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Connecting Locals to Locals: Market Discovery through E-Commerce

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Abstract:

Despite rapid growth in e-commerce, there has been little systematic research examining the impact of online commerce adoption on the entrepreneurs in ASEAN. Using a unique survey data of around 7,000 merchants on Shopee in Thailand, this paper seeks to fill that gap through a mix of econometric and trade connectivity analyses. We found that e-commerce adoption is associated with improvement in household incomes for the sellers. The benefits come from two different channels. First, e-commerce empowers existing SMEs by significantly boosting their revenue, efficiency, and profit growth. The improvement in profitability seems to go beyond a one-off gain as going online seems to also result in stronger profit growth rates. Second, our trade connectivity analysis illustrates how e-commerce allows merchants, especially those in the poorer regions, discover new market opportunity outside their own regions. In addition, e-commerce allows people of various employment status including full-time employees, homemakers, students, etc. to earn additional income, while maintaining other responsibilities.

Keywords: E-Commerce, Digital Economy, Connectivity, Thailand

JEL Codes: L81, F15, F63, R12

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1. Introduction

The digital economy, once a fringe market, has experienced remarkable growth globally. Technological advancements and the increasing ubiquity of affordable internet and internet-enabled devices has led to a spate of industries being disrupted and digitized. Though its introduction in Southeast Asia occurred far later than its Western counterparts, the digital economy throughout the region has seen a massive leap in growth. A report by Google and Temasek (2018) estimates that the internet economy within ASEAN6 (defined as Indonesia, Malaysia, Philippines, Singapore, Thailand and Vietnam) has more than doubled from USD 32 billion in 2015 to USD 72 billion in 2018. One of the digital economy's most successful constituents, accounting for roughly 31% of ASEAN6's digital economy in 2018, is e-commerce, which refers to the activity of transacting goods and services over the internet.

Despite its unprecedented proliferation, detailed academic research on e-commerce within the region has been few and far between. While, there has been some literature on e-commerce's effect on buyers, there has been little literature in regards to the sellers on these platforms in ASEAN. Thus, this paper aims to contribute to the literature by examining the e-commerce industry in Thailand through the perspective of its impact on online sellers. More specifically, the objective of the paper is to assess the effects of e-commerce on the broader economy through changes in firm-level efficiency and market connectivity. In particular, the paper explores the impact on e-commerce adoption on the sellers' geographical reach, business revenue, profit growth and, ultimately, household income.

We chose to focus on Thailand for a number of reasons. Firstly, Thailand has a burgeoning e-commerce industry that is rapidly growing. This is partly due to a large number of aspiring entrepreneurs and social sellers[3]. Secondly, Thailand has an ideal composition of both traditional, brick-and-mortar, small and medium-sized enterprises (SMEs) as well as 'pure' online sellers, defined as sellers with no offline stores. Thirdly, the government is pushing for the development of the digital economy, especially for SMEs, under the Thailand 4.0 plan.

One problem, common to much of the previous literature on e-commerce sellers, is sourcing data. A combination of having limited access to sellers, which entails a smaller survey pools, and low response rates result in relatively small sample sizes. These sample sizes were often inadequately large enough for researchers to extensively analyze and address their research questions. In order to overcome this problem, we have worked closely with Sea Group and Shopee, its e-commerce platform, to construct a data set from a novel and large-scale survey of sellers on Shopee. The benefit of collaborating with Shopee is that not only is it one of the largest e-

[3] Social sellers refer to online sellers who participate in social commerce. Social commerce can refer to either transacting on social media platforms (e.g. Facebook, Instagram, etc.), sellers promoting products and sales through social media but transacting on an e-commerce platform, or using social networking services (e.g. live chat, live stream, etc.) native to the e-commerce platform before completing the transaction on the said platform. For disambiguation, we will henceforth refer to the first case as social commerce, and the latter two cases as socially-enabled e-commerce.

commerce platforms in Southeast Asia, it also has one of the most diverse seller communities. Sellers on Shopee range from pure online microentrepreneurs, to traditional SMEs, to larger companies, and all across various product categories. With the help of the Shopee team, we were able to get close to 7,000 merchant responses - enough to construct a sizable micro-dataset for proper, in-depth and unique analyses. The richness of the data also allows for connectivity analysis using mapping visualizations as well as regression analyses on various sub-samples.

Utilizing the constructed dataset, the paper finds that e-commerce adoption is associated with improvement in household incomes for the sellers. The benefits come from two different channels. First, e-commerce empowers existing SMEs by significantly boosting their revenue, efficiency, and profit growth. The improvement in profitability seems to go beyond a one-off gain as going online seems to also result in stronger profit growth rates. Second, our trade connectivity analysis illustrates how e-commerce allows merchants, especially those in the poorer regions, discover new market opportunity outside their own regions.

Due to data limitation, we were only able to analyze the sellers who eventually engaged in e-commerce. We were not able to examine the traditional sellers that did not yet go online and compare the results. We note this as a limitation of our current study and encourage future research to revisit this issue once the required data are available and accessible.

The paper is structured as follows. Section 2 provides an overview of the e-commerce landscape within the region and Thailand. Section 3 delves into a brief literature review, which is then followed by Section 4, which outlines the survey methodology and data. Section 5 begins the main empirical investigation of the paper and explores the economic impact of e-commerce using regression analysis, by looking at the impact on sellers' revenue, profit growth, as well as efficiency (proxied by revenue per employment). Section 6 delves into the impact of e-commerce on seller connectivity, by way of market discovery, through the use of connectivity diagrams. Section 7 discusses this paper's overall findings, and is followed, lastly, by conclusions, policy implications and recommendations.

2. E-Commerce Landscape

E-commerce is defined as "the activity of transacting goods and services over the internet." The most common forms of e-commerce are business-to-consumer (B2C), consumer-to-consumer (C2C), consumer-to-business (C2B), and business-to-business (B2B) (UNESCAP and ADB, 2018).

This paper will focus on B2C and C2C due to data availability. B2C is where businesses sell to consumers and more naturally lends itself to e-tailing and marketplace e-commerce. On the other hand, C2C is where users (consumers) of an e-commerce platform can be either buyer, seller or both, and is most commonly done through marketplace e-commerce or social commerce.

2.1 E-commerce in Southeast Asia

E-commerce has seen an unprecedented growth within the region, with total gross merchandise value (GMV) of B2C and C2C estimated to have more than doubled in a single year from USD 11 billion in 2017, to USD 23 billion in 2018, and is projected to grow to USD 102 billion in 2025 (Google and Temasek, 2018). However, despite its current scale, e-commerce is still far behind more mature e-commerce markets. According to Sathirathai and Wan (2018), in 2017, e-commerce penetration within the region averaged at approximately 2% of the population, which is far below both China and the United States (US) at roughly 23% and 8% respectively. In context, e-commerce penetration of 2%, would put ASEAN6 where China was in 2010, roughly 7 years behind. This number only serves to highlight the nascence of the industry, and despite an already impressive CAGR of 39% from 2015-18, the industry is still expected to grow even further.

It is important to note, however, that ASEAN6 has characteristics unique to the region which has led to the evolution of business models different from other regions. The recent development of low-cost, entry-level smartphones has led to a population that accesses the internet with a mobile first, and in most cases, mobile only. Data from Google's Consumer Barometer (2017) reveal that smartphone ownership is at 74% in the region, while only 40% use a computer.[4] In addition, 63% of respondents claim that they access the internet more often via smartphone than computer or tablet. This trend is also reflected in mobile e-commerce penetration, where around 68% of internet users in ASEAN6 having purchased something online via mobile in the last month, while China and the US have penetration rates of 74% and 44%, respectively (We Are Social & Hootsuite, 2019).[5]

Lack of offline retail in ASEAN6 and low urbanization rates have supported the growth of C2C marketplaces. This form of e-commerce is almost entirely comprised of independent sellers,

[4] https://www.consumerbarometer.com/en/graph-builder/?question=N1&filter=country:vietnam,indonesia,philippines,taiwan,thailand,singapore,malaysia
[5] https://wearesocial.com/blog/2019/01/digital-2019-global-internet-use-accelerates

the majority of which are SMEs. In Indonesia, McKinsey & Company (2018) estimates that of the 4.5 million active sellers in 2017, 99% of them are microenterprises. Furthermore, they estimate that 15% of all sellers are selling their own products. The region is also highly social media centric resulting in popularity of both social commerce and socially-enabled e-commerce. For example, McKinsey & Company (2018) estimates that over 37% of Indonesia's e-commerce value is generated through social commerce, with roughly one third of all online shoppers being purely social commerce users.

2.2 E-commerce in Thailand

Thailand has an estimated e-commerce value of USD 3 billion in GMV in 2018, which is roughly 13% of the region's total value. Many of the drivers that have contributed to the prosperity of e-commerce in the region, can be found in Thailand. On top of an already favorable demographic, a report by Sea and WEF (2018) find that Thailand has the greatest propensity for entrepreneurship within the region, with 36% of youths aspiring to be entrepreneurs in the future, compared to a regional average of 25%. Additionally, Thailand boasts a social media centric population that is largely mobile-first. It is estimated that approximately 51% of consumers buy goods through social media, and that the value of social commerce is roughly half of the total e-commerce market.

In terms of connectivity drivers, Thailand completed its Village Broadband Internet Project (Net Pracharat) in 2017. The government installed and provided free broadband internet to 24,700 rural villages throughout the country. In 2018, Thailand's internet penetration rate is 82% (We Are Social, 2019), which grew significantly from 27% in 2011 (We Are Social, 2011). The country's average fixed internet connection speed is 57.6 MBPS, higher than the world's average of 54.3 MBPS. Thailand's mobile broadband connectivity (broadband mobile connections per population) is 133%, higher than the world's average of 74%.

