candidate at Leibniz University, Hannover, Germany.

The views expressed in this paper are the views of the author and do not necessarily reflect the views or policies of ADBI, ADB, its Board of Directors, or the governments they represent. ADBI does not guarantee the accuracy of the data included in this paper and accepts no responsibility for any consequences of their use. Terminology used may not necessarily be consistent with ADB official terms.

Working papers are subject to formal revision and correction before they are finalized and considered published.

The Working Paper series is a continuation of the formerly named Discussion Paper series; the numbering of the papers continued without interruption or change. ADBI's working papers reflect initial ideas on a topic and are posted online for discussion. Some working papers may develop into other forms of publication.

The Asian Development Bank refers to "China" as the People's Republic of China.

Suggested citation:

Nguyen, T. T. and M. H. Do. 2022. Female Rural–Urban Migrants and Online Marketplaces in Emerging Economies: Evidence from Thailand and Viet Nam. ADBI Working Paper 1338. Tokyo: Asian Development Bank Institute. Available: <https://doi.org/10.56506/LDWS3997>

Please contact the authors for information about this paper.

Email: thanh.nguyen@iuw.uni-hannover.de

We would like to thank the respondents from the migrant tracking survey and rural household survey in Thailand and Viet Nam for their kind support and cooperation. We acknowledge the support of the German Research Foundation (DFG) for the TVSEP project (DFG – FOR 756/2) and the Asian Development Bank Institute (ADBI). We appreciate the efforts of our colleagues at the Leibniz University Hannover for data collection and cleaning. The comments from the participants at the virtual ADBI Conference "*The Social and Economic Impact of Online Commerce on Women*" in 26–28 October 2021 are appreciated. MH Do would like to thank the German Academic Exchange Service (DAAD) for financial assistance. We are also grateful to the constructive comments from four anonymous reviewers.

Asian Development Bank Institute
Kasumigaseki Building, 8th Floor
3-2-5 Kasumigaseki, Chiyoda-ku
Tokyo 100-6008, Japan

Tel: +81-3-3593-5500
Fax: +81-3-3593-5571
URL: www.adbi.org
E-mail: info@adbi.org

© 2022 Asian Development Bank Institute

Abstract

This research aimed to examine the factors affecting the participation of female rural–urban migrants in online marketplaces, and the welfare gains and their distribution from their participation. Our analysis was based on a unique data set of rural households, villages, and rural–urban migrants in Thailand and Viet Nam. Online market participation is classified into three activities: financial transaction; trading; and business. We accounted for the endogeneity issue of online market participation in welfare impact assessment by using an instrumental variable approach. Our results show that the participation has a positive effect on the consumption of female migrants only when they participate in the complete bundle of online market activities. In addition, we also find that the poor benefit insignificantly from online marketplaces. This raises a concern regarding increasing welfare inequality and suggests that the poor should be supported in order not to be left behind.

Keywords: impact, welfare, poverty, endogenous, heterogeneity, instrumental variable

JEL Classification: O18, R11, I30

Contents

1.	INTRODUCTION.....	1
2.	CONCEPTUAL FRAMEWORK AND LITERATURE REVIEW	2
2.1	Conceptual Framework.....	2
2.2	Literature Review	3
3.	STUDY SITES AND DATA DESCRIPTIONS.....	5
3.1	Study Sites and Sample	5
3.2	Data Description	6
4.	METHODOLOGY	10
4.1	Identifying the Factors Affecting the Participation of Female Rural–Urban Migrants in Online Marketplaces	10
4.2	Examining Effects of Online Market Participation on Female Migrants’ Welfare	11
4.3	Determining the Distribution of the Welfare Effects	12
5.	RESULTS AND DISCUSSION	12
5.1	Factors Affecting Migrants’ Decision to Participate in Online Marketplaces ..	12
5.2	Effects of Participation in Online Marketplaces on Female Migrants’ Consumption and Poverty	14
5.3	Distribution of Consumption Effects of Participation in Online Marketplaces.	16
6.	CONCLUSION	18
	REFERENCES	19
	APPENDIXES	
1	Name, Definition, and Measurement of Variables	23
2	Descriptive Summary of Household Characteristics between the Uninterviewed and Interviewed Migrants	24
3	Variance Inflation Factor (VIF) Values on the Determinants of Migrant’s Participation in Internet Marketplaces	25
4	Variance Inflation Factor (VIF) Values on the Impact of Migrant’s Participation in Internet Marketplaces on Welfare	26
5	Tests for Heteroscedasticity in the Models of Effects of Online Market Participation on Welfare of Female Migrants	27
6	Factors Affecting the Participation of Rural–Urban Migrants in Online Market Activities (Marginal Effects)	28
7	Effects of Online Market Participation on Welfare of Rural–Urban Migrants by Type of Activities	29
8	Effects of Online Market Participation on Welfare of Rural–Urban Migrants by Number of Activities	30
9	Effects of Online Market Participation on Welfare of Female Migrants by Type of Activities (Country Dummy Excluded).....	31
10	Effects of Online Market Participation on Welfare of Female Migrants by the Number of Activities (Country Dummy Excluded).....	32

11	Results of Quantile Regressions of Online Market Participation and Female Migrant's Consumption for Financial Transaction.....	33
12	Results of Quantile Regressions of Online Market Participation and Female Migrant's Consumption for Trading.....	34
13	Results of Quantile Regressions of Online Market Participation and Female Migrant's Consumption for Business	35
14	Results of Quantile Regressions of Online Market Participation and Female Migrant's Consumption for at Least One Activity.....	36
15	Results of Quantile Regressions of Online Market Participation and Female Migrant's Consumption for at Least Two Activities.....	37
16	Results of Quantile Regressions of Online Market Participation and Female Migrant's Consumption for All Three Activities	38
17	Number of Female Migrants Using the Internet by Types and Number of Activities	39

1. INTRODUCTION

The rapid use of online marketplaces has brought new economic opportunities in the developing world, especially in emerging economies where it is facilitated by advances in digital technologies and the expansion of internet access (Goldfarb and Tucker 2019). This digital transformation has created a virtual place in which information, goods, and services are exchanged to boost economic growth (Greenstein 2020). An online market is an internet-based inter-organizational information system that provides participating buyers and sellers with opportunities to exchange information about prices and product offerings (Bakos 1991). It thus plays an intermediary role in facilitating and matching buyers and sellers (Troy and Michael 1999). According to a recent report of the Asian Development Bank (ADB), digital platform business-to-consumer revenues reached US\$3.8 trillion, equivalent to 4.4% of global Gross Domestic Product (GDP) in 2019. Asia accounted for about 48% of this total sales revenue (US\$1.8 trillion – equivalent to 6% of its regional GDP). It is expected that Asia will continue its rise as a major player in the world's digital platform market as wider access reaches more users and generates higher revenue growth (ADB 2021).

At the same time, rapid economic growth in several Asian countries has created opportunities for employment and education in urban centers with the financial returns expected to be higher than that in rural areas characterized by a high dependence on agriculture and high exposure to extreme climatic events. This has partly led to a considerable movement of laborers from rural areas to urban centers within their countries for work and education, even on a temporary basis. This is known as domestic migration. According to the World Bank (WB) (2016), there were about 756 million domestic migrants in 2015, which is roughly three times the size of international migrants. Rural–Urban migrants are vulnerable in the new urban setting due to their low level of education and limited access to social services. As a consequence, many of them fall into poverty (Cao and Liu 2015; Lee et al. 2021). Among them, female migrants are more disadvantaged than male ones (Llácer et al. 2007). They are even paid less than male migrants for the same job (Obermann, Hoang, and Hong 2021). The expansion of online marketplaces might offer additional benefits to domestic migrants in several ways. They might use these online platforms to look for employment opportunities and accommodation, to participate in various online purchasing activities, or to undertake their own online business. This is especially relevant for female migrants because their time is constrained due to their various family obligations, such as taking care of children and purchasing food. However, to date no empirical evidence is known about the factors facilitating or hindering the participation of female rural–urban migrants in online marketplaces, the welfare gains for them from the participation, and the distribution of the welfare gains.

Thailand and Viet Nam are suitable places to examine these issues. Both countries are emerging economies, which prior to the COVID-19 pandemic had relatively high rates of economic growth (Waibel et al., 2020). Thus, a relatively high number of migrants moved from rural areas to urban centers (i.e., Bangkok metropolitan area in Thailand and Ho Chi Minh City in Viet Nam) for employment and education (Nguyen, D. Grote, and Nguyen, T., 2019). Both countries are members of the Association of Southeast Asian Nations (ASEAN) and implementing the ASEAN Information and Communication Technology (ICT) Master Plan 2020. Thailand is undertaking the Thailand 4.0 strategy aimed at achieving economy-wide growth and innovation by creating an integrated digital economy. Viet Nam has also identified ICT as an important factor for economic growth. Both countries have experienced rapid growth in online market development (ITU 2020; ADB 2021). Nevertheless, these two countries are also distinct in several

aspects. Thailand is an upper-middle-income economy while Viet Nam is a lower-middle-income one. However, the share of internet users of the population has been higher in Viet Nam than in Thailand since 2006 (ITU 2020).

Against this background, our research thus aims to address the following research questions: (i) What are the factors affecting the participation of female migrants in online marketplaces?; (ii) How much are the welfare gains from online marketplace participation?; and (iii) How are the welfare gains distributed? Addressing these questions provides useful information for policy responses to design specific programs for this vulnerable population group to further benefit from online market development for an efficient and inclusive economic growth. We used a unique migrant data set linked to a data set of rural households and villages where the migrants come from to examine these issues. One of our key interests is on how the characteristics of the original households and villages where migrants come from impact their participation in online marketplaces. We employed an econometric estimation strategy that accounts for endogeneity in welfare impact assessment to achieve robust estimation results.

The rest of the paper is structured as follows. Section two outlines the conceptual framework in which potential factors affecting the decision of participating in online markets and the mechanisms through which online marketplaces affect welfare of the participants are conceptualized, reviews the evidence from the previous literature, and highlights our contributions. Section three describes the study sites and data. Section four explains the methodology. Section five presents the results and discusses the findings. Section six concludes.

2. CONCEPTUAL FRAMEWORK AND LITERATURE REVIEW

2.1 Conceptual Framework

We start with a female rural–urban migrant. Her decision to migrate depends on several factors, which are, in the migration literature, classified as “push” factors from the area of origin (her rural household and village), and “pull” factors from the area of destination (the city where she moves to). Several authors find that the decision to migrate from a rural area to an urban center reflects not only the goals or needs of the migrant, but also a livelihood strategy of the rural household (Stark and Bloom 1985; Rozelle, Taylor, and de Brauw, 1999). Once in the city, her participation in online marketplaces is dependent on her perceived net benefit from the participation, which is assumed to be positive when the decision to participate is made. The perceived net benefit is, in its turn, dependent on several factors including her characteristics, such as age, education level, marital status, wealth, and employment (Santouridis and Kyritsi 2014). This conceptualization allows us to link the activities undertaken by the migrant (i.e., participation in online marketplaces) to not only her characteristics, but also to the characteristics of the places of origin and destination (Taylor, Rozelle, and de Brauw 2003; Nguyen, D., Grote, and Nguyen, T. 2019). For example, how migrants who come from a relatively well-off background (e.g., having the internet at home) use opportunities provided by online marketplaces.

One of the most visible differences between men and women is the time devoted to unpaid care work for their families. This unpaid care work is both an important aspect of economic activity and an indispensable factor contributing to the well-being of individuals, their families and societies (Stiglitz, Sen, and Fitoussi 2007). According to a report of the Organization for Economic Cooperation and Development (OECD),

women spend two to ten times more time on unpaid care work than men (OECD 2014). The unpaid care work includes not only home activities such as cooking, cleaning, and caring for children, the ill and the elderly, but also outside activities such as purchasing foods, clothes, and various other items needed for their families. This is in addition to their paid activities, thus creating the “double burden” of work for women. Moreover, women are in several cases paid less than men for the same job (Obermann, Hoang Oanh, and Hong Ngoc 2021). The situation might even be worse for rural–urban migrants due to the lack of support from their relatives who are still in rural villages. In this regard, the development of the internet in general and online marketplaces in particular offers new opportunities especially for women as such development enables women to purchase needed items online, access a wealth of information for improving work skills, expand and strengthen social networks, and improve employment opportunities. These all might help them to gain in welfare.

Compared to conventional markets, online markets can help their participants to save time and money, which are more limited for women. Online financial transactions, such as sending or receiving money, help save women’s limited time and money as they do not need to go to a bank. When they offer something to sell in online markets, it is easier for potential buyers to know about their offers; and when they need to buy something, it is also more convenient for them to look for the needed goods or services, to search for lower prices, and to settle the purchases. When women undertake their own business, it is also easier for them to look for and meet with their business partners and reduce the costs for search and trade settlement (Troy and Michael 1999; Zanello, Srinivasan, and Shankar 2014). In this regard, one of the potential mechanisms through which the participation in online marketplaces can help to improve the welfare of online market participants is that it reduces transaction costs (Goldfarb and Tucker 2019; Garicano and Kaplan 2001;), which include search costs, price discovery, and trade settlement (Lee and Clark 1996). As a consequence, this increases the disposable income. The welfare gains are supposed to be different due to the nature of online market activities. For example, the gains from purchasing online for personal use are different from the gains from becoming an online merchant. The former is purely mechanical where better-off households have more disposable income and thus can spend more in online transactions; while the latter is productive and expected to bring a certain level of income. However, participation in online markets also involves a higher risk of fraud or cheating (Bilen and Matros 2021), which can lead to welfare losses as well. Thus, examining whether participation in online markets has a welfare-improving effect and how the welfare gains are distributed is an empirical question.

2.2 Literature Review

Even though online marketplaces have become increasingly popular in our daily lives, previous studies seem to have focused more on the factors affecting internet use and its welfare impact. This is because participation in online marketplaces is only possible if access to the internet is available (Howard and Mazaheri 2009). For the determinants of internet use, previous studies show that it is driven by various factors characterizing internet users (Lera-López, Billon, and Gil 2011; Ojo et al. 2019). Education is found to be positively associated with internet use (Briggeman and Whitacre 2010; Yang et al. 2021). This is explained by the lack of knowledge or computer skills which could demotivate individuals with low education levels from using the internet. In addition, better-educated individuals could take advantage of educational resources and information on the internet to strengthen their knowledge, improve employment opportunities, and enhance their income. Meanwhile, results on

the relationship between age and internet use are mixed. Chang and Just (2009) find that age is positively correlated with the probability of using the internet, whereas Lera-López, Billon, and Gil (2011) show that the probability of internet use decreases when age increases. Nguyen, Nguyen, and Grote (2022) demonstrate a nonlinearity in the effect of age on internet use. Briggeman and Whitacre (2010) show that higher income is positively associated with a higher probability of using the internet. Occupations are found to significantly affect the decision of using the internet. Mesch and Talmud (2011) find that people working in sale sectors are more likely to use the internet than those working in the agricultural sector. Lera-López, Billon, and Gil (2011) point out that urbanization is one of the key determinants of internet use. In developing countries, urbanization is usually accompanied by infrastructure development for production, transportation, and telecommunication. Regarding the welfare impact of internet use, the evidence is mixed. Some authors find a positive and significant effect of internet use on income in developing countries (Bailur and Masiero 2017), which helps to reduce poverty (Chang and Just 2009; Chen, Liu, and Song 2020). Some other authors find a significant but negative income effect of internet use as labor productivity is negatively affected by adjustment costs related to learning and the relocation of labor and other activities. In addition, internet diffusion tends to benefit more people with high education levels, consequently exacerbating income inequality (Nguyen, Nguyen, and Grote 2022).

Even though previous studies on the drivers and welfare impact of internet use provide important insight, there are several issues that need further attention. First, there is a lack of studies on the factors affecting the participation in online marketplaces of rural–urban migrants, despite some previous studies having examined the effectiveness of e-business on the empowerment of women (Hossain 2018). In rapidly growing economies, rural–urban migrants have increasingly contributed to economic growth, not only at the place of destination but also at the place of origin. Second, even less attention has been paid to female rural–urban migrants despite the fact that they are more disadvantaged than male migrants (Llácer et al. 2007; Pujazon-Zazik, and Park 2010). Third, the impact of internet development in general and of online market development in particular should theoretically be examined from both efficiency and equity perspectives. The efficiency perspective concerns whether these developments bring gains in total welfare. Meanwhile, the equity perspective is about how the welfare gains are distributed. Making economic growth more efficient and inclusive has always been a norm in the formulation of development policies. Previous literature seems to have focused more on the efficiency issues, largely ignoring the equity issues. Last, from a methodological point of view, the decision to migrate, to use the internet, or to participate in online marketplaces is endogenous. Participants in online marketplaces might be systematically different from nonparticipants. Thus, failure to account for this endogeneity issue results in biased estimates of the welfare impacts.

Hence, our study contributes to filling these research gaps. We used a unique data set that includes not only the characteristics of the migrants but also the characteristics of the rural households and villages from where they come to identify the determinants of female migrants' participation in online marketplaces. This allows us to see how the characteristics of the place of origin influence the participation in online marketplaces. We then examined the welfare impact of online marketplace participation with regard to the level of consumption and poverty status of migrants. We controlled for the potential endogeneity of the participation by using an instrumental variable (IV) approach. Last, we employed a quantile regression to examine the distribution of the gains in consumption from the participation. This enables us to see who benefit(s) more from the participation. Our findings are thus expected to enrich the literature on online marketplace participation and its welfare impact and distribution, and provide solid

evidence for formulating policy responses to support female rural–urban migrants to take the opportunities of online marketplace development. For example, which policy interventions should be introduced in the rural areas that facilitate female rural urban migrants to participate and benefit from participation in online marketplaces? Our findings are, therefore, expected to be relevant not only to Thailand and Viet Nam but also to other rapidly growing economies in the developing world.

3. STUDY SITES AND DATA DESCRIPTIONS

3.1 Study Sites and Sample

We used the data from the “*Poverty dynamics and sustainable development: A long-term panel project in Thailand and Vietnam (TVSEP)*” funded by the German Research Foundation (DFG FOR 756/2), and administered by the Leibniz University Hannover, Germany. The aim of the project is to establish a long-term database to examine and compare trends and drivers of long-term development dynamics in these two emerging economies, including economic transformation and rural–urban migration. Northern Thailand and Central Viet Nam were targeted because these regions have low average income and poor infrastructure (Nguyen et al. 2021). In these regions, three provinces in Thailand (Buri Ram, Nakhon Phanom, and Ubon Ratchathani) and three provinces in Viet Nam (Dak Lak, Ha Tinh, and Thua Thien Hue) were selected as study sites as these provinces are rural and agriculture is the primary livelihood of the population. These selected provinces are highly representative of rural population in the northern region of Thailand and the central region of Viet Nam (Klasen and Waibel 2015). The sampling procedure includes three stages following the guidelines of the United Nations Department of Economics and Social Affairs (United Nations 2005) and is described in Nguyen et al. (2017). At the first stage, sampled subdistricts (in Thailand) or communes (in Viet Nam) were selected. Then two villages per sampled subdistrict or commune were chosen in the second stage based on the size of the human population. At the third stage, ten households in each sampled village were randomly chosen with equal probability. The total number of sampled households was predetermined at about 2,200 in 220 villages in each country.

There have been several survey waves since 2007. In every wave, enumerators were carefully selected based on their experience in rural household surveys. They were then intensively trained. During the survey, each enumerator carried out face-to-face interviews at respondents’ homes. Each interview took, on average, about two and a half hours. Since 2013, the computer-assisted personal interview (CAPI) on tablets has been used to record data, which is then cross-checked for any inconsistent and implausible data by (i) survey team leaders at the spot, (ii) data-checking assistants, and (iii) staff members of the data center headquarters. During these checking processes, if there were any missing or implausible data, the responsible enumerator for that interview had to correct them by revisiting (if possible) or calling the respondent.

Two survey instruments for the rural surveys were used for data collection: the household questionnaire for household heads, and the village questionnaire for village heads. The village questionnaire records information on the economy of the village, such as the distance from the village to the provincial centers, and the share of households in the village with internet access, including the cable internet at home. The household questionnaire contains nine sections recording information on many aspects of the households, including education and health of household members, and income-generating activities. A specific subsection was designated for migration and

remittances in which information of household members who had migrated to other provinces/cities was recorded, including contact details. A migrant was defined (i) as a household member who was at least 13 years old at the time they left home, (ii) was living in the place of destination at the time of the rural survey, and (iii) had left home at the place of origin for at least one month during the reference period (from May of the previous year to April of the survey year). The most recent rural survey wave undertaken in both Thailand and Viet Nam was in 2017 for 1,914 rural households in Thailand and 1,898 rural households in Viet Nam.

A migrant tracking survey was conducted in 2018. From the rural survey in 2017, 1,690 individuals were identified as migrants (998 in Thailand and 692 in Viet Nam) from the rural household sample. From the contact information (addresses or phone numbers) of migrants recorded in the household survey in 2017, the enumerators contacted the migrants to arrange for an interview in urban cities where they were living. Similarly to the rural household survey in 2017, this migrant tracking survey also used CAPI on tablets to record data; and the collected data were also cross-checked as in the rural household survey. The project aimed to interview all migrants identified from the rural survey. However, only 760 migrants (388 in Thailand and 372 in Viet Nam) were successfully interviewed, of which 373 are female. Most of the interviewed migrants were in Bangkok metropolitan area in Thailand, and in Ho Chi Minh City, Da Nang City and Ha Noi Capital in Viet Nam. The reasons for this low response rate include (i) changes in the contact details so that it was not possible to reach the migrants, and (ii) time constraints and high mobility of respondents.

A separate section (section 9) is designed in the migrant survey instrument to record information on internet use in which the migrants reported whether she used the internet during the last 12 months and for what activities, including financial transactions (e.g., transferring or receiving money (internet banking)), communication with family members and friends, entertainment (e.g., playing games, listening to music, or watching movies), online business (e.g., working with business partners online), finding information about job opportunities, online trading (e.g., online buying or selling), and searching for medical/health information. Based on the definition that online markets are the virtual places that allow participating buyers or sellers to exchange information or facilitate their transactions (Bakos 1991; Troy and Michael 1999), three activities are classified as online market participation: (i) financial transactions; (ii) trading; and (iii) business. The first is online banking, while the second is buying and selling, and the third is undertaking business. The village, household and migrant survey questionnaires are available for download at the TVSEP homepage (www.tvsep.de).

3.2 Data Description

Table 1 describes the characteristics of migrants, rural households, and the villages where they come from, and the place of destination for the whole sample (including both male and female migrants), by gender (male and female) and by country (Thailand and Viet Nam). The average age of migrants is about 30 years. Female migrants are younger than male ones (29 years vs. 31 years), and migrants in Viet Nam are younger than those in Thailand (26 years vs. 33 years). The difference in age of migrants between Thailand and Viet Nam is probably due to the fact that more Vietnamese migrants first migrated for educational purposes than Thai migrants. The average schooling years of migrants is about 11.4 years with no significant difference between female and male migrants. Vietnamese migrants have a higher education level than Thai migrants. There are also more Vietnamese migrants than Thai migrants

who first left their place of origin for education (41% in Viet Nam vs. 15% in Thailand). About one third of Vietnamese migrants are married while this number of Thai migrants is 61%. However, the number of migrants living together with their own family (spouse and children) in the place of destination is higher in Viet Nam than in Thailand (23% vs. 10%). The average asset value of migrants for the whole sample is about PPP\$ 3,900 (purchasing power parity dollars – PPP\$) with Thai migrants owning more assets than Vietnamese migrants (PPP\$ 5,600 vs. PPP\$ 2,100).

Table 1: Descriptive Statistics of the Characteristics of Migrants and their Places of Origin and Destination

	Whole Sample (n = 760)	By Gender		By Country	
		Male (n = 387)	Female (n = 373)	Viet Nam (n = 372)	Thailand (n = 388)
<i>Migrant's characteristics</i>					
Age of migrant (years)	29.84 (8.76)	30.53 (8.90)	29.12 ^{**} , a (8.56)	26.17 (6.14)	33.35 ^{***} , a (9.43)
Education of migrant (years)	11.41 (3.65)	11.20 (3.63)	11.62 ^a (3.66)	12.27 (3.39)	10.59 ^{***} , a (3.71)
Marital status of migrant [†] (yes=1)	0.49 (0.50)	0.51 (0.50)	0.46 ^b (0.50)	0.35 (0.48)	0.61 ^{***} , b (0.49)
Living with family in the city [†] (yes=1)	0.16 (0.37)	0.17 (0.38)	0.16 ^b (0.36)	0.23 (0.42)	0.10 ^{***} , b (0.30)
Education purposes [†] (yes=1)	0.28 (0.45)	0.25 (0.44)	0.30 ^b (0.46)	0.41 (0.49)	0.15 ^{***} , b (0.36)
Accommodation-sharing adults (persons)	2.51 (1.68)	2.49 (1.68)	2.54 ^a (1.68)	2.84 (1.84)	2.20 ^{***} , a (1.45)
Asset value (PPP\$)	3,920.46 (7,910.02)	4,127.53 (7,853.02)	3,705.61 ^a (7,973.59)	2,152.89 (5,713.85)	5,615.14 ^{***} , a (9,248.29)
<i>Rural household's characteristics</i>					
Ethnic majority [†] (yes=1)	0.96 (0.20)	0.96 (0.19)	0.96 ^b (0.20)	0.96 (0.19)	0.96 ^b (0.20)
Mean adult education (years)	5.68 (1.93)	5.74 (1.99)	5.61 ^a (1.87)	5.54 (1.98)	5.81 [*] , a (1.88)
<i>Rural village's characteristics</i>					
Share of cable internet at home (%)	6.86 (9.86)	6.97 (9.45)	6.75 ^a (10.28)	10.63 (11.95)	3.25 ^{***} , a (5.19)
Distance to provincial center (km)	51.36 (31.43)	50.27 (30.41)	52.49 ^a (32.45)	41.67 (27.26)	60.64 ^{***} , a (32.38)
<i>Place of destination</i>					
Metropolitan [†] (yes=1)	0.46 (0.50)	0.43 (0.50)	0.49 ^b (0.50)	0.47 (0.50)	0.46 ^b (0.50)

PPP\$ = purchasing power parity dollars.

Standard deviation in parentheses; Statistic tests between gender groups and countries; ^a: Two-sample t-test; ^b: Nonparametric two-sample rank-sum test; [†]: Dummy variable; ^{***} $p < 0.01$, ^{**} $p < 0.05$, ^{*} $p < 0.1$.

Regarding the characteristics of the rural households that migrants come from, more than 90% of rural households belong to the majority ethnic group in their country (Thai majority in Thailand and Kinh majority in Viet Nam). The average schooling year of adult members of rural households is 5.68 years. This shows that the migrating members are better educated than members staying at home. With regard to the characteristics of the rural villages, the share of rural households having cable internet

at home in a village is relatively low, at around 7%, with Viet Nam having a higher share than Thailand (10% vs. 3%). The average distance from the village to the provincial center is 41 km in Viet Nam and 60 km in Thailand. There are no differences in this regard between female and male migrants. With regard to the place of destination, nearly 50% of the migrants are in metropolitan cities (i.e., Bangkok in Thailand or Ho Chi Minh City in Viet Nam), and there are no differences between male and female migrants in this aspect.

Table 2 reports the descriptive statistics of migrants' consumption and their online market participation by gender and country. The average annual consumption expenditure for the whole sample is about PPP\$ 4,300. Although the expenditure of male migrants is slightly higher than that of female migrants, the difference is not statistically significant. With regard to the participation in online marketplaces, more female migrants participate in financial transactions and trading activities than male ones, whereas the difference in business activities is not statistically significant between male and female migrants. There are more Vietnamese migrants participating in online trading activities. Meanwhile, the differences between Vietnamese and Thai migrants in financial transactions and business activities are not statistically significant.

Table 2: Descriptive Statistics of Migrants' Consumption and their Online Market Activities

	Whole Sample (n = 760)	By Gender		By Country	
		Male (n = 387)	Female (n = 373)	Viet Nam (n = 372)	Thailand (n = 388)
Annual consumption expenditure (PPP\$)	4,364.89 (2,991.65)	4,509.31 (2,948.30)	4,215.06 ^a (3,032.66)	4,286.90 (2,738.36)	4,439.67 ^a (3,217.60)
Financial transaction [†] (yes=1)	0.44 (0.50)	0.39 (0.49)	0.50 ^{***,b} (0.50)	0.44 (0.50)	0.45 ^b (0.50)
Trading [†] (yes=1)	0.47 (0.50)	0.41 (0.49)	0.53 ^{***,b} (0.50)	0.52 (0.50)	0.42 ^{***,b} (0.49)
Business [†] (yes=1)	0.25 (0.44)	0.25 (0.43)	0.26 ^b (0.44)	0.24 (0.43)	0.26 ^b (0.44)
At least 1 activity [†] (yes=1)	0.64 (0.48)	0.61 (0.49)	0.67 ^{*,b} (0.47)	0.68 (0.47)	0.60 ^{*,b} (0.49)
At least 2 activities [†] (yes=1)	0.38 (0.49)	0.33 (0.47)	0.43 ^{***,b} (0.50)	0.38 (0.49)	0.37 ^b (0.48)
All 3 activities [†] (yes=1)	0.15 (0.36)	0.12 (0.33)	0.18 ^{**,b} (0.38)	0.14 (0.35)	0.16 ^b (0.37)

PPP\$ = purchasing power parity dollars.