Thailand also has unique online consumer behavior. Banking penetration is relatively high in Thailand at 81% of the population aged above 15, compared to a regional average of 55% (World Bank, 2017). While bank transfers are the most popular form of online payment, constituting 28% of all online payments, cash-on-delivery remains highly preferred at 20% (Worldpay, 2018). A survey conducted by ecommerceIQ (2018) finds that the top two things Thai online shoppers value the most are cheaper product prices and greater product selection. This may reflect the fact that over half of online shoppers are located outside of Bangkok, and may be more sensitive to price and product diversity.

Despite its already impressive growth, the outlook of Thailand's e-commerce industry is still very positive. While Thailand's e-commerce market is estimated to account for less than 1% of retail sales, it is expected to rise to 5% over the next five years (Jones & Pimdee, 2017). This is expected to be further supported by the government's recent launch of the Thailand 4.0 initiative,

announced in October 2018.[6] The third agenda, of the five outlined in the announcement, focuses on "[incubating] entrepreneurs and [developing] networks of innovation-driven enterprise". One objective of the agenda is to increase the current contribution of SMEs from 37% of total GDP to 50% within 10 years through access to financing, development of skills, and supporting the enhancement of digital transformation. The government has also announced plans to develop 100 smart cities within two decades as part of another agenda within the initiative, thus further connecting more individuals and creating a more supportive environment for digital ventures.[7]

3. Literature Review

The digital revolution has changed the society in many aspects. From the communication standpoint, the online connectivity gave rise to the "Death of Distance." This means that distance is becoming less relevant and the people's ability to communicate and interact with one another is no longer constrained by it.

Focusing on international trade, the literature has documented that the value and amount of trade are inversely related to the distance between the locations of the parties involved in the trade transaction (Lendle et al., 2016). This is due to the fact that the further the distance between the parties, the higher the costs of communication and trade arrangements. With e-commerce taking off in the last decade, the costs of trade have dramatically reduced. In addition, e-commerce also benefited the economy as a whole in terms of lowering trade barriers, increasing employment, and enhancing economic development (McKinsey & Company, 2018).

The literature also documents the benefit of e-commerce from the sellers' perspectives and from the buyers' perspectives. From the sellers' point of view, e-commerce eliminates their costs of setting up actual physical stores, provides alternative means of earning, and makes it easier for them to become entrepreneurs (Fan et al., 2018; Dai and Zhang, 2015). From the buyers' point of view, e-commerce reduces search costs, allows them to get access to a broader variety of products, and makes it easier for them to buy things from far away (Dolfen et al., 2019).

Most of the recent literature on e-commerce has been focusing on China since the country's e-commerce sector recently experienced accelerated growth. Fan et al. (2018), using data from Alibaba Inc., document that e-commerce increases domestic trades within China. In addition, the adoption of e-commerce also increases welfare from the sellers' perspectives. Couture et al. (2018) evaluate the Chinese government's nationwide e-commerce expansion program and conclude that the program had reduced logistical barriers and resulted in sizeable welfare gains. However, the young and the rich appeared to benefit more from the program compared to other group of people. Dai and Zhang (2015), using firm registry data, show that e-commerce helps people with limited

[6] https://thaiembdc.org/thailand-4-0-2/
[7] https://www.opengovasia.com/thailand-4-0-the-smart-grid-project/

financial and social capital to become entrepreneurs. Huang et al. (2018) find that people residing in the areas with higher levels of e-commerce adoption are more likely to be entrepreneurs.

Despite rapidly explosive growth in e-commerce in Southeast Asia in recent years, only a limited number of studies have investigated the impact of e-commerce in the region. Wong (2003) argues that Singapore's infrastructure and people readiness should allow the country to be a very fast-adopter of e-commerce. Rowe, Truex, and Huynh (2012) study the factors that drive e-commerce adoption in Vietnam. They found that, among others, knowledge and resources available to the enterprises and the positive attitude of management towards technology are the most important key factors. McKinsey & Company (2018) explores the Indonesian e-commerce market and concludes that e-commerce helps increase sales and employment. For Thailand, Cheewatrakoolpong and Mallikamas (2019) study factors determining whether e-commerce sellers would export their products. Among others, the factors determining whether they would export are years in operation and the types of products that they sell.

To the best of our knowledge, this paper is the first to utilize a relatively large survey (close to 7,000 observations) of the e-commerce sellers in Thailand to analyze the impact of e-commerce on the sellers' household income, revenue, profitability, efficiency, and connectivity. Many of the previous studies that tried to investigate impact from the sellers' side were not able to collect a decent-sized survey due to low response rates. We overcome this problem by working closely with Sea Group and Shopee, its e-commerce platform, to launch and collect the survey data.

4. The Survey and Data

The data used in this paper are from a survey that we conducted with the assistance of Sea Group and Shopee team. The survey was prepared and conducted during 2018-2019. The questions were sent (via Shopee platform) to Shopee sellers who sold a minimum number of items over a 6-month period. The sellers were rewarded some small incentives for the participation of the survey.[8]

We would like to point out that although we were able to launch an extensive survey, we were not able to build an actual panel data set. Since this is a voluntary survey, we need to find a balance between the information we would like to get and the information that the respondents would be willing to provide without feeling too disturbed. Therefore, there is a limitation on the data that we could obtain. To measure the changes associated with engaging with e-commerce, we asked the sellers about their current situations (now that they are online) and the previous situations (when they were not online or when they were just started off). This information would allow us to visualize the impact, although not as accurately as if we were able to construct a panel data set. Also, some information such as the profit questions may be sensitive to the respondents. Therefore,

[8] Although we launched the survey in a systematic way, we were not able to control who decided to answer the survey. Therefore, we cannot claim that the results represent the population of Shopee sellers or overall Thai SMEs. However, in section 4.2, we compared the basic statistics of our data to the overall Thai SMEs to illustrate how our data fit with the overall Thai SMEs.

instead of asking about the actual profits, we asked how their profits have changed after they engaged in e-commerce.

4.1 Survey Questions

The survey questionnaire includes three broad sets of questions as follows: (See Appendix 1 for the full questionnaire.)

(i) Questions on Basic Demographics:

We asked the sellers about their basic demographic information such as age, gender, education, employment status, whether they are a primary earner of their household, their province of residence, etc.

(ii) Questions on Economic Impact of E-Commerce:

To measure the economic impact of e-commerce, we have to segregate the sellers into two groups namely (a) Existing SMEs, and (b) New Entrepreneurs.

Existing SMEs are sellers with prior offline business before going online. For these sellers, we asked questions about their prior offline business such as revenue, profit growth, employment (number of people employed including the owner), the locations of the customers that they used to sell to, etc. We asked when they started their online business. We then asked about their current business since they have been online. The information includes current revenue, profit growth, employment, the locations of the customers that they are now selling to, etc. In addition, we ask them about the size of their online business relative to their entire business. In this paper, we will call these questions "Set A questions," and we will call these SMEs "Group A sellers."

New Entrepreneurs are sellers with no prior offline business and just started their business as pure online business (very few of them may have set up their offline business later on). For these sellers, we asked questions about their current online business. The information includes the year they started the business, current revenue, profit growth, employment, the locations of the customers that they are selling to, etc. In this paper, we will call these questions "Set B questions," and we will call these entrepreneurs "Group B sellers."

For both groups, we also ask them whether entering into e-commerce business (i.e., start selling online) has changed their household income. The response choices are: Decreased Significantly, Decreased Somewhat, Not Much Impact, Increased Somewhat, and Increased Significantly.

(iii) Other Miscellaneous Questions:

We are also interested in why the sellers decided to enter into e-commerce business. Therefore, we asked them about the factors that motivated them to do so. Among the

responses are External Pressure (Others are doing it), Flexibility and Better Work-Life Balance, Financial Security, etc. In addition, we also asked questions about how they intend to spend their profits earned.

4.2 Overall Thailand's SMEs vs. Our Data

To discuss how our data fit with the overall Thailand's SME, we first discuss the overall summary statistics of Thailand's SME as provided by the Office of Small and Medium Enterprise promotion (OSMEP). The aggregate data of Thailand's Small Enterprises (SEs), Medium Enterprises (MEs), and Small-Medium Enterprises (SMEs) in 2018 are shown in Table 1 (left panel).[9] We separate the statistics for overall enterprises and enterprises in wholesale and retail sector.[10] According to OSMEP, there are 3,077,822 SMEs in the Thai economy (about 1,279,557 of them are in wholesale and retail sector). Only 23.03% of the SMEs are registered as juristic entities. Thailand's SMEs accounted for THB 7,013,971 Million in GDP and 13,950,241 in total employment. The imputed average monthly sales is THB 189,906 and the imputed average employment is 4.53.

Most of the SMEs are actually small enterprises (99.5%). Their imputed average monthly sales is THB 136,302 and their imputed average employment is 4.14. Out of the 3,063,651 small enterprises, 1,275,470 of them are in the wholesale and retail sector. Their imputed average monthly sales is THB 122,749 and their imputed average employment is 3.33.