Standard deviation in parentheses; Statistic tests between gender groups and countries; ^a: Two-sample t-test; ^b: Nonparametric two-sample rank-sum test; [†]: Dummy variable; ^{***} $p < 0.01$, ^{**} $p < 0.05$, ^{*} $p < 0.1$.

Table 3 shows the descriptive statistics of female migrants by their participation in online marketplace. About two thirds of female migrants participate in at least one activity. Participants have higher expenditure, a younger age, a higher educational level, and a higher asset value than nonparticipants. The share of migrants coming from the ethnic majority, the average number of schooling years of adult members, and the distance from the village to the provincial center do not show a significant difference between participants and nonparticipants. However, female migrants coming from rural villages with a higher share of households with cable internet at home are more likely to participate in online marketplaces than those from the villages with a lower share of households with cable internet at home.

Table 3: Descriptive Statistics of Female Migrants by their Participation in Online Marketplaces

	Nonparticipants (n = 122)		Participants (n = 251)	
	Mean	Std. Dev.	Mean	Std. Dev.
<i>Migrant's characteristics</i>				
Consumption expenditure (PPP\$)	3,278.02	1,782.05	4,670.52 ^{***, a}	3,392.84
Age of migrant (years)	32.81	10.91	27.32 ^{***, a}	6.45
Education of migrant (years)	9.67	3.76	12.57 ^{***, a}	3.21
Marital status of migrant [†] (yes=1)	0.58	0.50	0.40 ^{***, b}	0.49
Living with family in the city [†] (yes=1)	0.22	0.42	0.12 ^{** , b}	0.33
Education purposes [†] (yes=1)	0.17	0.38	0.37 ^{***, b}	0.48
Accommodation-sharing adults (persons)	2.60	1.68	2.52 ^a	1.69
Asset value (PPP\$)	2,495.17	5,435.17	4,293.95 ^{** , a}	8,901.90
<i>Rural household's characteristics</i>				
Ethnic majority [†] (yes=1)	0.93	0.25	0.97 ^b	0.18
Mean adult education (years)	5.46	1.60	5.68 ^a	1.98
<i>Rural village's characteristics</i>				
Share of cable internet at home (%)	4.90	7.62	7.65 ^{** , a}	11.26
Distance to provincial center (km)	54.21	35.11	51.65 ^a	31.12
<i>Place of destination</i>				
Metropolitan [†] (yes=1)	0.44	0.50	0.51 ^b	0.50
Thailand [†]	0.58	0.50	0.57 ^b	0.50

PPP\$ = purchasing power parity dollars.

^a: Two-sample t-test; ^b: Nonparametric two-sample rank-sum test; [†]: Dummy variable; ^{***} $p < 0.01$, ^{**} $p < 0.05$, ^{*} $p < 0.1$.

Table 4: Consumption, Absolute Poverty, and Relative Poverty of Migrants

	Whole Sample (n = 760)	By Gender		Only Female Migrants	
		Male Migrants (n = 387)	Female Migrants (n = 373)	Not participated (n = 122)	Participated (n = 251)
Daily consumption (PPP\$)	11.96 (8.20)	12.35 (8.08)	11.55 ^a (8.31)	8.98 (4.88)	12.80 ^{***, a} (9.30)
Absolute consumption poverty at PPP\$ 5.50 per capita a day [†]	0.14 (0.35)	0.13 (0.33)	0.16 ^b (0.37)	0.25 (0.43)	0.12 ^{***, b} (0.33)
Relative consumption poverty (in the 20% lowest consumption distribution) [†]	0.20 (0.40)	0.18 (0.39)	0.22 ^b (0.42)	0.33 (0.47)	0.17 ^{***, b} (0.38)

PPP\$ = purchasing power parity dollars.

Standard deviation in parentheses; Statistic tests between gender groups and female migrants' participation in internet market; ^a: Two-sample t-test; ^b: Nonparametric two-sample rank-sum test; [†]: Dummy variable; ^{***} $p < 0.01$, ^{**} $p < 0.05$, ^{*} $p < 0.1$.

Regarding poverty, we used both absolute and relative poverty. For absolute poverty, we used a daily consumption threshold of PPP\$ 5.50 per capita following the World Bank (2018) for urban residents in middle-income countries. A migrant is defined to be in absolute poverty if her consumption is lower than this threshold. For relative poverty, a migrant is defined to be in relative poverty if her consumption is in the lowest 20% of the consumption distribution in each country. Table 4 reports the descriptive statistics of consumption level and shares of absolute and relative poverty for all migrants and for female migrants. There are no significant differences in daily consumption per capita and in the share of absolute consumption poverty between male and female migrants. However, there are more female migrants in relative poverty

than male migrants. For female migrants, participants in at least one online market activity tend to have a higher level of consumption and a lower incidence of poverty than nonparticipants.

4. METHODOLOGY

4.1 Identifying the Factors Affecting the Participation of Female Rural–Urban Migrants in Online Marketplaces

Our first step was to identify the factors affecting the participation of female rural–urban migrants in online marketplaces. As conceptualized and reviewed in Section 2, the decision of a migrant to participate is theoretically affected by several factors representing not only her characteristics but also the characteristics of her places of origin and destination. The decision to participate can be represented by a dummy variable, R , which is equal to one if she participates and equal to zero otherwise. Thus, the probability of the participation of migrant i can be estimated via a probit regression as follows:

$$P(R_i = 1) = \alpha + \beta X_i + \gamma O_i + \delta D_i + \varepsilon_i \quad (1)$$

where P is the probability of participation; X_i is a vector representing the migrant's characteristics; O_i is a vector characterizing the original (rural) village and household where the migrant i comes from; D_i is a vector characterizing the migrant's destination (urban) place where the migrant is living and working; ε_i is the error term.

We include the following characteristics of the migrant: gender, age, education level, marital status, whether she left home for education purposes, whether she is living with her own family in the destination, the number of adults with whom she is currently sharing accommodation, and her asset value. For the place of origin, we included two variables at the household level (the ethnicity dummy and the average schooling years of rural household adults), and two variables at the village level (the share of households having cable internet at home in the village, and the distance from the village to the provincial center). For the place of destination, we used a dummy variable indicating whether it is the Bangkok metropolitan area in Thailand or Ho Chi Minh City in Viet Nam. We also included a country dummy variable to account for the unobserved differences between Thailand and Viet Nam. These variables are described in more detail in Appendix 1.

As we were able to interview only about a half of the migrants from the surveyed rural households, the attrition rate is high and raises a concern on our estimated results. Thus, we took a closer look on this issue. Since we did not have information of the uninterviewed migrants, we were not able to compare the differences between them and the interviewed ones. Instead, we compared the characteristics of the rural households and villages of these two groups. It appears that the uninterviewed migrants are from households with older heads, male-headed households, and poor households (daily per capita income less than PPP\$ 3.20 for rural areas in middle-income countries). The interviewed migrants are more likely to belong to the households owning a phone. This characteristic is reasonable because the TVSEP survey contacted migrants mostly by phones. Migrants coming from households with higher education heads and from remoter villages also appear to participate more in the survey (see Appendix 2). Since we pooled the data over two years (data of rural households and villages in 2017 and data of migrants in 2018), the data might suffer from a sample selection problem. Thus, we tried to mitigate the effect of this

problem by bootstrapping our estimation on the determinants of the participation with 500 replications. We also checked for multicollinearity among our independent variables in estimating Equation 1. The variance inflation factor (VIF) values signal no serious problems of multicollinearity (Appendix 3). To have robust standard errors and to prevent the spatial autocorrelation, the standard errors of our estimations were clustered at the village level.

4.2 Examining Effects of Online Market Participation on Female Migrants' Welfare

In the second step, the welfare effects from the participation of female migrants in online marketplaces were estimated via the following equation:

$$Y_i = \theta + \vartheta R_i + \varrho X_i + \int D_i + \eta_i \quad (2)$$

where Y_i represents a measure of the female migrant i 's welfare. We used three indicators to represent the welfare of the migrants: (i) the annual consumption expenditure per capita; (ii) the absolute poverty status; and (iii) the relative poverty status. R_i , X_i , and D_i are defined as in equation 1; η_i is the error term.

One of the challenges in estimating Equation 2 is that variable R_i is endogenous as explained in Equation 1. We addressed this issue by employing an instrumental variable (IV) approach based on the heteroscedasticity-based identification strategy developed by Lewbel (2012) and Baum et al. (2012). The endogeneity of migrant's participation in the internet market can be expressed as:

$$R_i = \phi + \Omega X_i + \varepsilon D_i + \omega_i \quad (3)$$

Besides the usual regression assumption that ω_i is independent from X_i , this approach assumes the existence of heteroscedasticity in ω_i , and hence in R_i . Lewbel (2012) and Baum et al. (2012) suggest using $[X_i - E(X_i)]\hat{\omega}_i$ as an internal IV for R_i in estimating Equation (2), where $\hat{\omega}_i$ is the predicted residuals obtained by estimating equation (3) excluding Y_i on the right-hand side. This is a valid instrument because $[X_i - E(X_i)]\hat{\omega}_i$ is uncorrelated with η_i (Nguyen et al. 2021).

We checked for the multicollinearity problem of independent variables in estimating Equation 2. The VIF values show that there is no such problem (Appendix 4). To validate the appropriateness of the method and IVs for our estimation, we first checked for the presence of heteroscedasticity in Equation 2 using two tests, namely the Breusch–Pagan/Cook–Weisberg test for heteroscedasticity and the White's test for homoscedasticity. The results of these tests (Appendix 5) confirmed the presence of heteroscedasticity. Next, we carried out several quality tests, namely the underidentification test (an LM test based on Kleibergen and Paap (2006)), the weak-identification test (Kleibergen-Paap rk Wald F statistics), and the overidentification test (Hansen J statistic test). The results of these tests presented in the lower panel of Tables 6 and 7 show that the generated IVs are valid (modestly weak for the case of financial transaction and trading). The robust standard errors were also clustered at the village level to prevent the spatial autocorrelation.

4.3 Determining the Distribution of the Welfare Effects

The welfare effects identified from Equation 2 only provide a mean-based estimation of the effect of the participation on the consumption level and poverty status of the migrants. Thus, in the last step, we further examined who benefit(s) more in terms of consumption expenditure. We followed Firpo, Fortin, and Lemieux (2009) to employ an unconditional quantile regression model that includes robust and clustered standard errors for this purpose. Unconditional quantile regression takes into account the effects of changes in independent variables on unconditional quantiles of dependent variables (Baltagi and Ghosh 2017). Its main advantage is that in the presence of multiple covariates, it provides more reliable and robust results than the conventional quantile one (Borah and Basu 2013). The procedure includes two steps, as explained by Borgen (2016). The first step was to obtain the recentered influence function (RIF) as:

$$RIF(Y; q_\tau, F_Y) = q_\tau + \frac{\tau - 1\{Y \leq q_\tau\}}{f_Y(q_\tau)} \quad (4)$$

where q_τ is the value of the outcome variable, Y , at the quantile τ . In our case, Y is the per capita expenditure of female migrants. F_Y is the cumulative distribution function of outcome variable Y , and $f_Y(q_\tau)$ is the density of Y at q_τ . The indicator function, $1\{Y \leq q_\tau\}$, identifies whether the value of outcome variable Y is below q_τ .

In the second step, the impact of online marketplace participation on the consumption level of each consumption quantile was estimated as follows:

$$I[RIF(Y_i; q_\tau)|X, R] = \epsilon + \lambda_i R_i + \psi_i X_i + \gamma D_i + \mu_i \quad (5)$$

We addressed the endogeneity concerns in Equation 5 by using the same procedure as in estimating Equation 2 as follows. First, we obtained the generated internal IVs from the estimation of Equation 2 using the heteroscedasticity-based method. In the next step, these generated internal IVs were included in Probit models to predict the probability of participation in online marketplaces. In the final step, the instrumented and predicted probabilities were included in estimating Equation 5.

5. RESULTS AND DISCUSSION

5.1 Factors Affecting Migrants' Decision to Participate in Online Marketplaces

We estimated Equation 1 first for the whole sample (including both male and female migrants) and then for the subsample of only female migrants. For the whole sample, in addition to the variables described in Equation 1, we included a dummy variable for gender. The results of the whole sample estimation are reported in Appendix 6. The coefficient of the gender dummy variable shows that female migrants (as compared to male migrants) use online platforms more for financial transaction and trading activities by 9.6% and 8.8%, respectively. Meanwhile, male migrants use the platforms for business activities more than female ones by 7.6%. This confirms the findings from previous studies that women and men use the internet for different purposes (Lera-López, Billon, and Gil 2011; Ojo et al. 2019). Regarding household and village characteristics (place of origin), ethnic majority and the education of rural households are positively associated with migrants' use of internet platforms for transaction activities and for at least two market activities. The development of rural

education is considered an engine for rural transformation (Ninh 2021). Furthermore, the share of the home cable internet in villages is positively associated with using the internet for trading and for at least one market activity.

Table 5: Factors Affecting the Participation of Female Rural–Urban Migrants in Online Market Activities (Marginal Effects)

	Financial Transaction	Trading	Business	At Least 1 Activity	At Least 2 Activities	All 3 Activities
Education purposes [†]	−0.095 (0.065)	0.032 (0.066)	0.108 [*] (0.055)	−0.032 (0.059)	0.008 (0.067)	0.068 (0.043)
Age of migrant	−0.010 ^{***} (0.003)	−0.018 ^{***} (0.004)	−0.004 (0.003)	−0.014 ^{***} (0.003)	−0.011 ^{***} (0.004)	−0.007 ^{**} (0.004)
Schooling years of migrant	0.046 ^{***} (0.008)	0.018 ^{**} (0.009)	0.018 ^{**} (0.008)	0.027 ^{***} (0.007)	0.027 ^{***} (0.008)	0.029 ^{***} (0.008)
Marital status of migrant [†]	−0.134 ^{**} (0.057)	−0.032 (0.061)	−0.020 (0.055)	−0.054 (0.052)	−0.096 [*] (0.057)	−0.037 (0.045)
Living with family in the city [†]	0.138 [*] (0.076)	0.004 (0.082)	0.062 (0.079)	0.015 (0.064)	0.121 (0.084)	0.078 (0.067)
Accommodation sharing adults	−0.013 (0.015)	−0.017 (0.017)	−0.032 [*] (0.017)	−0.011 (0.014)	−0.023 (0.017)	−0.038 ^{**} (0.015)
Asset value (ln)	0.034 [*] (0.018)	0.036 [*] (0.018)	0.042 ^{***} (0.014)	0.036 ^{**} (0.015)	0.042 ^{**} (0.021)	0.038 ^{**} (0.015)
Ethnic majority [†]	0.175 [*] (0.102)	0.123 (0.142)	0.065 (0.095)	0.107 (0.104)	0.258 ^{**} (0.120)	0.002 (0.082)
Mean adult education	0.019 (0.014)	−0.003 (0.014)	0.004 (0.012)	0.007 (0.013)	0.023 (0.015)	−0.007 (0.010)
Share of cable internet at home	0.002 (0.002)	0.004 (0.003)	0.005 ^{**} (0.002)	0.005 (0.003)	0.004 (0.003)	0.003 ^{**} (0.001)
Distance to provincial center	−0.001 (0.001)	−0.000 (0.001)	0.001 (0.001)	0.000 (0.001)	−0.000 (0.001)	0.001 (0.001)
Thailand [†]	0.268 ^{***} (0.059)	0.128 [*] (0.077)	0.140 ^{**} (0.068)	0.165 ^{**} (0.068)	0.219 ^{***} (0.072)	0.144 ^{***} (0.049)
Metropolitan [†]	0.091 [*] (0.052)	0.098 [*] (0.059)	0.206 ^{***} (0.046)	0.111 ^{**} (0.048)	0.204 ^{***} (0.054)	0.088 ^{**} (0.038)
Number of observations	373	373	373	373	373	373
Wald chi2(13)	73.35	49.94	72.70	59.75	65.28	48.68
Prob. > chi2	0.000	0.000	0.000	0.000	0.000	0.000
Pseudo R ²	0.202	0.152	0.210	0.201	0.185	0.266

Robust standard errors bootstrapped with 500 replications and clustered at rural villages in parentheses; †: Dummy variable; ln: natural logarithm; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table 5 presents the marginal effects of the determinants of female migrants' participation in online activities by activity. We find that the first migration for educational purposes is positively associated with the participation in online business. Age of migrants is negatively associated with the participation in online marketplaces. An increase in age by one year leads to a decrease in the probability of participation in at least one activity by 1.4%, in at least two activities by 1.1%, and in all three activities by 0.7%. An increase in age by one year results in a decrease in the probability of participation in financial transactions by 1.0% and in trading by 1.8%. These results are consistent with Fang and Yen (2006) and Ojo et al. (2019), that is the older the migrants, the less likely that they use the internet, and thus they participate less in online markets. The number of schooling years of migrants has a positive and significant effect on participation. This finding is in line with Lera-López, Billon, and

Gil (2011) and Ojo et al. (2019). Married migrants have a lower likelihood of using the internet for financial transactions, while living with family in the city has a higher probability of using the internet for this activity. The higher the number of accommodation-sharing adults, the less likely that the female migrant participates in business and in all three online market activities. Better-off migrants in terms of asset value participate more in online marketplaces. This is understandable as wealthier people have better access to ICT and the internet than poorer ones. Our finding is also in line with Shoma (2019) who report that there are many obstacles faced by female entrepreneurs in Bangladesh, and that a combination of legislative and regulatory reform can mitigate many of the issues that prevent women gaining from and contributing to economic growth.

Regarding the characteristics of the places of origin and destination, our results show that female migrants from the ethnic majority are more likely to use the internet platform for at least two online market activities by 25.8%. The higher the share of households with cable internet at home in a rural village, the higher the probability that female migrants from that village participate in online business and in all three online activities. Female migrants in metropolitan areas participate more in online business than those in the other places, and female migrants in Thailand participate more in online financial transactions, trading, and business than those in Viet Nam. It also appears that female migrants living in metropolitan cities are more likely to participate in online business and they have higher probabilities of participating in at least one activity, at least two activities, or all three activities.

5.2 Effects of Participation in Online Marketplaces on Female Migrants' Consumption and Poverty

Tables 6 and 7 report the impacts of participation in online marketplaces on female migrants' welfare with regard to (i) per capita consumption expenditure, (ii) absolute poverty status (daily consumption per capita less than PPP\$ 5.50), and (iii) relative poverty status (belong to the group of 20% poorest in each country) by type and by number of activities, respectively (the estimations for the whole sample of both male and female migrants are presented in Appendix 7 for type of activities and Appendix 8 for number of activities). The results from the estimations on each type of activities show that participation in online business is significant in increasing female migrants' consumption and reducing relative consumption poverty, while the effects of online financial transactions and trading are not significant. Further, the results from the estimations on the number of activities show that participating only in one or two activities does not have any significant effects on consumption and poverty status. However, participating in all three online market activities has positive and significant effects in increasing the consumption and reducing the poverty status of female migrants. This finding remains consistent when we excluded the country dummy variable (see Appendix 9 and Appendix 10), which allows us to generalize the finding to a larger extent. Thus, it is important to facilitate female migrants to participate in the complete bundle of online market activities so that their welfare can be improved. Our finding is consistent with several previous studies (Bailur and Masiero 2017; Chen, Liu, and Song 2020; Galperin, and Fernanda Vicens 2017; Nguyen, Nguyen, and Grote 2022): that internet use improves the welfare of its users and reduces poverty. However, our finding is different from these studies in that the effect is dependent on the extent of the participation.

Table 6: Effects of Online Market Participation on Welfare of Female Migrants by Type of Activities

	Expenditure (ln)			Absolute Consumption Poverty			Relative Consumption Poverty		
Financial transaction [†]	0.397 (0.312)			0.027 (0.164)			-0.105 (0.192)		
Trading [†]		0.299 (0.314)			-0.026 (0.191)			-0.019 (0.212)	
Business [†]			0.382*** (0.143)			-0.139* (0.077)			-0.157* (0.085)
Education purposes [†]	0.180** (0.085)	0.131 (0.092)	0.091 (0.089)	-0.047 (0.048)	-0.048 (0.049)	-0.028 (0.050)	-0.067 (0.053)	-0.057 (0.053)	-0.035 (0.055)
Age of migrant	0.005 (0.007)	0.006 (0.007)	0.003 (0.006)	0.002 (0.003)	0.001 (0.004)	0.001 (0.003)	0.003 (0.004)	0.003 (0.004)	0.003 (0.003)
Schooling years of migrant	0.013 (0.019)	0.028* (0.014)	0.027** (0.011)	-0.012 (0.010)	-0.011 (0.008)	-0.008 (0.007)	-0.004 (0.012)	-0.009 (0.009)	-0.007 (0.007)
Marital status of migrant [†]	-0.227** (0.096)	-0.265*** (0.090)	-0.276*** (0.087)	0.043 (0.052)	0.039 (0.049)	0.039 (0.049)	0.066 (0.059)	0.079 (0.056)	0.079 (0.055)
Living with family in the city [†]	0.293*** (0.100)	0.349*** (0.095)	0.326*** (0.093)	-0.075 (0.064)	-0.072 (0.063)	-0.065 (0.063)	-0.133* (0.070)	-0.147** (0.068)	-0.139** (0.068)
Accommodation-sharing adults	-0.124*** (0.022)	-0.126*** (0.023)	-0.119*** (0.023)	0.072*** (0.016)	0.072*** (0.015)	0.068*** (0.016)	0.073*** (0.016)	0.075*** (0.016)	0.070*** (0.017)
Asset value (ln)	0.060** (0.024)	0.063*** (0.019)	0.062*** (0.018)	-0.026** (0.012)	-0.024** (0.012)	-0.021* (0.011)	-0.027** (0.012)	-0.030*** (0.012)	-0.026** (0.011)
Thailand [†]	0.156 (0.114)	0.226*** (0.076)	0.203*** (0.071)	-0.050 (0.061)	-0.041 (0.046)	-0.025 (0.045)	-0.077 (0.066)	-0.101* (0.053)	-0.082 (0.053)
Metropolitan [†]	0.098 (0.070)	0.102 (0.072)	0.045 (0.071)	-0.063* (0.037)	-0.058 (0.041)	-0.031 (0.044)	-0.044 (0.044)	-0.050 (0.046)	-0.018 (0.050)
Constant	7.434*** (0.270)	7.219*** (0.289)	7.445*** (0.256)	0.299** (0.137)	0.306* (0.157)	0.263* (0.138)	0.318* (0.167)	0.347* (0.195)	0.303* (0.169)
Number of observations	373	373	373	373	373	373	373	373	373
R ²	0.301	0.294	0.328	0.166	0.166	0.157	0.165	0.170	0.174
Prob. > F	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Underidentification	0.019	0.008	0.000	0.019	0.008	0.000	0.019	0.008	0.000
Overidentification	0.911	0.479	0.496	0.705	0.146	0.656	0.554	0.172	0.753
Weak identification	5.873	5.534	15.586	5.873	5.534	15.586	5.873	5.534	15.586

Robust standard clustered at rural villages in parentheses; †: Dummy variable; ln: natural logarithm; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$; The underidentifying test is an LM test relied on the rk LM statistics (Kleibergen and Paap 2006) with the null hypothesis stating that the model is underidentified. The overidentifying test based on the Hansen J test with the null hypothesis stating that all instruments are valid in the model. The reported values of under-identification and overidentification tests are p-values. The report of weak-identifying test uses the Kleibergen-Paap rk Wald F statistic.

Other factors that have a significant and positive effect on either consumption or poverty status or both, include the education level, whether they are living with their own families in the place of destination, and asset value, whether they live in a metropolitan city, their marital status, and the number of adults sharing the accommodation.

Table 7: Effects of Online Market Participation on Welfare of Female Migrants by Number of Activities

	Expenditure (ln)			Absolute Consumption Poverty			Relative Consumption Poverty		
At least 1 activity	-0.196 (0.343)			0.039 (0.264)			-0.042 (0.254)		
At least 2 activities		0.453 (0.318)			0.023 (0.175)			-0.017 (0.191)	
All 3 activities			0.310** (0.125)			-0.106* (0.055)			-0.157*** (0.061)
Education purposes†	0.143 (0.088)	0.134 (0.090)	0.113 (0.087)	-0.048 (0.048)	-0.050 (0.050)	-0.037 (0.049)	-0.059 (0.053)	-0.058 (0.054)	-0.041 (0.054)
Age of migrant	-0.001 (0.007)	0.005 (0.006)	0.003 (0.006)	0.002 (0.005)	0.002 (0.003)	0.001 (0.003)	0.003 (0.005)	0.003 (0.004)	0.003 (0.003)
Schooling years of migrant	0.040** (0.017)	0.019 (0.015)	0.026** (0.012)	-0.012 (0.010)	-0.012 (0.009)	-0.008 (0.006)	-0.008 (0.010)	-0.009 (0.010)	-0.006 (0.007)
Marital status of migrant†	-0.292*** (0.093)	-0.238** (0.094)	-0.269*** (0.086)	0.042 (0.052)	0.042 (0.050)	0.036 (0.048)	0.078 (0.057)	0.079 (0.058)	0.075 (0.055)
Living with family in the city†	0.345*** (0.097)	0.299*** (0.102)	0.325*** (0.094)	-0.071 (0.062)	-0.074 (0.062)	-0.065 (0.062)	-0.147*** (0.067)	-0.145*** (0.067)	-0.137*** (0.068)
Accommodation-sharing adults	-0.132*** (0.022)	-0.118*** (0.024)	-0.123*** (0.022)	0.072*** (0.016)	0.073*** (0.016)	0.069*** (0.016)	0.075*** (0.016)	0.075*** (0.017)	0.071*** (0.017)
Asset value (ln)	0.082*** (0.023)	0.056** (0.022)	0.068*** (0.017)	-0.026 (0.016)	-0.026** (0.011)	-0.023** (0.011)	-0.029* (0.015)	-0.030*** (0.011)	-0.028*** (0.010)
Thailand†	0.280*** (0.081)	0.166 (0.104)	0.212*** (0.069)	-0.049 (0.058)	-0.047 (0.060)	-0.029 (0.044)	-0.097 (0.063)	-0.099 (0.065)	-0.082 (0.052)
Metropolitan†	0.145** (0.068)	0.045 (0.080)	0.094 (0.065)	-0.064 (0.040)	-0.065 (0.048)	-0.049 (0.038)	-0.048 (0.046)	-0.048 (0.051)	-0.035 (0.043)
Constant	7.436*** (0.260)	7.394*** (0.274)	7.434*** (0.258)	0.279* (0.169)	0.295** (0.140)	0.269** (0.136)	0.354* (0.191)	0.336** (0.167)	0.301* (0.167)
Number of observations	373	373	373	373	373	373	373	373	373
R ²	0.289	0.280	0.332	0.162	0.169	0.162	0.173	0.170	0.170
Prob. > F	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Underidentification	0.038	0.006	0.000	0.038	0.006	0.000	0.038	0.006	0.000
Overidentification	0.815	0.924	0.278	0.363	0.278	0.757	0.401	0.709	0.711
Weak identification	7.803	7.943	47.664	7.803	7.943	47.664	7.803	7.943	47.664

Robust standard clustered at rural villages in parentheses; †: Dummy variable; ln: natural logarithm; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$; The underidentifying test is an LM test relied on the rk LM statistics (Kleibergen and Paap, 2006) with the null hypothesis stating that the model is underidentified. The overidentifying test based on the Hansen J test with the null hypothesis stating that all instruments are valid in the model. The reported values of underidentification and overidentification tests are p-values. The report of weak-identifying test uses the Kleibergen-Paap rk Wald F statistic.

5.3 Distribution of Consumption Effects of Participation in Online Marketplaces

We further examined the distribution of consumption effects from the participation of female migrants in online marketplaces. We run separate regressions for the participation by type and number of activities (full results reported in Appendices 11–16). We summarized the results of all these estimations with regard to the effects of online marketplace participation on consumption expenditure in Table 8.

Considering each activity separately, the participation has a positive and significant effect for female migrants in the higher consumption quantile groups. More specifically, financial transaction has a positive and significant effect only for the 50th and 75th groups. The effect of trading is significant only for the 90th group, whereas the effect of business is significant for the 50th, 75th and 90th groups. The effects of each of

these activities for the 10th and 25th groups are all insignificant. Considering the combination of these activities, participation in one activity has no significant effects on all groups. Meanwhile, participation in at least two activities or in all three activities brings no significant effects for the poorest group. The results imply that online market participation is benefiting the better-off, rather than the poor.