According to Thailand's Ministry of Industry (Ministerial Regulation issued in 2002), SMEs in retail sector are defined as enterprises with employees of up to 30 or with assets (excluding land) of up to THB 60 Million. In our survey data, we only have the information on employment but not assets. Therefore, we applied this employment threshold to eliminate sellers who are not SMEs. We were able to gather 6,860 observations from the survey. Among them, 2,049 observations (29.9%) belong to Group A and 4,811 observations (70.1%) belong to Group B.[11]

The basic summary statistics of our data are shown in Table 1 (right panel). Overall, the average monthly sales is THB 58,073 and the average employment is 2.04. These statistics are lower than those of the overall Thai SMEs. However, looking Group A and Group B separately, we find that Group A's statistics are comparable to those of Thailand's small enterprises in

[9] Note that we were only able to gather the annual GDP and the total employment. Therefore, we had to impute the estimated monthly sales (GDP / 12 / Number of Enterprises) and the average employment (Total Employment / Number of Enterprises).

[10] We were not able to segregate retail sector vs. wholesale sector.

[11] We were able to collect the initial sample of 7,226 observations. However, we dropped observations with missing important information like gender, age. We also dropped observations that are extreme outliers (possibly due to input errors). Examples of these are negative age, negative revenue, negative employment, extremely high revenue growth (more than 10,000%), etc. Finally, we keep only observations that are between the ages of 10 to 70. We also excluded observations that were not SMEs by definition. After the cleaning process, we ended up with 6,860 observations.

wholesale and retail sector. Group A's average sales is THB 123,147 and average employment is 2.86 whereas Thailand's small enterprises in wholesale and retail sector's imputed average sales is THB 122,749 and imputed average employment is 3.33. On the other hand, Group B's average sales of THB 30,298 and average employment of 1.69 are far below compared to those of Thailand's overall SMEs. They are also lower than the average of Thailand's small enterprises.

4.3 Summary Statistics of the Sellers

Table 2 provides the detailed summary statistics of the sellers in our data. For the overall sample, the average age is 32.46 years old. About 27.9% of the survey respondents are male and about 45.3% of them are the primary earner of their household. The majority (68.3%) have a bachelor's degree as their highest education level. Also, the majority (43.4%) are employed with organizations.

As mentioned above, we segregated our respondents into Existing SMEs (Group A) and New Entrepreneurs (Group B), therefore we also computed the summary statistics for each of the groups separately. The average age of Group A is 34.16 and the average age of Group B is 31.74. About 35.7% of Group A and about 24.5% of Group B are male. Approximately 52% of Group A and about 42.5% of Group B are the primary earner of their household. We conducted the T-Tests (of the difference in means) and can conclude that Group A are older than Group B, Group A has more men compared to Group B, and Group A has more primary earners compared to Group B.[12] Regarding education, the majority of both groups (68.1% of Group A and 68.3% of Group B) have a bachelor's degree as their highest level of education. Regarding employment, Group A appears to be mostly self-employed (58.5%) whereas Group B appears to be mostly employed with organizations (50.5%).

5. Economic Impact Analysis

In this section, the paper explores the potential economic impact of going online for individual sellers. We start by examining the impact on household income of e-commerce adoption. One of the survey questions that we asked was how entering into e-commerce business (i.e., start selling online) has changed each seller's household income, Table 3 summarizes the responses[13]. Overall, entering into e-commerce appears to have a positive impact on household income for most sellers. In particular, 72% reported that their household income increase due to e-commerce, with 16.3% of the respondents reported a "significant" increase. Looking at Group A (Existing SMEs) and Group B (New Entrepreneurs) separately, the former saw higher proportion of households reporting income gains due to e-commerce. Among Group A, 82.4% of households

[12] Specifically, the T-statistics are 11.906, 9.107, and 7.244 for the difference in the means of Age, Male (dummy), and Primary Earner (dummy), respectively.
[13] See Appendix 1 Question 18 (for Set A) and Question 16 (for Set B)

indicated income gains, with 22.8% seeing significant increase, while for Group B the numbers were 67.5% and 13.5% respectively.

Next, we explore the mechanisms through which e-commerce adoption could contribute to higher household income for the merchants. For existing SMEs, the key mechanism is likely to be improvement in profitability coming from rising sales and higher efficiency, i.e. generating more revenue without ballooning costs. For new entrepreneurs, online channels may help provide additional incomes. We employ different empirical investigation methods to examine each group below.

5.1 Economic Analysis for Existing SMEs (Group A)

Recalling that Group A sellers had offline business before entering online business. Therefore, we were able to collect the data related to their business performance before and after they went online. The dependent variables of interest for Group A sellers are the change in their performance measures. Specifically, we will first explore the economic impact on sellers via increased revenue and profit growth. Then we also explore how entering into e-commerce business helps improve their business efficiency (as proxied by revenue per employment).

The empirical model used for the analysis is as follows:

$$\Delta y_i = \alpha + \beta \cdot x_i + \theta_p + \gamma_c + \varepsilon_i \quad (1)$$

Δy_i represents changes in the dependent variables of seller i which are (i) percentage change in revenue before vs. after the seller went online, and (ii) change in profit growth before vs. after the seller went online and (iii) change in efficiency (change in revenue per employment before vs. after the seller went online). Note that for profits, we can only compare change in the *growth rates*, i.e. acceleration, and not the level of profits due to the nature of the survey questions. This means the measure will not capture any potential level shift in profits after merchants going online.

x_i is a vector of observable characteristics of seller i. The key variable of interest is the *degree of digital integration* measured by the size of their online business relative to their entire business (constructed as group dummies with the base group being the sellers who have at most 20% of their business online; other groups are 20-40%, 40-60%, 60-80%, and 80-100%).[14] We anticipate that the higher the degree of digital integration, the higher the positive impact of e-commerce on the SMEs in terms of revenue, profit, and efficiency.

[14] Specifically, the base group are sellers with at most 20% of their business online. The subsequent groups are the sellers with more than 20% but not more than 40% online; the sellers with more than 40% but not more than 60% online; the sellers with more than 60% but not more than 80% online; and the sellers with more than 80% up to 100% online.

The other variables (which are the components of the vector x_i) include number of people employed (including the seller) prior to going online and years in operation of the business. The first variable is a control for the size of the business prior to going online. The second variable is a control for how long the SME has been in operation. It is possible that older SMEs are more likely to be traditional and may not be able to adjust quickly to e-commerce. We also include the information on the age and the gender of the seller, the highest education level of the seller (constructed as group dummies with the base group being the sellers with lower than high school education; other groups are high school, vocational, bachelor, and an advanced degree), and a dummy indicating whether they enter e-commerce because of the external pressure. θ_p's are the province dummies. γ_c's are main product category dummies. ε_i's are the error terms. We use the robust standard errors clustered by province. For each of the dependent variables, we run 3 regressions, the first regression (the base analysis) has neither the province or product category dummies, the second regression has the province dummies but no product category dummies, the last regression has both the province dummies and the product category dummies.

The results are shown in Table 4. Columns 1 to 3 display the results for percent increase in revenue. The SMEs with moderate-to-high online presence (40% or higher) are more likely to experience higher revenue increase after going online. Specifically, the SMEs that have 40% to 60% of their business online experienced 42.2 to 45.3 percentage points higher in terms of percentage change in revenue compared to the base group (sellers with at most 20% of their business online). SMEs that have 60% to 80% of their business online and SMEs that have 80% to 100% of their business online experienced 99.72 to 103.5 percentage points and 280 to 284.6 percentage points higher in terms of percentage change in revenue compared to the base group, respectively. This confirms our hypothesis that the higher the degree of digital integration, the higher the positive impact of e-commerce on the SMEs in terms of revenue increase.

Columns 4 to 6 display the results for change in profit growth. The results revealed that SMEs with more than 20% of their business online experienced larger increase in profit growth. Specifically, the SMEs that have 20% to 40% of their business online experienced 2.6 to 2.7 percentage points higher in terms of increased profit growth compared to the base group (sellers with at most 20% of their business online). SMEs with 40% to 60% online, 60% to 80% online, and 80% to 100% online experienced 3.7 to 3.8, 6.7 to 6.9, and 4.6 to 4.7 percentage points higher in terms of increased profit growth compared to the base group, respectively. Interestingly, for most groups, the higher the degree of digital integration, the higher the increase in profit growth except for the last group (80% to 100% online) in which the increased profit growth became slightly lower. The longer the SMEs have been in operation the lower the increase in profit growth. Specifically, an additional year of business being in operation is associated with 0.03 percentage points lower in terms of increased profit growth. Older sellers appeared to be doing worse than their younger peers (about 0.03 to 0.04 percentage points lower for an additional year of age). For some specifications, the ones who went online due to external pressure appeared to have higher increase in profit growth (about 0.8 to 0.9 percentage points higher) but the results are only slightly significant.

Columns 7 to 9 display the results for increased efficiency (change in revenue per employment before vs. after the seller went online). For all specifications, the SMEs with high online presence (60% or higher) are associated with larger increase in efficiency. Specifically, SMEs with 60% to 80% online and 80% to 100% online experienced 9,180 to 10,541 and 20,295 to 21,309 baht/person higher in terms of increased efficiency compared to the base group, respectively. (Note that for the 20% to 40% group, the significance is only minor and not robust across all specifications.)

In terms of increased efficiency, one may be concerned that efficiency may come at a cost of a reduction in employment. Table 5 addressed this concern. The table revealed changes in employment of Group A sellers after they went online. It turned out that only 8.8% of them reported a decrease in employment. The majority (72.3%) did not have any changes in employment whereas about 18.9% reported an increase in employment.

Recalling from our discussion regarding Table 1, Group A sellers' characteristics are similar to that of overall Thailand's small enterprises operating in wholesale and retail sector. Although we cannot claim that our data sample represents the population of Thai SMEs, we may view at the results as what could have happened to the small enterprises operating in the wholesale and retail sector. However, as already mentioned, due to data limitation, we were not able to examine the traditional sellers that did not yet go online and compare the results. We cannot exclude the possibility that the SMEs that went online are the more able ones and thus our results could be overestimated. We note this as a limitation of our study and encourage future research to revisit this issue once the required data are available and accessible.

5.2 Economic Analysis for New Entrepreneurs (Group B)

For Group B, the sellers did not have an offline business. They started off as online.[15] Therefore, we were only able to gather the data on their current business. For the empirical analysis, we are not able to compare their business before they went online vs. after they went online the same way we analyzed Group A.

Recalling from our discussion regarding Table 1, Group B sellers are much smaller than compared to the average of Thailand's overall SMEs. Our interest here is to examine whether these smallest sellers or individual sellers in Group B have augmented their household income by selling online. For this group, we will use the logistic regressions to assess whether certain attributes of their online business are associated with any increase in household income of the sellers.

The empirical model used for the analysis is as follows:

$$y_i = \alpha + \beta \cdot x_i + \theta_p + \gamma_c + \varepsilon_i \qquad (2)$$

[15] Very few of them may have set up their offline business later on.

y_i represents the dependent variables of seller i that takes value 1 if the seller reported an increase in household income and 0 otherwise.

x_i is a vector of observable characteristics of seller i's business. The key variable of interest is current revenue, current employment, years online (in this case is the same as years in operation), and whether the seller is the primary earner of his/her household. θ_p's are the province dummies. γ_c's are main product category dummies. ε_i's are the error terms. We use the robust standard errors clustered by province. We run 3 regressions, the first regression (the base analysis) has neither the province or product category dummies, the second regression has the province dummies but no product category dummies, the last regression has both the province dummies and the product category dummies.

The results are shown in Table 6. Columns 1 to 3 report the results of the base analysis and the augmented analyses, respectively. The results revealed that having high revenue and employment (proxied for the size of the business) are associated with an increase in household income. The increase is also more likely if the sellers are the primary earners of their household.

6. Connectivity Analysis: E-commerce's role in increasing market discovery

In this section, we examine how e-commerce can help existing SMEs (Group A) discover new market opportunity through two main potential mechanisms.

(i) Reducing Geographical barriers:

Through e-commerce, buyers are able to discover new products from faraway provinces and regions more easily, in part due to reduced search costs. Sellers are also able to find new markets that they could not access in the past, for instance through lower marketing costs and greater economies of scale in logistics.

(ii) Reducing Information Asymmetry:

Services on e-commerce platforms such as chat function, payments (e.g. escrow) and data analytics can help reduce information asymmetry and improve trust among buyers and sellers, resulting in more efficient transactions.

6.1 Trade Connection – Defined

As already mentioned, in our survey, we asked our Group A sellers about the locations of the customers that they sell to (prior to going online vs. current period). Specifically, we asked respondents to select the regions they sell products to, with 8 options to choose from representing

the various regions in Thailand.[16] Due to the potential sensitivity of this question, we do not ask sellers about the value of sales to each region. As such, we only know if the seller sells to a particular region or to their own province, but not the actual value of sales.

A "trade connection" exists if the seller indicates that he/she sells to a particular region in our survey. For instance, if a seller based in Bangkok selects province of own residence, North Thailand, and Northeast Thailand, we define this seller to have 3 trade connections.[17] We asked the sellers for data for two time periods, (i) before the seller went online, and (ii) the current period. Changes in responses for these time periods is used to determine the impact of e-commerce on trade connectivity.

The survey shows total trade connections increased materially after sellers adopted e-commerce. This increase was driven almost exclusively by trade outside the sellers' region. The number of trade connections roughly doubled after sellers went online, rising from 4,400 to 8,600. In addition, the average number of trade connections per seller increased from 2.1 to 4.2. Putting differently, the survey shows that entrepreneurs in Thailand sold to 2 more regions on average after utilizing e-commerce. The map in Figure 1 shows how trade intensity has risen across Thailand, before and after going online, while Figure 2 shows how trade has changed before and after e-commerce separately for Thailand's regions. Figure 3 shows how the increase in trade connections was driven by an increase in activity outside the sellers' own regions.

6.2 Extensive vs. Intensive Margins

In order to examine the trade connections in detail, we first define Extra-Regional Sellers (ERS) as sellers who sell good outside their own geographic region. We then tried to capture the increased trade connections from two aspects (i) the Extensive Margin and (ii) the Intensive Margin which can be defined as follow:

(i) Extensive Margin: The new extra-regional sellers (ERS):

The extensive margin can be measured by the increase in trade connections by sellers who were not originally ERS and then become ERS after going online.

(ii) Intensive Margin: The pre-existing extra-regional sellers (ERS):

The intensive margin can be measured by the increase in trade connections by sellers who were ERS and then sold to more regions after going online.

The increase in trade connections was driven much more by the "new ERS" (extensive margin) compared with "pre-existing ERS" (intensive margin). The extensive margin accounted

[16] These 8 options are: 1) province of own residence, 2) Bangkok, 3) other provinces in North Thailand, 4) other provinces in Northeast Thailand, 5) other provinces in East Thailand, 6) other provinces in South Thailand, 7) other provinces in West Thailand, and 8) provinces in Central Thailand

[17] For sellers from Bangkok who click on both Bangkok and province of own residence, we just keep one option.

for around 76% of the increase in trade connections for Thailand sellers after coming online. The rest of the increase in trade connections is due to the intensive margin (24%) (see Figure 4 for waterfall chart decomposing the change in trade connections to extensive margin and intensive margin). Figure 5 shows the share of trade connection increase based on extensive vs. intensive margins.

Another way to look at the extensive margin is from the seller's perspective. Before coming online, around 44% of sellers in Thailand sold outside their own region. After coming online, close to 81% of sellers in Thailand are now selling outside of their own region (see Table 7 for more details).

6.3 Market Discovery

Trade connectivity increase and market discovery post e-commerce was most significant for sellers in upcountry areas such as in North and Northeast Thailand. Our survey results also show that sellers in the two poorest regions in Thailand[18] - the North and Northeast - saw the largest increase to trade connectivity and market discovery after going online.

For instance, the share of sellers in the North and Northeast selling outside their own region increased by 48 percentage points and 45 percentage points respectively, higher than the nation-wide increase of 36 percentage points (see Table 7). Sellers in the North and Northeast were also among the top 3 regions seeing the largest increase in average trade connections per seller, at 2.3 and 2.6 respectively (see Table 8). For the Northern sellers, 85% of the expansion in trade connections came from extensive margins (high counts of ERS) versus only 61% for Central merchants.

This is important as it points to the possibility that e-commerce could help increase the reach for merchants who need them most - those from the more remote and poorer regions. While we cannot establish causality from analyses, it is interesting to note that North and Northeast saw among the largest proportion of sellers reporting increase in household income after adopting e-commerce. 86.1% of merchants in the North reported an increase in household income after going online while 83.8% in the Northeast did so, higher than the nation-wide average of 82.4% (See Figure 6 and Table 9 for the data by region).

7. Discussions

Our analyses show that e-commerce can help improve household income of the merchants. 72% of sellers reported an increase in income due to e-commerce, while 16.3% reported significant improvement in household earnings. The improvement in income potentially works through different mechanisms for existing SMEs and new entrepreneurs.

[18] Based on the latest GDP per capita data as of 2016

7.1 Existing SMEs (Group A)

For existing SMEs, e-commerce empowers the business - raising profitability by lifting sales and improving efficiency. Generally, our models suggest the higher the degree of digital integration - measured by share of e-commerce in total business - the stronger the benefits of e-commerce. Due to data limitations, we were unable to estimate the potential shift in *level* of profits after merchants go online. But the significant jump in revenue and efficiency gains could indicate improvement in level of profits. On average, merchants experienced 163.4% boost to revenue by going online, and can attain as much as 284.6% rise in sales if their degree of digital integration reach 80-100%. The surge in revenue came with improvement in efficiency - here measured as revenue per employee. In addition, we showed that for most sellers, such increased efficiency did not come at a cost of reduction in employment.

Moreover, our analyses point to the potential improvement in profitability that goes beyond a one-off level shift. We found that merchants experience acceleration in profit growth as share of e-commerce in total sales rises, with the benefit peaking at 6.9% when the ratio hit 60-80%. This implies that digital integration may have more than just a *static* boost to business performance, but a more *dynamic* improvement. Perhaps rise in the share of online sales indicate that firms are going through broader and/or deeper digital transformation (e.g. digitalization of business processes) that bring about longer lasting efficiency gains.

Our connectivity analysis provides important clues to why such boost to revenue was possible. E-commerce help reduce "distance" between sellers and buyers resulting in market discovery beyond their immediate geography. On average, businesses saw the number of trade connections doubled after coming online. This is predominantly through extensive margins - the share of sellers who sell to customers outside their own region rose from 44% to 81% after going online. But those who were already selling outside their own region also expanded the number of destinations.

Interestingly, we found that the poorest regions in Thailand, North and Northeast, experienced the greatest increase in trade connections after their sellers adopting e-commerce. Note that these two regions also contain among the highest shares of households reporting improvement in income due to e-commerce. This points to the possibility that e-commerce can be utilized to develop more remote and lower income regions, contributing to more inclusive economic growth.

The basic characteristics of Group A sellers resemble those of overall Thailand's small enterprises operating in whole sale and retail sector, however, we cannot claim that they are true representatives of the population. Due to data limitation, we were not able to examine traditional sellers that did not yet go online. We note this as a limitation of our study and would like to leave this for future research to explore once the necessary data are available and accessible.