Table 8: Distribution of Consumption Effects from Online Market Participation for Female Migrants

	Expenditure per Capita (PPP\$)				
	10th Group	25th Group	50th Group	75th Group	90th Group
<i>By type of activities</i>					
Financial transaction	-1,443.966 (1,254.271)	-8.217 (1,102.315)	3,302.045*** (1,232.112)	4,024.028** (1,969.097)	5,303.799 (4,593.143)
Trading	-1,684.309 (1,474.413)	88.852 (1,225.904)	839.310 (1,292.788)	2,906.132* (1,631.600)	7,071.414* (3,616.711)
Business	-505.104 (536.059)	524.974 (502.308)	1,344.201** (620.907)	2391.106** (1,045.001)	5,694.411* (2,933.960)
<i>By number of activities</i>					
At least 1 activity	-2,510.860 (2,136.222)	950.984 (1,729.533)	2,061.193 (1,677.825)	2,369.769 (2,228.366)	-2,079.420 (4,926.135)
At least 2 activities	-1,245.415 (873.075)	-959.504 (753.564)	2,009.499** (1,004.743)	4,619.254*** (1,472.466)	9,899.557*** (3,312.235)
All 3 activities	-108.569 (246.949)	594.840** (252.556)	1,145.878*** (361.124)	2,069.616*** (658.166)	3,211.991* (1,869.692)

PPP\$ = purchasing power parity dollars.

Robust standard errors clustered at rural villages in parentheses; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$; Full results are presented in Appendices 11–16.

The insignificant effects on poorer quantiles raises the concern that it is not clear to what extent the results are driven by lack of variation in participation in lower quantiles of consumption. For example, if very few migrants at the lowest quantile use the internet, there would not be enough variation in the data to estimate the impact of participation on consumption. Thus, we checked the variation of internet use in different quantiles (see Appendix 17) and saw that the results are not driven by the lack of variation in participation in lower quantile groups of expenditure per capita. The numbers of female migrants who do not use and do use the internet for online market activities are balanced in the cases of financial transactions, trading, at least one activity, and at least two activities.

While these results seem plausible because better-off individuals might be more capable of taking the opportunities, it raises a concern that the disparity between the better-off and the poor is enlarged. Similarly with our results, Ma and Wang (2020) and Nguyen, Nguyen, and Grote (2022) also show that internet access has positive and significant effects on the income of individuals in the middle and the upper tail of the income distribution, whereas the impact on the poor is not significant. Furthermore, the internet market might actually exacerbate inequality (Galperin and Fernanda Viegens 2017).

6. CONCLUSION

Understanding the drivers and welfare effects of participation in online marketplaces in emerging countries is important in order to take advantage of ICT development. In this study, we examined the factors affecting the participation of female rural–urban migrants in online marketplaces, its effects on consumption and poverty, and the distribution of the consumption effect. We used a data set of 373 female migrants in Thailand and Viet Nam and linked it with a data set of rural households and the villages where they come from. We employed a probit model to examine the determinants of the participation, a heteroscedasticity-based approach to account for endogeneity concerns to investigate the effects on consumption and poverty, and an unconditional quantile regression model to examine the distribution of the consumption effect. Our analysis provides several important findings.

First, the participation of female migrants in online markets is driven by several factors characterizing the migrant herself, her places of origin, and destination. A higher education level and a higher asset value are among the factors facilitating the participation, whereas an older age and sharing accommodation with a higher number of adults are among the factors hindering participation. Migrants who left home for education purposes are more likely to participate in online business and in all three activities. Living with family in the city appears to increase the probability of female migrants using the internet for financial transactions, whereas married migrants are less likely to use online financial transactions. Migrants coming from the villages with a higher share of households with cable internet at home or living in a metropolitan area are more likely to participate in online marketplaces.

Second, a positive effect on consumption and poverty reduction can only be realized if female migrants use the internet for business activities or they participate fully in all online market activities. However, the consumption effect of online market participation is not equally distributed, with the effect being significant only for the better off. This might enlarge the consumption gap between the rich and the poor. Our findings thus suggest that, on the one hand, facilitating migrants to fully participate in online market activities should be undertaken. This can be done through developing rural education and supporting rural households to use the internet. On the other hand, other specific programs to support the poor segment of female migrants to improve the welfare so that they are not left behind should be established.

Although our study provides important insight, it still has a number of limitations. First, our data are cross-sectional and cover only three provinces in each country. Second, our sample of rural–urban migrants in both countries has a high attrition rate, which obviously affects the estimation results. Thus, interpretation of our results should be taken with care. Third, we are not able to account for migrants' unobservable factors such as her talent and ability. Extending the coverage of the data in both temporal and spatial aspects is thus strongly suggested. In addition, it is for sure that after the COVID-19 pandemic, the participation in online marketplaces and its welfare impact might be completely different. The strict lockdown in Thailand and Viet Nam in response to the pandemic might have forced migrants back to their place of origin and decreased their welfare significantly; and at the same time, since conventional markets and supermarkets are closed, it might have facilitated their participation. These issues should be taken into account in future studies.

REFERENCES

- ADB. 2021. *Asian Economic Integration Report 2021: Making Digital Platforms Work for Asia and the Pacific*. The Asian Development Bank (ADB). https://aric.adb.org/pdf/aeir/AEIR2021_complete.pdf (accessed 9 March 2021).
- Bailur, S., and S. Masiero. 2017. Women's Income Generation Through Mobile Internet: A Study of Focus Group Data from Ghana, Kenya, and Uganda. *Gender, Technology and Development* 21(1–2): 77–98.
- Bakos, J. Y. 1991. A Strategic Analysis of Electronic Marketplaces. *MIS Quarterly* 15: 295–310.
- Baltagi, B. H., and P. K. Ghosh, 2017. Replication of Unconditional Quantile Regressions by Firpo, Fortin and Lemieux (2009). *Journal of Applied Econometrics* 32(1): 218–223.
- Baum, C. F., A. Lewbel, M. E. Schaffer, and O. Talavera, 2012. Ivrreg2h: Stata Module to Perform Instrumental Variables Estimation Using Heteroscedasticity-based Instruments. *Statistical Software Components S457555* Boston College Department of Economics.
- Bilen, E., and A. Matros. 2021. Online Cheating Amid COVID-19. *Journal of Economic Behavior and Organization* 182: 196–211.
- Borah, B. J., and A. Basu. 2013. Highlighting Differences Between Conditional and Unconditional Quantile Regression Approaches Through an Application to Assess Medication Adherence. *Health Economics* 22(9): 1052–1070.
- Borgen, N. T. 2016. Fixed Effects in Unconditional Quantile Regression. *The Stata Journal* 16(2): 403–415.
- Briggeman, B. C. and B. E. Whitacre. 2010. Farming and the internet: Reasons for Non-use. *Agricultural and Resource Economics Review* 39(3): 571–584.
- Cao, Y., and Z. Liu. 2015. Poverty and Health: Children of Rural-to-Urban Migrant Workers in Beijing, China. *Social Indicators Research* 123: 459–477.
- Chang, H. H., and D. R. Just. 2009. Internet Access and Farm Household Income: Empirical Evidence Using a Semi-parametric Assessment in [Taipei, China]. *Journal of Agricultural Economics*, 60: 348–366.
- Chen, S., W. Liu, and H. Song. 2020. Broadband Internet, firm Performance, and Worker Welfare: Evidence and Mechanism. *Economic Inquiry* 58(3): 1146–1166.
- Fang, X., and D. C. Yen. 2006. Demographics and Behavior of Internet Users in China. *Technology in Society* 28(3): 363–387.
- Firpo, S., N. M. Fortin, and T. Lemieux, (2009). Unconditional Quantile Regressions. *Econometrica* 77: 953–973.
- Galperin, H., and M. Fernanda Viacens. 2017. Connected for Development? Theory and Evidence about the Impact of Internet Technologies on Poverty Alleviation. *Development Policy Review* 35(3): 315–336.
- Garicano, L., and S. N. Kaplan. 2001. The Effects of Business-to-business E-commerce on Transaction Costs. *Journal of Industrial Economics* 49(4): 463–485.
- Goldfarb, A., and C. Tucker. 2019. Digital Economics. *Journal of Economic Literature* 57, 3–43.

- Greenstein, S. 2020. The Basic Economics of Internet Infrastructure. *Journal of Economic Perspectives* 34: 192–214.
- Hossain, T. 2018. Empowering Women through E-business: A Study on Women Entrepreneurs in Dhaka City. *Asian Business Review* 8: 21–160.
- Howard, P. N., N. Mazaheri, 2009. Telecommunications Reform, Internet Use and Mobile Phone Adoption in the Developing World. *World Development* 37(7): 1159–1169.
- ITU. 2020. *World Telecommunication/ICT Indicators Database 2020*. International Telecommunication Union (ITU). <https://www.itu.int/en/ITU-D/Statistics/Pages/publications/wtid.aspx> (accessed 9 March 2021).
- Klasen, S., and H. Waibel. 2015. Vulnerability to Poverty in South-East Asia: Drivers, Measurement, Responses, and Policy Issues. *World Development* 71: 1.
- Kleibergen, F., and R. Paap. 2006. Generalized Reduced Rank Tests Using the Singular Value Decomposition. *Journal of Econometrics* 133(1): 97–126.
- Lee, H. G., and T. H. Clark. 1996. Impacts of the Electronic Marketplace on Transaction Cost and Market Structure. *International Journal of Electronic Commerce* 1(1): 127–149.
- Lee, N., J. Morduch, S. Ravindran, A. Shonchoy, and H. Zaman. 2021. Poverty and Migration in the Digital Age: Experimental Evidence on Mobile Banking in Bangladesh. *American Economic Journal: Applied Economics* 13, 38–71.
- Lera-López, F., M. Billon, and M. Gil. 2011. Determinants of Internet use in Spain. *Economics of Innovation and New Technology* 20(2): 127–152.
- Lewbel, A. 2012. Using Heteroscedasticity to Identify and Estimate Mismeasured and Endogenous Regressor Models. *Journal of Business and Economic Statistics* 30: 67–80.
- Llácer, A., M. V. Zunzunegui, J. del Amo, L. Mazarrasa, and F. Bolumar. 2007. The Contribution of a Gender Perspective to the Understanding of Migrants' Health. *Journal of Epidemiology and Community Health* 61 (Suppl 2): ii4–ii10.
- Ma, W., and X. Wang. 2020. Internet Use, Sustainable Agricultural Practices and Rural Incomes: Evidence from China. *Australian Journal of Agricultural and Resource Economics* 64: 1087–1112.
- Mesch, G. S., and I. Talmud. 2011. Ethnic Differences in Internet Access: The Role of Occupation and Exposure. *Information, Communication and Society* 14(4): 445–471.
- Nguyen, D. L., U. Grote, and T. T. Nguyen. 2019. Migration, Crop Production and Non-farm Labor Diversification in Rural Vietnam. *Economic Analysis and Policy* 63: 175–187.
- Nguyen, T. T., L. D. Nguyen, R. S. Lippe, and U. Grote. 2017. Determinants of Farmers' Land Use Decision-making: Comparative Evidence from Thailand and Vietnam. *World Development* 89:199–213.
- Nguyen, T. T., T. T. Nguyen, and U. Grote. 2022. Internet Use, Natural Resource Extraction and Poverty Reduction in Rural Thailand. *Ecological Economics* 196: 107417.

- Nguyen, T. T., V. T. Tran, T. T. Nguyen, and U. Grote, (2021). Farming Efficiency, Cropland Rental Market and Income Effect: Evidence from Panel Data for Rural Central Vietnam. *European Review of Agricultural Economics* 48(1): 207–248.
- Ninh, L. K. 2021. Economic Role of Education in Agriculture: Evidence from Rural Vietnam. *Journal of Economics and Development* 23: 47–58.
- Obermann, G., N. Hoang Oanh, and N. Hong Ngoc. 2021. Gender Pay Gap in Vietnam: A Propensity Score Matching Analysis. *Journal of Economics and Development* 23: 238–253.
- OECD. 2014. *Unpaid Care Work: The Missing Link in the Analysis of Gender Gaps in Labour Outcomes*. Paris.
- Ojo, A. O., C. N. Arasanmi, M. Raman, and C. N. L. Tan. 2019. Ability, Motivation, Opportunity and Sociodemographic Determinants of Internet Usage in Malaysia. *Information Development* 35(5): 819–830.
- Pujazon-Zazik, M., and M. J. Park, 2010. To Tweet, or Not To Tweet: Gender Differences and Potential Positive and Negative Health Outcomes of Adolescents' Social Internet Use. *American Journal of Men's Health* 4(1): 77–85.
- Rozelle, S., J. E. Taylor, and A. de Brauw. 1999. Migration, Remittances, and Agricultural Productivity in China. *American Economic Review* 89: 287–291.
- Santouridis, I., and M. Kyritsi. 2014. Investigating the Determinants of Internet Banking Adoption in Greece. *Procedia Economics and Finance* 9: 501–510.
- Shoma, C. D. 2019. Financing Female Entrepreneurs in Cottage, Micro, Small, and Medium Enterprises: Evidence from the Financial Sector in Bangladesh 2010–2018. *Asia and the Pacific Policy Studies* 6:397–416.
- Stark, O., and D. E. Bloom. 1985. The New Economics of Labor Migration. *American Economic Review* 75: 173–178.
- Stiglitz, J., A. Sen, and J. P. Fitoussi. 2007. *Report on the Commission on the Measurement of Economic Performance and Social Progress*. Paris.
- Taylor, E., S. Rozelle, and de A. Brauw. 2003. Migration and Income in Source Communities: A New Economics of Migration Perspective from China. *Economic Development and Cultural Change* 52: 75–101.
- Troy, J. S., and J. S. Michael. (1999. Consumer Cost Differences for Traditional and Internet Markets. *Internet Research: Electronic Networking Applications and Policy* 9(2): 82–92.
- United Nations (UN). 2005. *Designing Household Survey Samples: Practical Guidelines*. New York: Department of Economic and Social Affairs, United Nations.
- Waibel, H., U. Grote, S. Min, T.T. Nguyen, and S. Praneetvatakul. 2020. COVID-19 in the Greater Mekong Subregion: How Resilient are Rural Households? *Food Security* 12: 779–782.
- World Bank (WB). 2016. *Migrations and Development: A Role for the World Bank Group*. Report No. 108105. Washington, DC. <http://documents.worldbank.org/curated/en/690381472677671445/Migration-and-development-a-role-for-the-World-Bank-Group> (accessed 9 September 2021).