7.2 New Entrepreneurs (Group B)

For the new entrepreneurs, we found that e-commerce could provide a source of additional income. In addition, the larger the sales and the employment, the better probability that the sellers experienced higher household income. The evidence is strengthened in the case where the sellers are the primary earners of their households.

The basic characteristics of Group B sellers are not similar to the average characteristics of overall Thailand's SMEs. In fact, Group B sellers are much smaller in terms of sales and employment. The authors conjecture that these sellers may be operating as sole proprietors or as individuals. Perhaps these are individuals who tried to supplement their incomes by selling items online. Our empirical results revealed that the more they can sell online the better chance they have in increasing their household income.

7.3 E-commerce: Different Strokes for Different Folks

There is also a number of evidence suggesting that these new entrepreneurs (Group B Sellers) are using e-commerce as a means of supplementing income rather than being the main business for the households.

According to our data, the majority of Group B tend to be people with other full time responsibility. Share of people with full time employment and homemakers in Group B are twice of those in Group A. The share of students are three times higher in Group B than Group A. Second, these new entrepreneurs (Group B Sellers) use profits from business in a different way compared to the existing SMEs (Group A Sellers). (See Table 10 for detail.) When asked what their profits are used for, 60.6% of responses from Group B indicated profits were used for "personal reasons" - including saving, caring for families, and education. Existing SMEs, on the other hand, have higher tendency to use the profits for business purpose such as reinvestment, hiring workers etc. Third, the two groups have different motives for adopting e-commerce. (See Table 11 for detail.) When asked about their motivations to join e-commerce, 59.9% of responses from Group B were classified as "personal reasons" - quality of life, convenience, flexibility etc. as the prime motivation for adopting e-commerce, while only 40.1% mentioned business motivations including cutting costs or business expansion. For Group A, the numbers are 53.2% for personal reasons and 46.8% for business-related purpose. In addition, the majority of Group B are people with full time jobs.

8. Conclusions and Policy Implications

Using unique and large-scale survey data on merchants in Thailand, this paper found that e-commerce adoption can result in improvement in household incomes for the sellers. In particular, by reducing distance, time and cost constraints, e-commerce can result in two types of discovery.

First, e-commerce empowers existing SMEs by significantly boosting their revenue, efficiency, and profit growth. The improvement in profitability seems to go beyond a one-off gain as going online seems to also result in stronger profit growth rates. Second, our trade connectivity analysis illustrates how e-commerce allows merchants, especially those in the poorer regions, discover new market opportunity outside their own regions. In addition, e-commerce allows people of various employment status including full-time employees, homemakers, students, etc. to earn additional income, while maintaining other responsibilities.

While existing SMEs have greater tendency to re-invest additional profits into the business, the part-time entrepreneurs are more likely to use extra earnings to care for families and pay for education. Our research also points to the possibility that e-commerce can help spread development to remote areas such as upcountry in the North and Northeastern parts of Thailand. Connectivity analyses showed that these two poorest regions saw the largest boost to trade connectivity and were among the top regions to report improvement in household incomes post e-commerce adoption.

Our study is, however, still subject to certain limitations. Since our survey is voluntary, we need to find a balance between the information we would like to get and the information that the respondents would be willing to provide without feeling too disturbed. First, we were not able to build a panel data set. We were only able to ask the sellers about their current situations (now that they are online) and the previous situations (when they were not online or when they were just started off). This information would allow us to visualize the impact, although not as accurately as if we were able to construct a panel data set. Second, some information may be sensitive to the sellers, so we avoid asking them. However, we tried to ask second-best questions. For example, we avoid asking the sellers about the actual profit but instead asking them about their profit growth. Third, we were only able to analyze the sellers who eventually engaged in e-commerce. We were not able to examine the traditional sellers that did not yet go online and compare the results. We note all these as the limitations of our current work and encourage future research to revisit this issue once the appropriate data are available and accessible.

However, it is still undeniable that e-commerce can potentially serve as tools to contribute to economic growth, by empowering SMEs, new entrepreneurs and those in more remote areas. This is particularly important for emerging markets such as ASEAN whereby 99% of enterprises are SMEs[19] and urbanization is relatively low at only 51% versus 85% in Latin America, for example.[20] E-commerce adoption by entrepreneurs is by no means automatic. To fully unlock the potential of e-commerce, the government and the private sector need to work together to address two types of constraints entrepreneurs face in selling online. First, the constraints that prevent entrepreneurs to adopt e-commerce such as limited access to internet and lack of digital skills.

[19] Bain & Company (Sep 2018): Advancing towards ASEAN Digital Integration.
[20] UN Population Statistics.

Second, factors that hold back the effectiveness of e-commerce including underdeveloped logistics, payments and regulatory environment.[21]

8.1 Promoting e-commerce adoption

As we observed from our results that existing businesses gained by going online in terms of increase in revenue, profit growth, and efficiency. In addition, individuals can also earn extra income streams that could potentially increase their household income by selling online. Therefore, promoting e-commerce adoption should be a key policy recommendation for policy makers. This can be achieved in two ways (i) increased digital access, and (ii) increased digital literacy.

For increased digital access, the Thai government has implemented its Village Broadband Internet Project (Net Pracharat) in 2017. The government installed and provided free broadband internet to 24,700 rural villages throughout the country. In 2018, Thailand's internet penetration rate is 82% (We Are Social, 2019). In addition, Thailand's mobile broadband connectivity (broadband mobile connections per population) is 133%, higher than the world's average of 74%.

However, improving internet access through better digital infrastructure is essential but not sufficient. According to Bain & Company, although 75% of ASEAN SMEs see digital as an opportunity, only 16% of SMEs truly utilize digital tools to their full potential.[22] The same paper found that 45% of ASEAN SMEs lack an understanding of technology, while 40% see a gap in digital skills.[23] The authors see this lack of digital literacy as the last-mile barrier for e-commerce adoption. Improving digital skills is crucial to ensure that the rapid growth in the digital economy is inclusive, benefiting everyone and not just those with the know-how to unlock the potential of digital tools.

Governments and the private sector can collaborate to provide relevant training for would-be online entrepreneurs on e-commerce. For instance, policy makers can work with various e-commerce platforms in the region to scale up various offline training programs to teach SMEs how to sell online. Academia-industry partnerships are crucial as well. Given how rapidly skillsets change, higher education institutions should constantly adjust to make sure what's taught in the lecture theatres are industry-relevant. Universities should partner with private institutions to shape curriculum.

[21] We draw from the World Bank's recent comprehensive report on Southeast Asia's digital economy - World Bank (2019).
[22] https://www.bain.com/insights/advancing-towards-asean-digital-integration/
[23] https://www.bain.com/insights/advancing-towards-asean-digital-integration/

8.2 Enhancing the effectiveness of e-commerce

Although the sellers in our sample who went online were able to discover new market opportunities, the benefits that the sellers can achieved are still limited by the effectiveness of e-commerce. Therefore, our policy recommendations would be to increase e-commerce effectiveness by (i) increase logistics efficiency, (ii) improve regulatory environment, and (iii) increase adoption of digital payments.

The government has a crucial to play in improving logistics infrastructure to reduce costs of shipping items around and across the country. This goes beyond building hard infrastructure but also improving general regulatory environment for businesses including cutting red tape, streamlining approval process, dismantling tariff and non-tariff barriers among others. For example, Thailand's ongoing effort to do Regulatory Guillotine and remove outdated laws is a step in the right direction.

Another key constraint holding back e-commerce growth is the lack of digital payments and high reliance on cash-on-delivery in ASEAN. The good news is that governments across the region, including in Thailand, are already taking steps to improve digital payments ecosystem through initiatives such as QR code standardization and enabling e-KYC (Know-Your-Customer). Next steps for policymakers include promoting digital ID, and improving interoperability of different systems to promote efficiency of the payment systems.

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Figures and Tables

Figure 1: Increase in trade connections (Whole of Thailand)

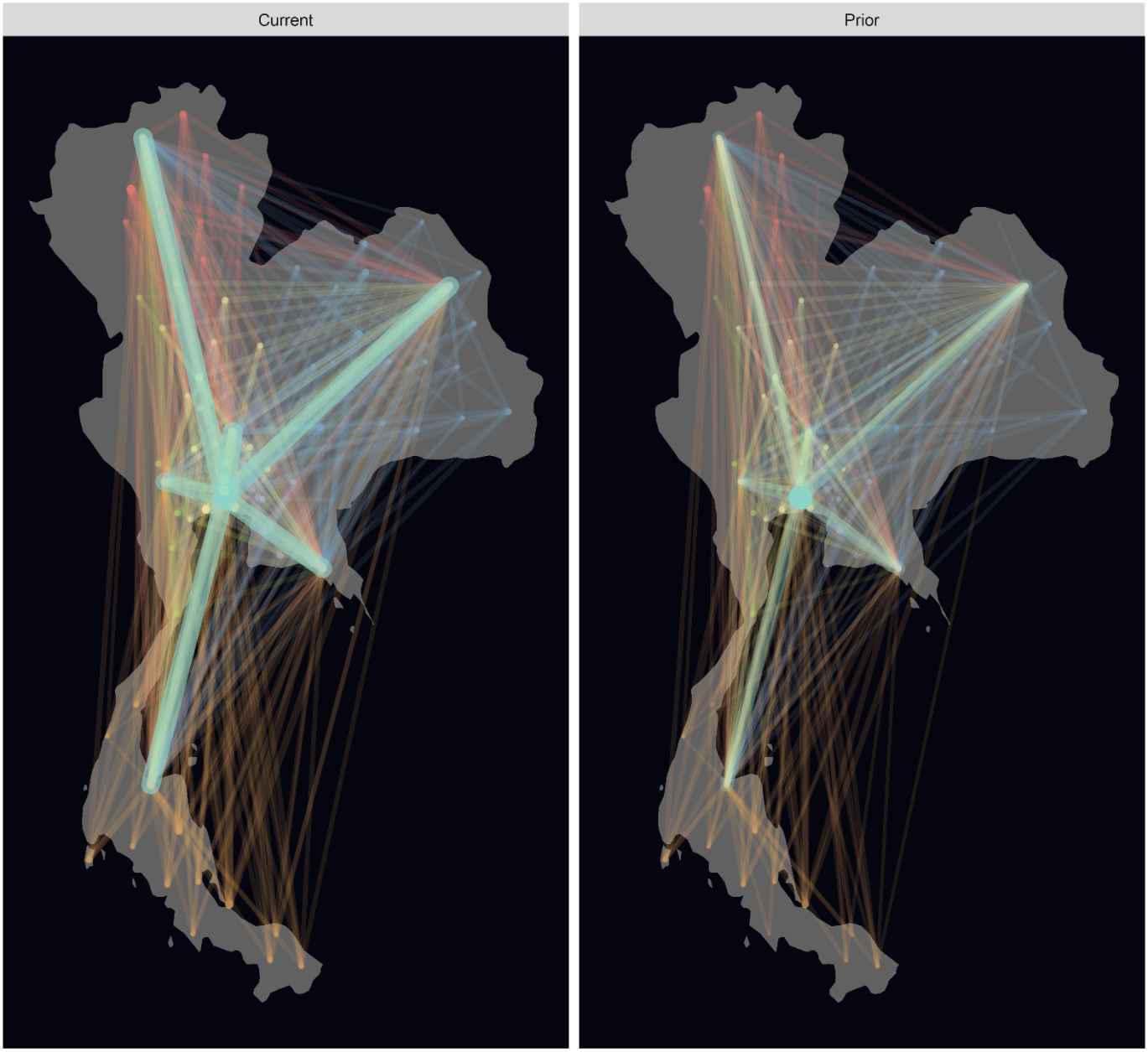
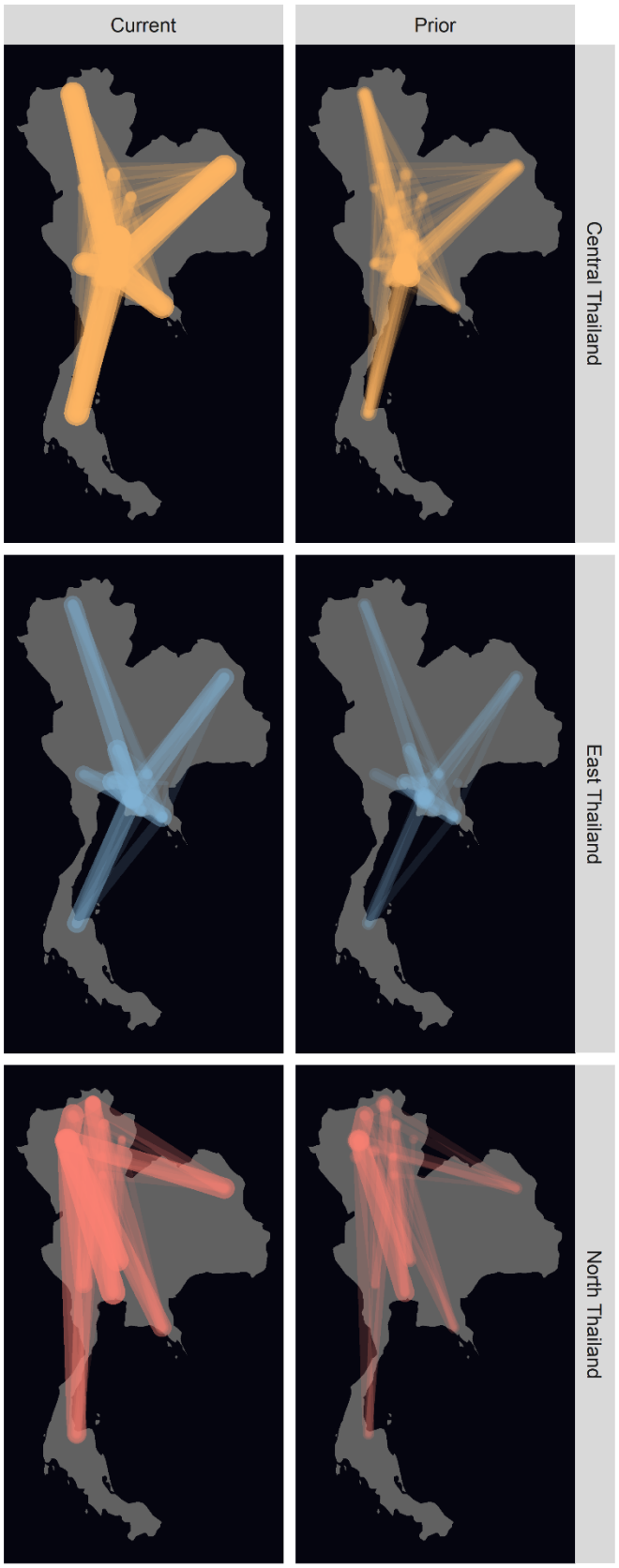


Figure 2: Increase in trade connections by region in Thailand



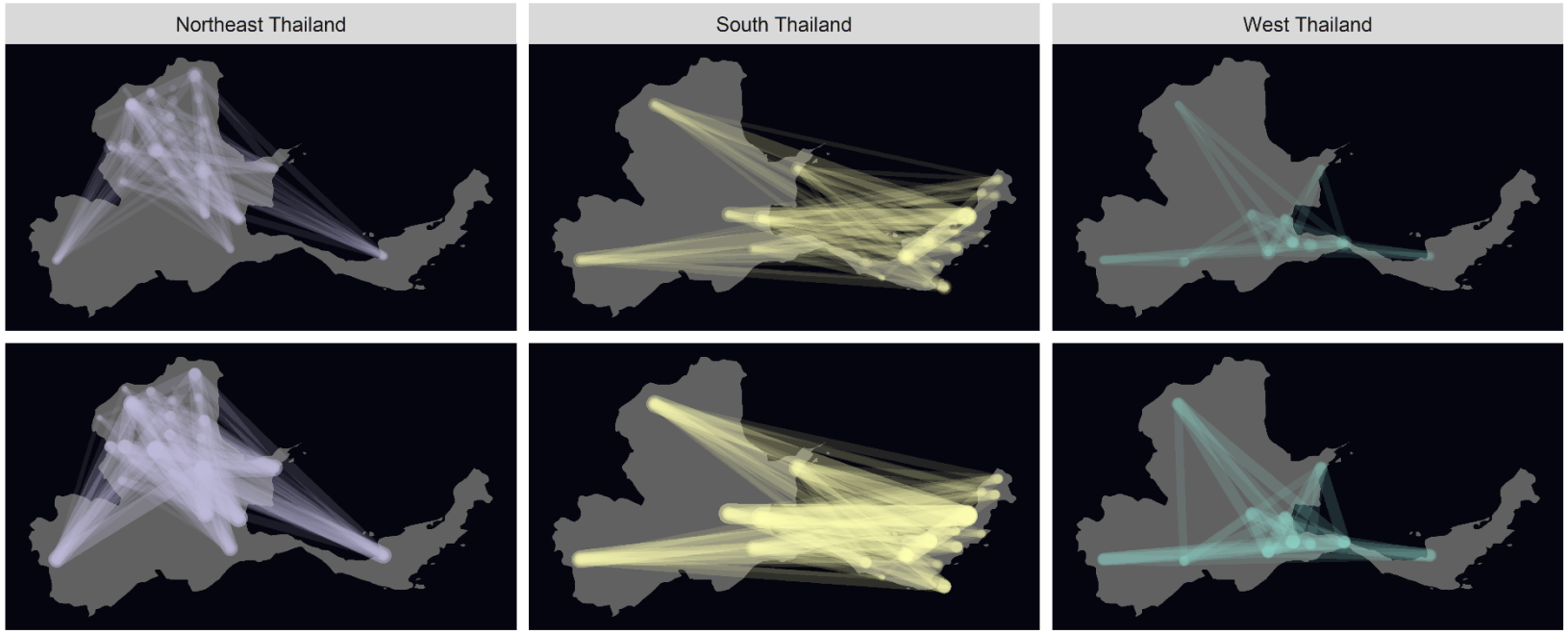
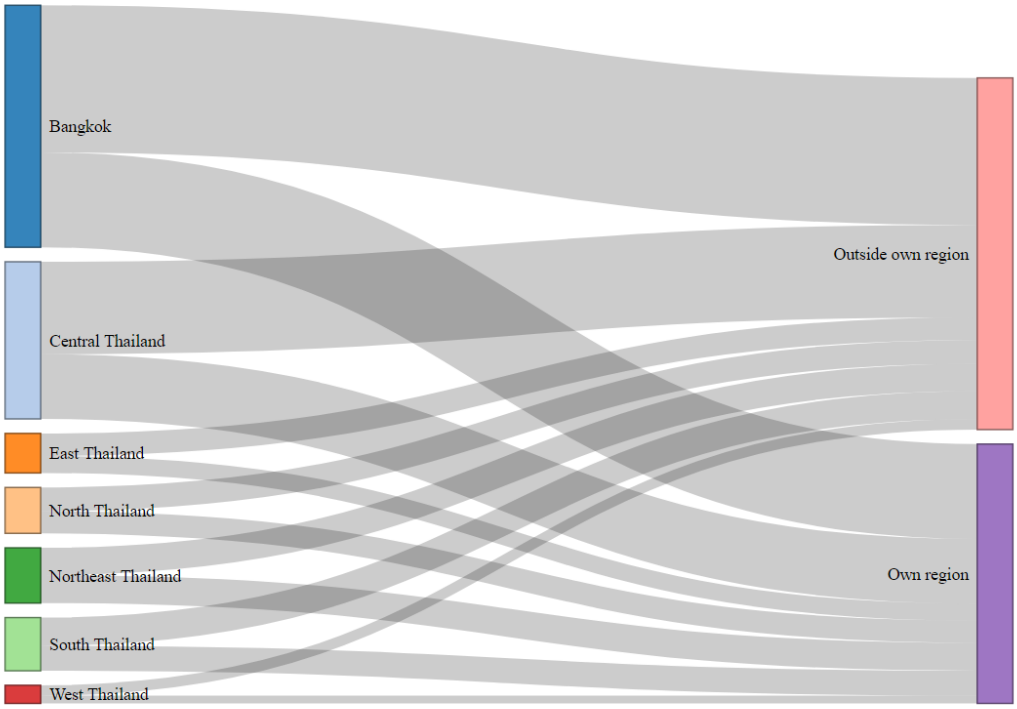