- World Bank (WB). 2018. Why the World Bank Is Adding New Ways to Measure Poverty. The World Bank Group (WB). <https://blogs.worldbank.org/developmenttalk/why-world-bank-adding-new-ways-measure-poverty> (accessed 9 September 2021).
- Yang, L., H. Lu, S. Wang, and M. Li. 2021. Mobile Internet Use and Multidimensional Poverty: Evidence from a Household Survey in Rural China. *Social Indicators Research* <https://doi.org/10.1007/s11205-021-02736-1>.
- Zanello, G., C. S. Srinivasan, and B. Shankar. 2014. Transaction Costs, Information Technologies, and the Choice of Marketplace among Farmers in Northern Ghana. *Journal of Development Studies* 50(9): 1226–1239.

APPENDIX 1: NAME, DEFINITION, AND MEASUREMENT OF VARIABLES

Name	Measurement	Definition
<i>A. Welfare and internet participation of rural–urban migrants</i>		
Expenditure per capita	PPP\$ adjusted to 2005 prices	Annual expenditure per capita of the migrant
Financial transaction	Dummy	If the migrant uses the internet for financial transactions = 1; otherwise = 0
Trading	Dummy	If the migrant uses the internet for trading activities (buying or selling) = 1; otherwise = 0
Business	Dummy	If the migrant uses the internet for business (finding or working with business partners) = 1; otherwise = 0
At least one activity	Dummy	If the migrant uses the internet for at least one activity = 1; otherwise = 0
At least two activities	Dummy	If the migrant uses the internet for at least two activities = 1; otherwise = 0
All three activities	Dummy	If the migrant uses the internet for all three activities = 1; otherwise = 0
<i>B. Migrant's characteristics</i>		
Female migrant	Gender dummy	Female migrant = 1; otherwise = 0
Age of migrant	Years of age	Age of the migrant
Education of migrant	Years	Number of schooling years of the migrant
Marital status of migrant	Dummy	If the migrant is married = 1; otherwise = 0
Education purposes	Dummy	If the first migration was for educational purposes = 1; otherwise = 0
Living with family in the city	Dummy	If the migrant is currently living with her own family in the city = 1; otherwise = 0
Accommodation-sharing adults	Persons	Number of adults sharing accommodation with the migrant.
Asset value	PPP\$ adjusted to 2005 prices	Total asset value of the durable goods that the migrant owns
<i>C. Rural household's characteristics</i>		
Ethnic majority	Dummy	If the household head belongs to the Thai majority in Thailand or Kinh majority in Viet Nam = 1; otherwise = 0
Mean adult education	Years	Average schooling years of all household adult members
<i>D. Rural village's characteristics</i>		
Share of cable internet at home	Percentage	Share of households in the village having cable internet at home
Distance to provincial center	Kilometers (km)	Distance from the village to provincial center
<i>E. Place of destination</i>		
Metropolitan	Dummy	If the migrant is living in Bangkok (Thailand) or Ho Chi Minh City (Viet Nam) = 1; otherwise = 0
Thailand	Country dummy	Thailand = 1; Viet Nam = 0

PPP\$ = purchasing power parity dollars.

APPENDIX 2: DESCRIPTIVE SUMMARY OF HOUSEHOLD CHARACTERISTICS BETWEEN THE UNINTERVIEWED AND INTERVIEWED MIGRANTS

	Uninterviewed	Interviewed	Statistical Test
Age of heads (years)	58.571 (11.052)	56.449 (9.736)	3.214***
Male heads (Yes = 1)	0.538 (0.499)	0.481 (0.500)	2.253**
Daily per capita income less than PPP\$3.20 (Yes = 1)	0.157 (0.364)	0.121 (0.327)	2.016**
If the household own a phone (Yes = 1)	0.872 (0.334)	0.907 (0.291)	-2.152**
Number of schooling years of heads (years)	5.849 (3.246)	6.266 (3.438)	-2.038**
Average schooling years of household members (years)	6.039 (2.589)	5.983 (2.373)	0.359
Distance to provincial centers (km)	48.834 (31.714)	52.440 (31.830)	-2.254**

PPP\$ = purchasing power parity dollars.

Note: *** significant at 1% level; ** significant at 5% level.

APPENDIX 3: VARIANCE INFLATION FACTOR (VIF) VALUES ON THE DETERMINANTS OF MIGRANT'S PARTICIPATION IN INTERNET MARKETPLACES

Variable	VIF	1/VIF
Female [†]	1.06	0.94
Age of migrant	1.53	0.65
Education of migrant	1.69	0.59
Marital status of migrant [†]	1.76	0.57
Living with family in the city [†]	1.48	0.68
Education purposes [†]	1.48	0.68
Accommodation-sharing adults	1.12	0.89
Asset value (ln)	1.14	0.88
Ethnic majority [†]	1.04	0.96
Mean adult education	1.11	0.90
Share of cable internet at home	1.24	0.81
Distance to provincial center	1.17	0.85
Thailand [†]	1.76	0.57
Metropolitan [†]	1.15	0.87
Mean VIF	1.34	

VIF = variance inflation factor.

†: Dummy variable; ln: natural logarithm.

APPENDIX 4: VARIANCE INFLATION FACTOR (VIF) VALUES ON THE IMPACT OF MIGRANT'S PARTICIPATION IN INTERNET MARKETPLACES ON WELFARE

Variable	VIF	1/VIF
Age of migrant	1.51	0.66
Education of migrant	1.62	0.62
Marital status of migrant [†]	1.72	0.58
Living with family in the city [†]	1.47	0.68
Education purposes [†]	1.47	0.68
Accommodation-sharing adults	1.11	0.90
Asset value (ln)	1.12	0.89
Thailand [†]	1.47	0.68
Metropolitan [†]	1.12	0.89
Mean VIF	1.40	

VIF = variance inflation factor.

†: Dummy variable; ln: natural logarithm.

APPENDIX 5: TESTS FOR HETEROSCEDASTICITY IN THE MODELS OF EFFECTS OF ONLINE MARKET PARTICIPATION ON WELFARE OF FEMALE MIGRANTS

Breusch–Pagan/Cook–Weisberg Test for Heteroscedasticity		
(Ho: Constant Variance)	chi2(1)	Prob > chi2
<i>Type of activities</i>		
Financial transaction	29.35	0.000
Trading	25.48	0.000
Business	27.73	0.000
<i>Number of activities</i>		
At least 1 activity	22.70	0.000
At least 2 activities	25.63	0.000
All 3 activities	34.20	0.000
White's Test for Homoscedasticity		
(Ho: Homoscedasticity)	chi2(59)	Prob > chi2
<i>Type of activities</i>		
Financial transaction	100.85	0.001
Trading	102.97	0.000
Business	98.22	0.001
<i>Number of activities</i>		
At least 1 activity	99.05	0.001
At least 2 activities	102.90	0.000
All 3 activities	99.57	0.001

APPENDIX 6: FACTORS AFFECTING THE PARTICIPATION OF RURAL–URBAN MIGRANTS IN ONLINE MARKET ACTIVITIES (MARGINAL EFFECTS)

	Financial Transaction	Trading	Business	At Least 1 Activity	At Least 2 Activities	All 3 Activities
Female†	0.096** (0.046)	0.088** (0.040)	−0.076* (0.044)	0.040 (0.038)	0.078* (0.045)	−0.007 (0.036)
Education purposes†	0.019 (0.058)	0.032 (0.067)	−0.036 (0.053)	−0.016 (0.064)	0.056 (0.056)	−0.017 (0.044)
Female*education purposes	−0.086 (0.072)	−0.048 (0.070)	0.164** (0.066)	−0.023 (0.075)	−0.056 (0.065)	0.079 (0.050)
Age of migrant	−0.005* (0.002)	−0.012*** (0.003)	−0.002 (0.002)	−0.009*** (0.002)	−0.006** (0.003)	−0.003 (0.002)
Schooling years of migrant	0.035*** (0.005)	0.029*** (0.006)	0.016*** (0.005)	0.028*** (0.005)	0.030*** (0.005)	0.023*** (0.005)
Marital status of migrant†	−0.140*** (0.039)	−0.038 (0.046)	0.005 (0.035)	−0.079** (0.037)	−0.061 (0.042)	−0.034 (0.030)
Living with family in the city†	0.104* (0.061)	0.027 (0.062)	0.103** (0.047)	0.064 (0.055)	0.102 (0.064)	0.069* (0.041)
Accommodation-sharing adults	−0.002 (0.012)	−0.008 (0.013)	−0.007 (0.011)	−0.009 (0.011)	−0.001 (0.014)	−0.006 (0.011)
Asset value (ln)	0.044*** (0.011)	0.042*** (0.012)	0.040*** (0.009)	0.049*** (0.010)	0.041*** (0.012)	0.037*** (0.009)
Ethnic majority†	0.169* (0.090)	0.025 (0.081)	0.077 (0.085)	0.076 (0.061)	0.183* (0.106)	0.011 (0.062)
Mean adult education	0.026** (0.010)	−0.002 (0.010)	−0.003 (0.009)	0.009 (0.009)	0.015* (0.009)	−0.003 (0.007)
Share of cable internet at home	0.001 (0.002)	0.005*** (0.002)	0.003 (0.002)	0.005*** (0.002)	0.003 (0.002)	0.001 (0.001)
Distance to provincial center	0.000 (0.001)	0.000 (0.001)	0.001 (0.001)	0.001 (0.001)	−0.000 (0.001)	0.000 (0.000)
Thailand†	0.118*** (0.046)	0.061 (0.055)	0.090* (0.047)	0.069 (0.050)	0.113** (0.048)	0.079** (0.034)
Metropolitan†	0.100** (0.040)	0.157*** (0.038)	0.210*** (0.034)	0.143*** (0.038)	0.206*** (0.036)	0.121*** (0.027)
Number of observations	760	760	760	760	760	760
Wald chi2(15)	145.19	145.70	131.31	143.05	148.98	101.09
Prob. > chi2	0.000	0.000	0.000	0.000	0.000	0.000
Pseudo R ²	0.152	0.165	0.145	0.178	0.162	0.212

Robust standard errors bootstrapped with 500 replications and clustered at rural villages in parentheses; †: Dummy variable; ln: natural logarithm; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

APPENDIX 7: EFFECTS OF ONLINE MARKET PARTICIPATION ON WELFARE OF RURAL–URBAN MIGRANTS BY TYPE OF ACTIVITIES

	Expenditure (ln)			Absolute Consumption Poverty			Relative Consumption Poverty		
Financial transactions [†]	0.488 [*]			−0.018			−0.160		
	(0.257)			(0.140)			(0.161)		
Trading [†]		0.336 [*]			−0.117			−0.125	
		(0.196)			(0.121)			(0.141)	
Business [†]			0.368 ^{***}			−0.038			−0.030
			(0.101)			(0.058)			(0.065)
Female [†]	−0.151 ^{***}	−0.144 ^{***}	−0.110 ^{***}	0.042 [*]	0.050 ^{**}	0.040 [*]	0.062 ^{**}	0.061 [*]	0.051 [*]
	(0.043)	(0.044)	(0.038)	(0.024)	(0.025)	(0.023)	(0.029)	(0.032)	(0.030)
Education purposes [†]	0.099 [*]	0.083	0.067	−0.042	−0.039	−0.039	−0.059 [*]	−0.054	−0.055
	(0.056)	(0.056)	(0.055)	(0.029)	(0.029)	(0.029)	(0.036)	(0.037)	(0.037)
Age of migrant	0.005	0.007 [*]	0.004	0.001	0.000	0.001	0.001	−0.000	0.001
	(0.004)	(0.004)	(0.004)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.002)
Schooling years of migrant	0.009	0.018 [*]	0.022 ^{***}	−0.007	−0.004	−0.007	−0.003	−0.006	−0.009 [*]
	(0.013)	(0.011)	(0.007)	(0.007)	(0.006)	(0.005)	(0.008)	(0.008)	(0.005)
Marital status of migrant [†]	−0.224 ^{***}	−0.265 ^{***}	−0.285 ^{***}	0.058	0.053	0.060 [*]	0.074 [*]	0.087 ^{***}	0.094 ^{**}
	(0.063)	(0.059)	(0.056)	(0.036)	(0.033)	(0.032)	(0.042)	(0.038)	(0.037)
Living with family in the city [†]	0.317 ^{***}	0.356 ^{***}	0.323 ^{***}	−0.086 [*]	−0.086 ^{**}	−0.084 ^{**}	−0.133 ^{***}	−0.146 ^{***}	−0.145 ^{***}
	(0.068)	(0.061)	(0.060)	(0.044)	(0.041)	(0.040)	(0.050)	(0.046)	(0.046)
Accommodation–sharing adults	−0.133 ^{***}	−0.133 ^{***}	−0.132 ^{***}	0.072 ^{***}	0.072 ^{***}	0.072 ^{***}	0.077 ^{***}	0.077 ^{***}	0.077 ^{***}
	(0.014)	(0.015)	(0.015)	(0.010)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)
Asset value (ln)	0.049 ^{***}	0.055 ^{***}	0.055 ^{***}	−0.023 ^{***}	−0.019 ^{**}	−0.022 ^{***}	−0.021 ^{**}	−0.023 ^{***}	−0.026 ^{***}
	(0.016)	(0.014)	(0.013)	(0.008)	(0.008)	(0.007)	(0.009)	(0.009)	(0.008)
Thailand [†]	0.020	0.068	0.048	0.004	0.006	0.005	−0.019	−0.035	−0.036
	(0.063)	(0.052)	(0.048)	(0.038)	(0.030)	(0.031)	(0.041)	(0.034)	(0.035)
Metropolitan [†]	0.139 ^{***}	0.128 ^{**}	0.098 ^{**}	−0.057 ^{**}	−0.040	−0.050 [*]	−0.046	−0.040	−0.053
	(0.048)	(0.052)	(0.045)	(0.028)	(0.032)	(0.030)	(0.032)	(0.036)	(0.035)
Constant	7.753 ^{***}	7.603 ^{***}	7.720 ^{***}	0.170	0.182 [*]	0.164	0.246 ^{**}	0.296 ^{**}	0.280 ^{**}
	(0.194)	(0.182)	(0.171)	(0.104)	(0.106)	(0.105)	(0.124)	(0.122)	(0.122)
Number of observations	760	760	760	760	760	760	760	760	760
R ²	0.291	0.290	0.353	0.187	0.164	0.187	0.185	0.172	0.190
Prob. > F	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Underidentification	0.002	0.000	0.000	0.002	0.000	0.000	0.002	0.000	0.000
Overidentification	0.958	0.601	0.961	0.832	0.985	0.975	0.353	0.437	0.922
Weak identification	7.516	12.277	19.295	7.516	12.277	19.295	7.516	12.277	19.295

Robust standard clustered at rural villages in parentheses; †: Dummy variable; ln: natural logarithm; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$; The underidentifying test is an LM test relied on the rk LM statistics (Kleibergen and Paap, 2006) with the null hypothesis stating that the model is underidentified. The overidentifying test based on the Hansen J test with the null hypothesis stating that all instruments are valid in the model. The reported values of underidentification and overidentification tests are p-values. The report of weak-identifying test uses the Kleibergen-Paap rk Wald F statistic.