Northeast Thailand
South Thailand
West Thailand

Figure 3: Sankey Diagram: Own region vs outside own region

Before E-Commerce:



After E-Commerce:

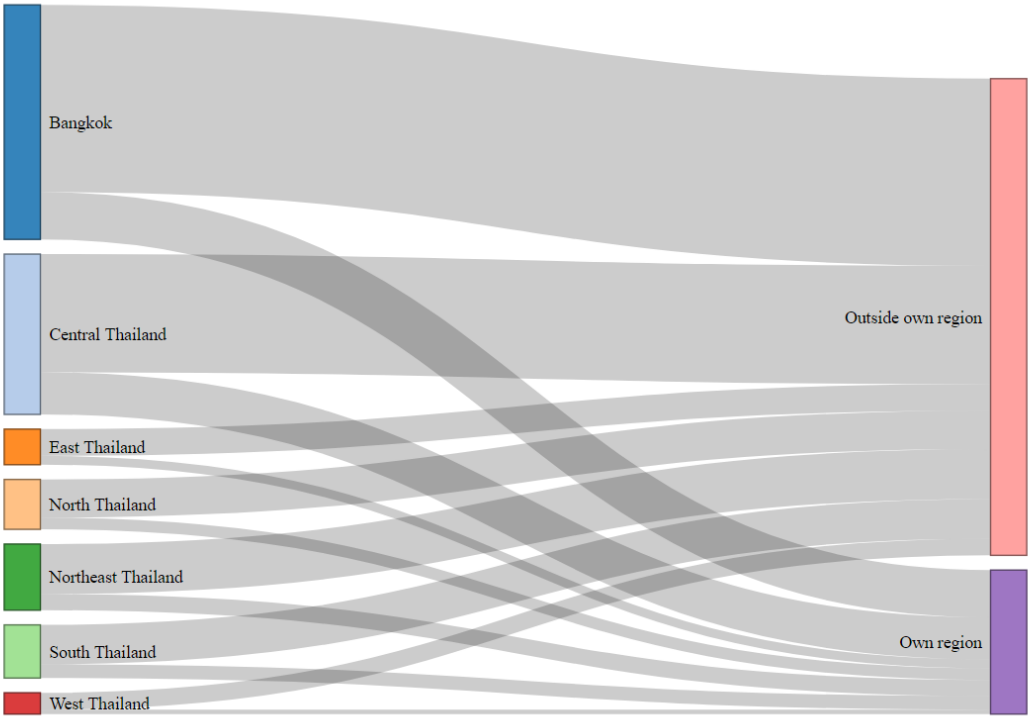


Figure 4: Waterfall chart: Decomposing into extensive vs intensive margin

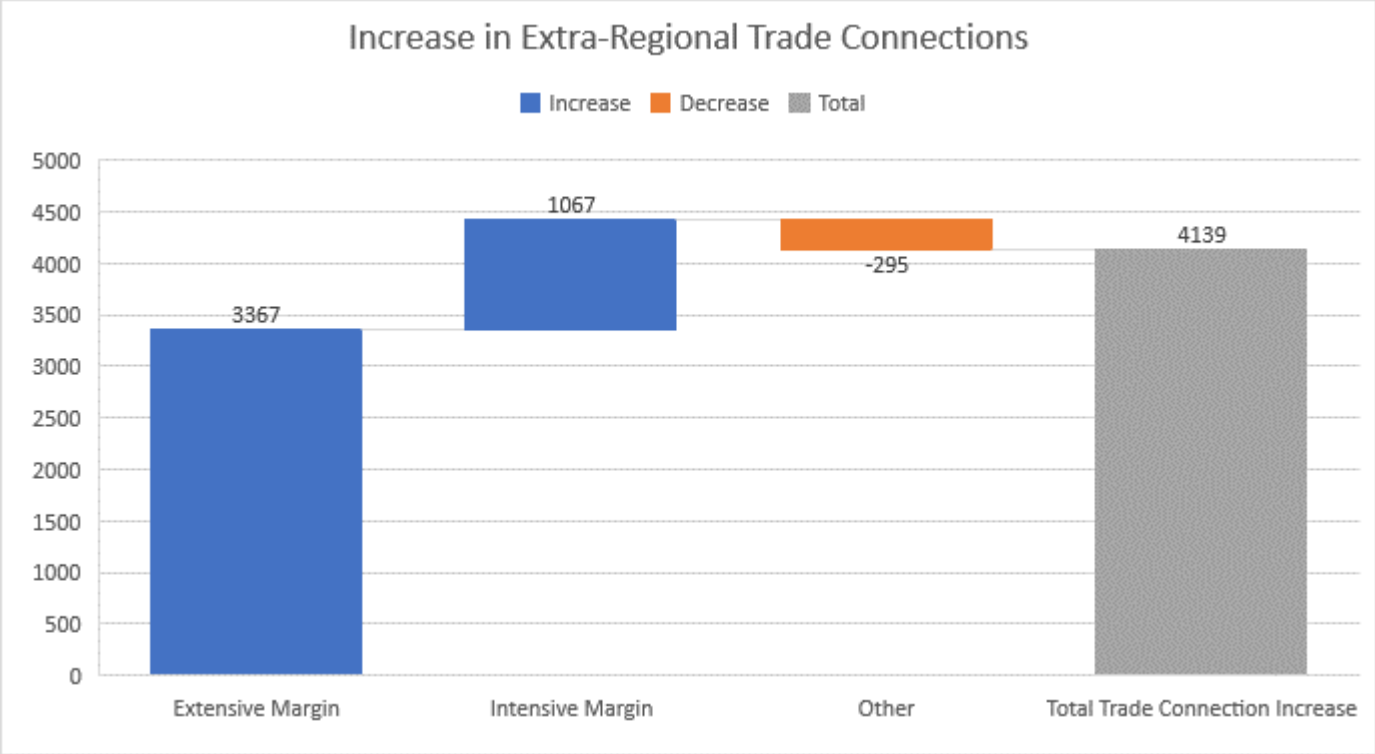


Figure 5: Share of trade connection increase based on extensive vs intensive margin