APPENDIX 8: EFFECTS OF ONLINE MARKET PARTICIPATION ON WELFARE OF RURAL–URBAN MIGRANTS BY NUMBER OF ACTIVITIES

	Expenditure (ln)			Absolute Consumption Poverty			Relative Consumption Poverty		
At least 1 activity [†]	-0.022 (0.222)			-0.113 (0.157)			-0.238 (0.176)		
At least 2 activities [†]		0.449** (0.205)			-0.059 (0.115)			-0.091 (0.125)	
All 3 activities [†]			0.320*** (0.082)			-0.030 (0.041)			-0.056 (0.048)
Female [†]	-0.117*** (0.043)	-0.146*** (0.043)	-0.127*** (0.040)	0.044* (0.023)	0.044* (0.024)	0.041* (0.023)	0.059** (0.029)	0.057* (0.031)	0.053* (0.029)
Education purposes [†]	0.092 (0.058)	0.071 (0.055)	0.073 (0.056)	-0.045 (0.029)	-0.039 (0.030)	-0.040 (0.030)	-0.064* (0.037)	-0.053 (0.038)	-0.054 (0.037)
Age of migrant	0.004 (0.004)	0.005 (0.004)	0.004 (0.004)	0.000 (0.003)	0.001 (0.002)	0.001 (0.002)	-0.001 (0.003)	0.001 (0.002)	0.001 (0.002)
Schooling years of migrant	0.029*** (0.010)	0.014 (0.010)	0.021*** (0.007)	-0.004 (0.006)	-0.006 (0.006)	-0.007 (0.005)	-0.002 (0.007)	-0.007 (0.007)	-0.009 (0.005)
Marital status of migrant [†]	-0.288*** (0.064)	-0.258*** (0.058)	-0.275*** (0.056)	0.050 (0.034)	0.057* (0.033)	0.059* (0.032)	0.073* (0.039)	0.089** (0.038)	0.093** (0.037)
Living with family in the city [†]	0.363*** (0.063)	0.320*** (0.064)	0.345*** (0.060)	-0.081* (0.042)	-0.082** (0.040)	-0.086** (0.040)	-0.132*** (0.048)	-0.139*** (0.044)	-0.145*** (0.045)
Accommodation-sharing adults	-0.134*** (0.014)	-0.134*** (0.015)	-0.132*** (0.015)	0.072*** (0.011)	0.072*** (0.011)	0.072*** (0.011)	0.076*** (0.012)	0.077*** (0.011)	0.077*** (0.011)
Asset value (ln)	0.067*** (0.016)	0.052*** (0.014)	0.060*** (0.012)	-0.018* (0.010)	-0.021*** (0.007)	-0.023*** (0.006)	-0.016 (0.011)	-0.024*** (0.008)	-0.026*** (0.007)
Thailand [†]	0.081 (0.050)	0.034 (0.056)	0.051 (0.048)	0.008 (0.032)	0.008 (0.032)	0.005 (0.030)	-0.027 (0.036)	-0.030 (0.035)	-0.034 (0.035)
Metropolitan [†]	0.184*** (0.048)	0.090 (0.055)	0.139*** (0.042)	-0.043 (0.029)	-0.047 (0.035)	-0.055** (0.027)	-0.028 (0.034)	-0.042 (0.037)	-0.053* (0.030)
Constant	7.628*** (0.178)	7.756*** (0.195)	7.727*** (0.174)	0.192* (0.112)	0.157 (0.112)	0.165 (0.102)	0.326** (0.129)	0.261** (0.127)	0.270** (0.120)
Number of observations	760	760	760	760	760	760	760	760	760
R ²	0.320	0.310	0.346	0.186	0.182	0.185	0.175	0.188	0.187
Prob. > F	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Underidentification	0.001	0.000	0.000	0.001	0.000	0.000	0.001	0.000	0.000
Overidentification	0.318	0.454	0.288	0.438	0.793	0.775	0.709	0.338	0.216
Weak identification	16.392	18.640	70.334	16.392	18.640	70.334	16.392	18.640	70.334

Robust standard clustered at rural villages in parentheses; †: Dummy variable; ln: natural logarithm; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$; The underidentifying test is an LM test relied on the rk LM statistics (Kleibergen and Paap, 2006) with the null hypothesis stating that the model is underidentified. The overidentifying test based on the Hansen J test with the null hypothesis stating that all instruments are valid in the model. The reported values of underidentification and overidentification tests are p-values. The report of weak-identifying test uses the Kleibergen-Paap rk Wald F statistic.

APPENDIX 9: EFFECTS OF ONLINE MARKET PARTICIPATION ON WELFARE OF FEMALE MIGRANTS BY TYPE OF ACTIVITIES (COUNTRY DUMMY EXCLUDED)

	Expenditure (ln)			Absolute Consumption Poverty			Relative Consumption Poverty		
Financial transactions [†]	0.422 (0.296)			0.023 (0.158)			-0.114 (0.186)		
Trading [†]		0.295 (0.317)			-0.029 (0.192)			-0.019 (0.214)	
Business [†]			0.388*** (0.135)			-0.122* (0.073)			-0.131* (0.078)
Education purposes [†]	0.160* (0.088)	0.097 (0.090)	0.059 (0.087)	-0.040 (0.047)	-0.041 (0.046)	-0.027 (0.047)	-0.056 (0.053)	-0.042 (0.051)	-0.026 (0.052)
Age of migrant	0.008 (0.006)	0.011* (0.006)	0.007 (0.006)	0.001 (0.003)	0.000 (0.004)	0.001 (0.003)	0.001 (0.003)	0.001 (0.004)	0.002 (0.003)
Schooling years of migrant	0.012 (0.018)	0.028* (0.014)	0.026** (0.012)	-0.012 (0.010)	-0.010 (0.008)	-0.009 (0.007)	-0.004 (0.011)	-0.009 (0.009)	-0.007 (0.008)
Marital status of migrant [†]	-0.187** (0.088)	-0.209** (0.088)	-0.227*** (0.086)	0.031 (0.049)	0.028 (0.049)	0.032 (0.049)	0.047 (0.058)	0.055 (0.058)	0.059 (0.058)
Living with family in the city [†]	0.222** (0.089)	0.246*** (0.087)	0.234*** (0.084)	-0.052 (0.055)	-0.053 (0.059)	-0.053 (0.056)	-0.098 (0.062)	-0.102 (0.064)	-0.102* (0.061)
Accommodation-sharing adults	-0.130*** (0.024)	-0.137*** (0.024)	-0.128*** (0.024)	0.075*** (0.016)	0.074*** (0.016)	0.070*** (0.016)	0.077*** (0.017)	0.080*** (0.017)	0.075*** (0.017)
Asset value (ln)	0.061** (0.025)	0.066*** (0.020)	0.064*** (0.018)	-0.026** (0.012)	-0.024** (0.012)	-0.021* (0.011)	-0.028** (0.012)	-0.031*** (0.012)	-0.028** (0.011)
Metropolitan [†]	0.110 (0.072)	0.122* (0.071)	0.062 (0.072)	-0.067* (0.038)	-0.062 (0.042)	-0.037 (0.044)	-0.050 (0.045)	-0.059 (0.047)	-0.031 (0.050)
Constant	7.444*** (0.272)	7.228*** (0.300)	7.453*** (0.262)	0.296** (0.138)	0.306* (0.160)	0.266* (0.139)	0.314* (0.168)	0.344* (0.202)	0.306* (0.173)
Number of observations	373	373	373	373	373	373	373	373	373
R ²	0.287	0.276	0.312	0.164	0.164	0.159	0.158	0.160	0.169
Prob. > F	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Underidentification	0.014	0.009	0.000	0.014	0.009	0.000	0.014	0.009	0.000
Overidentification	0.894	0.473	0.694	0.721	0.145	0.728	0.573	0.171	0.766
Weak identification	6.033	5.488	17.177	6.033	5.488	17.177	6.033	5.488	17.177

Robust standard clustered at rural villages in parentheses; †: Dummy variable; ln: natural logarithm; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$; The underidentifying test is an LM test relied on the rk LM statistics (Kleibergen and Paap, 2006) with the null hypothesis stating that the model is underidentified. The overidentifying test based on the Hansen J test with the null hypothesis stating that all instruments are valid in the model. The reported values of underidentification and overidentification tests are p-values. The report of weak-identifying test uses the Kleibergen-Paap rk Wald F statistic.

APPENDIX 10: EFFECTS OF ONLINE MARKET PARTICIPATION ON WELFARE OF FEMALE MIGRANTS BY THE NUMBER OF ACTIVITIES (COUNTRY DUMMY EXCLUDED)

	Expenditure (ln)			Absolute Consumption Poverty			Relative Consumption Poverty		
At least 1 activity [†]	-0.081 (0.308)			0.013 (0.249)			-0.089 (0.243)		
At least 2 activities [†]		0.492 (0.310)			0.005 (0.166)			-0.042 (0.183)	
All 3 activities [†]			0.363*** (0.127)			-0.095* (0.053)			-0.139** (0.056)
Education purposes [†]	0.106 (0.088)	0.108 (0.086)	0.076 (0.086)	-0.042 (0.048)	-0.043 (0.045)	-0.034 (0.046)	-0.047 (0.052)	-0.043 (0.050)	-0.030 (0.051)
Age of migrant	0.006 (0.006)	0.009 (0.006)	0.007 (0.006)	0.001 (0.004)	0.001 (0.003)	0.001 (0.003)	0.001 (0.004)	0.001 (0.003)	0.001 (0.003)
Schooling years of migrant	0.036** (0.016)	0.018 (0.015)	0.024** (0.012)	-0.011 (0.009)	-0.011 (0.009)	-0.009 (0.006)	-0.007 (0.010)	-0.008 (0.010)	-0.006 (0.008)
Marital status of migrant [†]	-0.220** (0.089)	-0.195** (0.090)	-0.217** (0.086)	0.030 (0.049)	0.030 (0.048)	0.029 (0.048)	0.053 (0.058)	0.054 (0.058)	0.055 (0.057)
Living with family in the city [†]	0.225** (0.088)	0.224** (0.090)	0.229*** (0.085)	-0.051 (0.056)	-0.052 (0.055)	-0.052 (0.056)	-0.106* (0.061)	-0.100 (0.061)	-0.100 (0.062)
Accommodation-sharing adults	-0.144*** (0.023)	-0.124*** (0.026)	-0.131*** (0.023)	0.074*** (0.016)	0.074*** (0.017)	0.071*** (0.016)	0.079*** (0.017)	0.079*** (0.018)	0.076*** (0.017)
Asset value (ln)	0.080*** (0.023)	0.057** (0.023)	0.069*** (0.018)	-0.026 (0.016)	-0.025** (0.011)	-0.023** (0.011)	-0.028* (0.015)	-0.031*** (0.012)	-0.029*** (0.010)
Metropolitan [†]	0.158** (0.068)	0.052 (0.083)	0.107* (0.065)	-0.066 (0.040)	-0.066 (0.050)	-0.053 (0.038)	-0.052 (0.046)	-0.052 (0.053)	-0.044 (0.044)
Constant	7.401*** (0.270)	7.402*** (0.279)	7.453*** (0.264)	0.287* (0.168)	0.293** (0.141)	0.271** (0.137)	0.369* (0.195)	0.332* (0.171)	0.302* (0.171)
Number of observations	373	373	373	373	373	373	373	373	373
R ²	0.286	0.259	0.313	0.165	0.167	0.162	0.166	0.160	0.165
Prob. > F	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Underidentification	0.028	0.004	0.000	0.028	0.004	0.000	0.028	0.004	0.000
Overidentification	0.969	0.856	0.340	0.336	0.263	0.892	0.356	0.655	0.820
Weak identification	8.616	8.431	52.045	8.616	8.431	52.045	8.616	8.431	52.045

Robust standard clustered at rural villages in parentheses; †: Dummy variable; ln: natural logarithm; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$; The underidentifying test is an LM test relied on the rk LM statistics (Kleibergen and Paap, 2006) with the null hypothesis stating that the model is underidentified. The overidentifying test based on the Hansen J test with the null hypothesis stating that all instruments are valid in the model. The reported values of underidentification and overidentification tests are p-values. The report of weak-identifying test uses the Kleibergen-Paap rk Wald F statistic.

APPENDIX 11: RESULTS OF QUANTILE REGRESSIONS OF ONLINE MARKET PARTICIPATION AND FEMALE MIGRANT'S CONSUMPTION FOR FINANCIAL TRANSACTION

	Expenditure per Capita (PPP\$)				
	10th Group	25th Group	50th Group	75th Group	90th Group
Financial transaction	-1,443.966 (1,254.271)	-8.217 (1,102.315)	3,302.045*** (1,232.112)	4,024.028** (1,969.097)	5,303.799 (4,593.143)
Education purposes [†]	278.788 (341.314)	393.120 (288.625)	340.412 (310.501)	807.567* (450.092)	2,600.545** (1,066.456)
Age of migrant	7.918 (22.251)	-12.770 (17.580)	31.200* (17.087)	40.345* (23.810)	15.612 (46.091)
Schooling years of migrant	132.536** (66.935)	75.605 (56.967)	-12.436 (66.342)	-70.440 (100.616)	33.312 (227.911)
Marital status of migrant [†]	-399.071 (339.062)	-421.776 (349.678)	-1,045.890*** (354.056)	-1,194.055** (538.652)	-2,466.994** (1,209.083)
Living with family in the city [†]	469.217 (401.527)	702.670* (377.384)	1,436.724*** (462.739)	1,830.260*** (640.740)	1,842.854 (1,136.415)
Accommodation-sharing adults	-382.711*** (97.715)	-350.818*** (81.431)	-355.046*** (78.470)	-405.573*** (86.010)	-445.667** (221.043)
Asset value (ln)	234.944** (98.615)	144.393** (60.427)	21.246 (58.838)	77.254 (100.431)	131.888 (219.083)
Thailand [†]	340.045 (348.500)	448.880 (283.699)	277.999 (313.418)	842.009 (559.279)	3,927.229*** (1,304.079)
Metropolitan [†]	556.448** (260.205)	186.949 (231.191)	-79.238 (286.703)	361.191 (387.223)	150.427 (1,008.498)
Constant	-516.740 (1,011.870)	1,556.667* (856.595)	2,087.996** (887.575)	2,701.594** (1,043.807)	1,522.175 (2,633.979)
Number of observations	373	373	373	373	373
R ²	0.147	0.158	0.240	0.215	0.166
F(10, 170)	4.18	7.63	15.46	11.29	4.20
Prob. > F	0.000	0.000	0.000	0.000	0.000

PPP\$ = purchasing power parity dollars.

Robust standard errors clustered at rural villages in parentheses; †: Dummy variable; ln: natural logarithm; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

APPENDIX 12: RESULTS OF QUANTILE REGRESSIONS OF ONLINE MARKET PARTICIPATION AND FEMALE MIGRANT'S CONSUMPTION FOR TRADING

	Expenditure per Capita (PPP\$)				
	10th Group	25th Group	50th Group	75th Group	90th Group
Trading	-1,684.309 (1,474.413)	88.852 (1,225.904)	839.310 (1,292.788)	2,906.132 [*] (1,631.600)	7,071.414 [*] (3,616.711)
Education purposes [†]	360.871 (358.323)	389.837 (291.730)	267.440 (317.625)	646.909 (442.143)	2,265.348 ^{**} (1,034.719)
Age of migrant	-2.403 (24.419)	-11.883 (20.348)	25.879 (20.286)	51.943 [*] (28.447)	62.015 (57.891)
Schooling years of migrant	127.432 [*] (72.020)	72.441 (57.572)	95.169 (63.265)	0.716 (77.785)	23.880 (167.029)
Marital status of migrant [†]	-277.311 (305.468)	-418.012 (321.467)	-1,418.310 ^{***} (315.940)	-1,589.149 ^{***} (454.060)	-2,886.625 ^{***} (1,091.558)
Living with family in the city [†]	298.999 (373.788)	702.442 [*] (373.962)	1,803.316 ^{***} (451.373)	2,291.174 ^{***} (603.802)	2,474.736 ^{**} (1,226.257)
Accommodation-sharing adults	-389.477 ^{***} (99.590)	-350.088 ^{***} (80.918)	-363.087 ^{***} (78.462)	-400.672 ^{***} (88.402)	-413.909 [*] (228.980)
Asset value (ln)	237.949 ^{**} (96.220)	141.281 ^{**} (64.241)	110.114 [*] (62.166)	125.697 (93.522)	92.731 (206.619)
Thailand [†]	188.961 (306.540)	444.646 [*] (268.640)	726.761 ^{***} (277.993)	1,324.331 ^{***} (435.765)	4,451.840 ^{***} (1,222.128)
Metropolitan [†]	713.262 ^{**} (341.727)	170.722 (310.918)	86.026 (352.079)	235.072 (457.855)	-579.437 (1,114.072)
Constant	-42.790 (1,010.950)	1,547.903 [*] (886.985)	1,354.921 (843.898)	1,588.948 [*] (959.828)	-321.703 (2,459.158)
Number of observations	373	373	373	373	373
R ²	0.149	0.158	0.229	0.211	0.170
F(10, 170)	3.93	7.42	13.38	10.37	4.10
Prob. > F	0.000	0.000	0.000	0.000	0.000

PPP\$ = purchasing power parity dollars.

Robust standard errors clustered at rural villages in parentheses; †: Dummy variable; ln: natural logarithm; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

APPENDIX 13: RESULTS OF QUANTILE REGRESSIONS OF ONLINE MARKET PARTICIPATION AND FEMALE MIGRANT'S CONSUMPTION FOR BUSINESS

	Expenditure per Capita (PPP\$)				
	10th Group	25th Group	50th Group	75th Group	90th Group
Business	-505.104 (536.059)	524.974 (502.308)	1,344.201** (620.907)	2,391.106** (1,045.001)	5,694.411* (2,933.960)
Education purposes†	333.290 (343.059)	355.213 (293.512)	202.085 (324.093)	584.477 (460.190)	2,122.398* (1,090.700)
Age of migrant	13.009 (20.619)	-11.947 (16.867)	19.842 (17.296)	27.636 (22.948)	2.684 (49.697)
Schooling years of migrant	81.393* (44.552)	67.370* (39.900)	101.671** (44.108)	57.286 (60.404)	163.394 (132.284)
Marital status of migrant†	-227.543 (316.029)	-417.895 (320.452)	-1,437.099*** (311.738)	-1,666.658*** (443.305)	-3,075.908*** (1,095.921)
Living with family in the city†	362.662 (357.423)	648.775* (379.017)	1,661.299*** (452.779)	2,027.919*** (619.690)	1,846.662 (1,229.089)
Accommodation-sharing adults	-383.232*** (98.716)	-343.608*** (82.110)	-351.271*** (79.076)	-390.683*** (88.523)	-391.295* (231.889)
Asset value (ln)	197.766** (91.675)	130.232** (55.031)	101.267** (48.834)	154.873** (72.844)	166.995 (176.186)
Thailand†	178.948 (309.796)	398.088 (276.598)	628.522** (275.129)	1198.024*** (440.587)	4,156.201*** (1,266.728)
Metropolitan†	517.483* (291.732)	85.222 (269.462)	-26.503 (286.583)	280.653 (392.425)	-444.716 (962.226)
Constant	-332.326 (1,039.016)	1,655.344* (888.954)	1,701.261* (883.978)	2,369.568** (970.410)	1,554.863 (2,303.787)
Number of observations	373	373	373	373	373
R ²	0.146	0.160	0.237	0.220	0.179
F(10, 170)	4.09	7.54	13.20	9.97	4.20
Prob. > F	0.000	0.000	0.000	0.000	0.000

PPP\$ = purchasing power parity dollars.

Robust standard errors clustered at rural villages in parentheses; †: Dummy variable; ln: natural logarithm; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

APPENDIX 14: RESULTS OF QUANTILE REGRESSIONS OF ONLINE MARKET PARTICIPATION AND FEMALE MIGRANT'S CONSUMPTION FOR AT LEAST ONE ACTIVITY

	Expenditure per Capita (PPP\$)				
	10th Group	25th Group	50th Group	75th Group	90th Group
At least one activity	-2,510.860 (2,136.222)	950.984 (1,729.533)	2,061.193 (1,677.825)	2,369.769 (2,228.366)	-2,079.420 (4,926.135)
Education purposes [†]	224.901 (352.004)	420.423 (292.884)	358.364 (317.384)	825.380 [*] (469.680)	2,475.206 ^{**} (1,096.571)
Age of migrant	-12.306 (31.428)	-2.861 (24.031)	39.226 [*] (20.096)	48.651 (31.962)	-27.470 (73.656)
Schooling years of migrant	148.338 [*] (81.942)	47.036 (67.987)	60.703 (73.474)	22.910 (93.319)	310.819 (189.523)
Marital status of migrant [†]	-383.166 (335.153)	-360.789 (321.769)	-1,314.461 ^{***} (338.395)	-1,530.313 ^{***} (466.848)	-3,238.423 ^{***} (1,115.489)
Living with family in the city [†]	446.449 (401.221)	650.726 [*] (385.381)	1,686.360 ^{***} (455.624)	2,142.106 ^{***} (603.729)	2,533.160 ^{**} (1,167.593)
Accommodation-sharing adults	-395.885 ^{***} (100.007)	-343.375 ^{***} (84.540)	-353.585 ^{***} (78.768)	-404.899 ^{***} (90.172)	-485.300 ^{**} (230.022)
Asset value (ln)	308.071 ^{**} (134.339)	97.271 (93.053)	35.281 (84.882)	101.355 (130.741)	419.882 (316.496)
Thailand [†]	258.591 (317.179)	399.451 (293.937)	650.974 ^{**} (296.812)	1,303.742 ^{***} (427.475)	4,799.736 ^{***} (1,219.119)
Metropolitan [†]	740.058 [*] (378.632)	65.086 (307.293)	-30.464 (316.528)	438.722 (465.775)	915.092 (1,219.946)
Constant	344.290 (1,113.571)	1,337.364 (950.788)	973.896 (809.168)	1,376.904 (1,041.372)	984.652 (2,737.484)
Number of observations	373	373	373	373	373
R ²	0.150	0.159	0.231	0.207	0.163
F(10, 170)	4.10	7.38	14.72	10.11	4.11
Prob. > F	0.000	0.000	0.000	0.000	0.000

PPP\$ = purchasing power parity dollars.

Robust standard errors clustered at rural villages in parentheses; †: Dummy variable; ln: natural logarithm; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

APPENDIX 15: RESULTS OF QUANTILE REGRESSIONS OF ONLINE MARKET PARTICIPATION AND FEMALE MIGRANT'S CONSUMPTION FOR AT LEAST TWO ACTIVITIES

	Expenditure per Capita (PPP\$)				
	10th Group	25th Group	50th Group	75th Group	90th Group
At least two activities	-1,245.415 (873.075)	-959.504 (753.564)	2,009.499** (1,004.743)	4,619.254*** (1,472.466)	9,899.557*** (3,312.235)
Education purposes [†]	358.108 (351.488)	440.517 (292.432)	200.356 (321.522)	529.905 (431.845)	2,046.715** (1,033.628)
Age of migrant	8.643 (20.862)	-16.685 (16.735)	26.091 (17.456)	43.052 [*] (23.350)	34.865 (48.820)
Schooling years of migrant	116.492** (57.293)	108.168** (47.738)	53.001 (56.460)	-65.108 (74.544)	-90.333 (138.613)
Marital status of migrant [†]	-281.937 (307.705)	-464.832 (319.386)	-1,352.244*** (314.874)	-1,467.756*** (456.980)	-2,652.776** (1,102.846)
Living with family in the city [†]	416.870 (373.470)	782.823** (365.184)	1,627.259*** (456.686)	1,879.123*** (639.613)	1,585.321 (1,195.306)
Accommodation-sharing adults	-385.865*** (98.056)	-358.128*** (80.075)	-354.253*** (79.753)	-387.988*** (87.542)	-393.309 [*] (221.667)
Asset value (ln)	220.977** (87.432)	172.271*** (53.029)	77.801 (54.546)	82.464 (82.200)	26.877 (190.044)
Thailand [†]	270.843 (326.762)	555.260** (273.773)	530.251 [*] (295.625)	906.098 [*] (477.023)	3,584.431*** (1,202.302)
Metropolitan [†]	693.562** (286.401)	396.664 (277.777)	-208.844 (340.342)	-272.877 (418.174)	-1,521.378 (1,054.212)
Constant	-513.380 (1,049.646)	1,346.785 (890.919)	1,895.517** (908.756)	2,945.356*** (973.027)	2,683.412 (2,301.287)
Number of observations	373	373	373	373	373
R ²	0.149	0.161	0.237	0.230	0.185
F(10, 170)	4.14	7.87	13.77	10.89	4.24
Prob. > F	0.000	0.000	0.000	0.000	0.000

PPP\$ = purchasing power parity dollars.

Robust standard errors clustered at rural villages in parentheses; †: Dummy variable; ln: natural logarithm; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

APPENDIX 16: RESULTS OF QUANTILE REGRESSIONS OF ONLINE MARKET PARTICIPATION AND FEMALE MIGRANT'S CONSUMPTION FOR ALL THREE ACTIVITIES

	Expenditure per Capita (PPP\$)				
	10th Group	25th Group	50th Group	75th Group	90th Group
All three activities	-108.569 (246.949)	594.840** (252.556)	1,145.878*** (361.124)	2,069.616*** (658.166)	3,211.991* (1,869.692)
Education purposes†	307.109 (336.820)	336.297 (288.034)	189.751 (317.214)	559.541 (438.507)	2,227.306** (1,081.243)
Age of migrant	13.424 (20.785)	-10.850 (16.946)	21.456 (17.551)	30.607 (23.129)	4.312 (49.569)
Schooling years of migrant	76.157* (43.450)	62.312 (39.785)	96.937** (44.154)	48.183 (60.127)	179.113 (129.625)
Marital status of migrant†	-228.070 (315.929)	-402.668 (319.053)	-1,409.596*** (311.686)	-1,616.783*** (447.015)	-3,009.416*** (1,111.358)
Living with family in the city†	318.853 (366.550)	662.418* (371.216)	1,721.189*** (446.383)	2,132.383*** (608.871)	2,209.028* (1,187.158)
Accommodation-sharing adults	-378.662*** (99.277)	-338.004*** (82.297)	-345.025*** (79.068)	-378.901*** (86.460)	-400.112* (228.265)
Asset value (ln)	186.759** (89.854)	131.275** (54.259)	112.074** (49.789)	173.422** (72.599)	248.198 (179.123)
Thailand†	143.063 (300.321)	382.816 (269.517)	630.558** (268.568)	1,198.232*** (437.006)	4,343.937*** (1,243.573)
Metropolitan†	434.604* (260.599)	108.086 (240.943)	81.560 (266.655)	468.772 (366.178)	228.662 (880.814)
Constant	-263.333 (1,022.089)	1,692.088* (883.248)	1,710.470* (879.868)	2,392.991** (981.117)	1,224.366 (2,437.493)
Number of observations	373	373	373	373	373
R ²	0.149	0.167	0.246	0.240	0.179
F(10, 170)	4.31	10.25	14.15	10.86	4.15
Prob. > F	0.000	0.000	0.000	0.000	0.000

PPP\$ = purchasing power parity dollars.

Robust standard errors clustered at rural villages in parentheses; †: Dummy variable; ln: natural logarithm; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

APPENDIX 17: NUMBER OF FEMALE MIGRANTS USING THE INTERNET BY TYPES AND NUMBER OF ACTIVITIES

Quantiles of Expenditure per Capita (Female Migrants)	By Type of Activities						By Number of Activities					
	Financial Transaction		Trading		Business		At Least 1 Activity		At Least 2 Activities		All 3 Activities	
	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
1st	51	24	44	31	68	7	38	37	53	22	72	3
2nd	46	29	45	30	65	10	31	44	54	21	71	4
3rd	41	33	36	38	59	15	23	51	49	25	64	10
4th	27	48	25	50	50	25	15	60	31	44	56	19
5th	22	52	26	48	35	39	15	59	25	49	43	31
Total	187	186	176	197	277	96	122	251	212	161	306	67