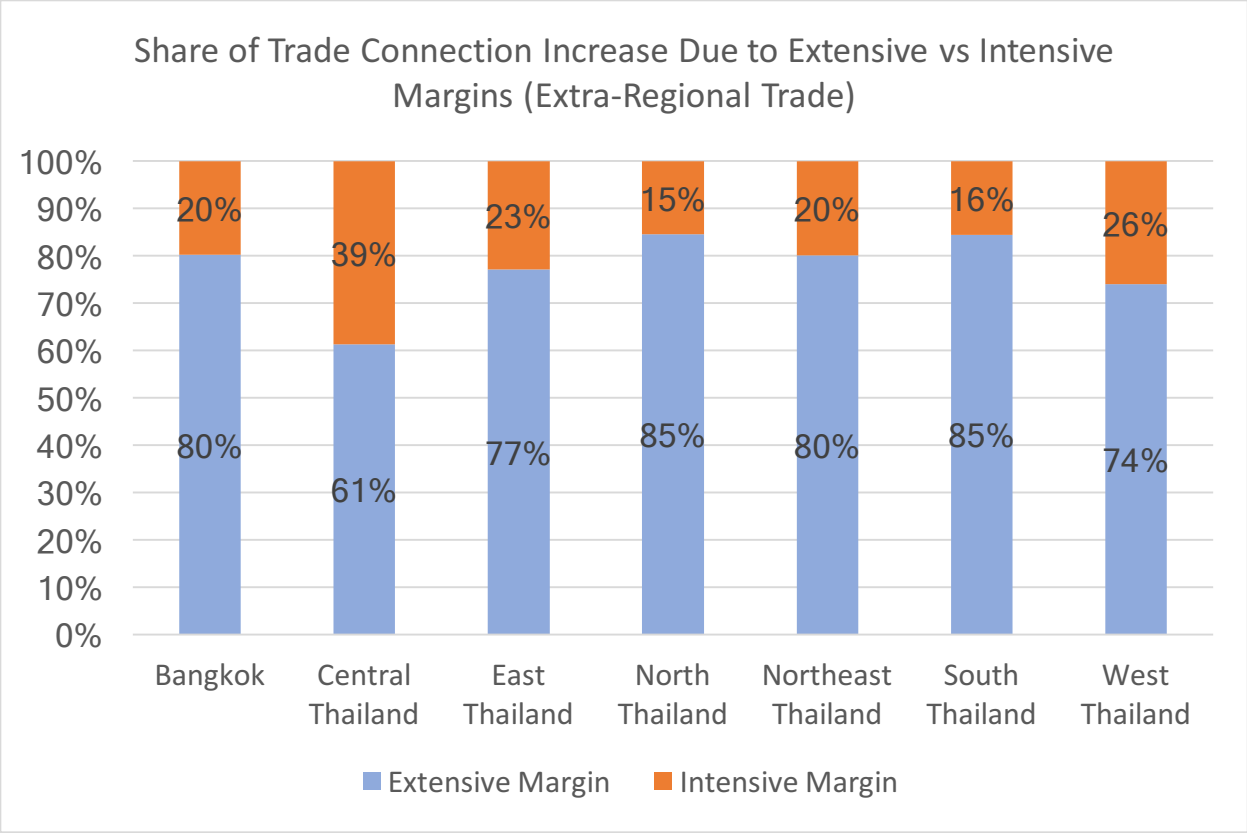


Figure 6: Impact to household income from e-commerce by region

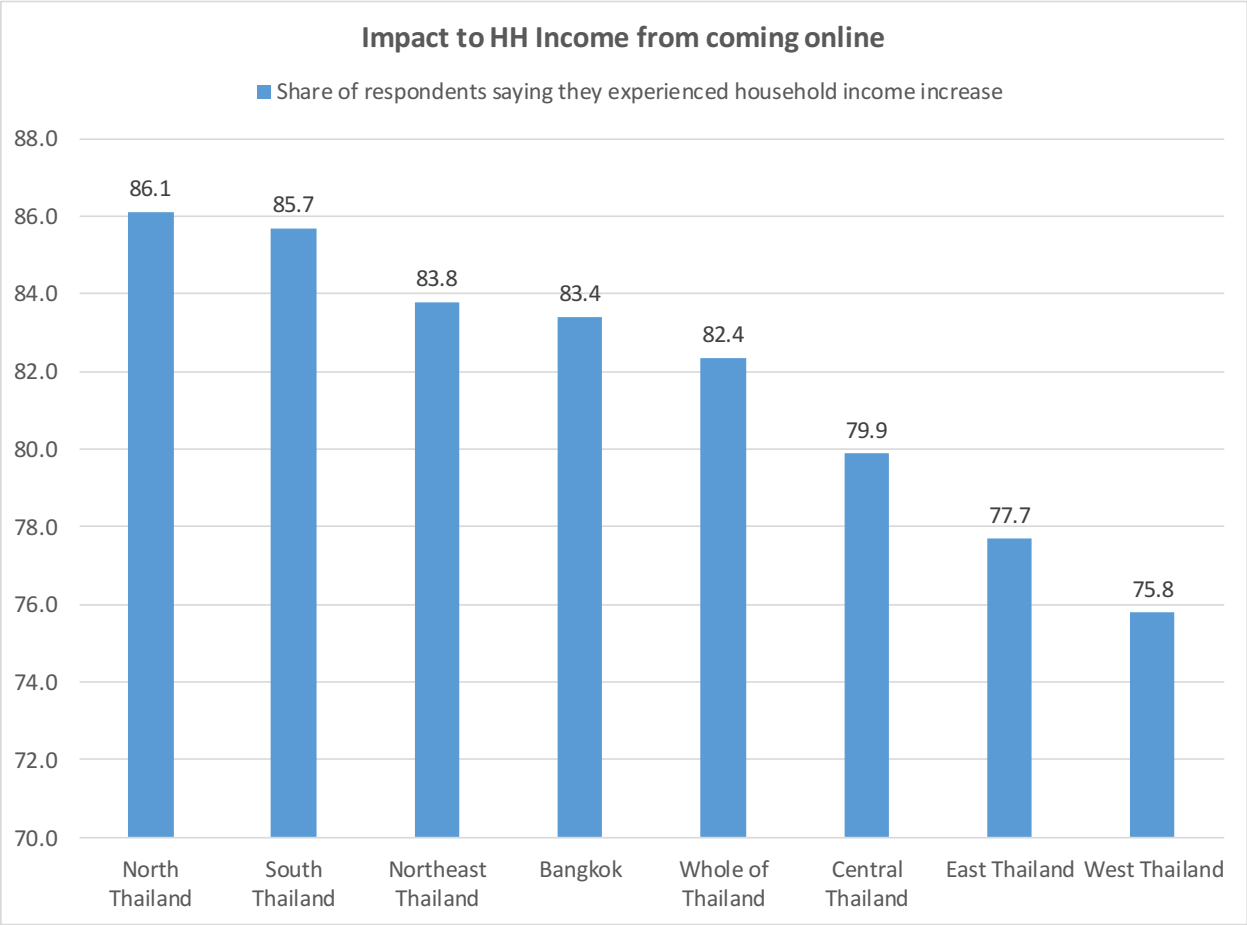


Table 1: All Thai SMEs vs Our Sample

VARIABLES	Unit	Thailand's Office of Small and Medium Enterprise Promotion (OSMEP) Data*						Our Data		
		Small Enterprises (2018)		Medium Enterprises (2018)		Small-Medium Enterprises (2018)				
		All	Wholesale & Retail Sector	All	Wholesale & Retail Sector	All	Wholesale & Retail Sector	All	Group A	Group B
No. of Enterprises		3,063,651	1,275,470	14,171	4,087	3,077,822	1,279,557	6,860	2,049	4,811
Registered as Juristic Entities	(%)	22.78%	18.79%	78.58%	54.51%	23.03%	18.90%	N/A	N/A	N/A
Sole Proprietor/Others	(%)	74.51%	81.01%	21.42%	45.49%	74.27%	80.90%	N/A	N/A	N/A
Community Enterprises	(%)	2.72%	0.20%	0%	0%	2.70%	0.20%	N/A	N/A	N/A
Total										
GDP	Million THB per year	5,010,991	1,878,750	2,002,980	324,118	7,013,971	2,202,900	N/A	N/A	N/A
Employment	Persons	12,670,351	4,246,714	1,279,890	191,844	13,950,241	4,438,558	N/A	N/A	N/A
Average										
Sales**	THB per month	136,302	122,749	11,778,632	6,608,719	189,906	143,468	58,073	123,147	30,298
Employment**	Persons	4.14	3.33	90.32	46.94	4.53	3.47	2.04	2.86	1.69

* All Thai SME Statistics are from the Office of Small and Medium Enterprise Promotion (OSMEP) White Paper on SME 2019
** Average Monthly Sales and Average Employment for all Thai SMEs are not provided in the OSMEP White Paper but are imputed by the authors

Table 2: Summary Statistics

VARIABLES		All	Group A	Group B
No. of Observations		6,860	2,049	4,811
Age	Average	32.46	34.16	31.74
Male	(%)	27.9%	35.7%	24.5%
Primary Earner	(%)	45.3%	52.0%	42.5%
Education	Below High School (%)	2.5%	2.5%	2.5%
	High School (%)	7.0%	6.0%	7.5%
	Vocational (%)	4.9%	5.1%	4.8%
	Bachelor (%)	68.3%	68.1%	68.3%
	Advanced Degree (%)	17.3%	18.3%	16.8%
Employment	Employed Full-time (%)	41.6%	25.1%	48.7%
	Employed Part-time (%)	1.8%	1.9%	1.8%
	Not Employed: Homemaker (%)	7.0%	4.3%	8.2%
	Not Employed: Retired (%)	0.5%	0.2%	0.6%
	Not Employed: Student (%)	7.9%	3.4%	9.8%
	Other (%)	3.9%	3.8%	3.9%
	Self-Employed (%)	31.7%	58.5%	20.2%
	Unemployed (%)	5.7%	2.8%	6.9%

Table 3: Change in Household Income after E-Commerce

ANSWER	All		Group A		Group B	
	Freq.	%	Freq.	%	Freq.	%
Decreased significantly	18	0.3%	18	0.9%	0	0.0%
Decreased somewhat	137	2.0%	33	1.6%	104	2.2%
Not much impact	1,755	25.8%	308	15.1%	1,447	30.3%
Increased somewhat	3,793	55.7%	1,212	59.6%	2,581	54.0%
Increased significantly	1,110	16.3%	464	22.8%	646	13.5%
Total	6,813	100.0%	2,035	100.0%	4,778	100.0%

Table 4: Impact on Sellers (Group A)*

VARIABLES	(1) Percent_Inc_Rev	(2) Percent_Inc_Rev	(3) Percent_Inc_Rev
PercentOnline_A_20_40	5.635	4.665	9.980
	(33.10)	(35.96)	(35.59)
PercentOnline_A_40_60	42.18*	38.82	45.32**
	(22.78)	(25.29)	(22.71)
PercentOnline_A_60_80	99.72***	103.5***	100.9***
	(20.88)	(22.09)	(22.10)
PercentOnline_A_80_100	280.0***	281.5***	284.6***
	(68.62)	(71.59)	(70.53)
PriorEmp_A	-2.209	-2.360	-2.574
	(1.719)	(1.866)	(1.922)
YearsInOperation_A	-0.684	-0.840	-0.976
	(0.874)	(0.962)	(1.273)
Age	-2.350	-2.431	-2.325
	(1.751)	(1.829)	(1.914)
Male	-14.26	-21.68	-27.89
	(13.84)	(15.43)	(17.78)
RC_Education = 2, High School	-10.46	4.888	12.84
	(27.99)	(31.71)	(32.99)
RC_Education = 3, Vocational	4.575	16.05	27.27
	(39.07)	(41.11)	(43.60)
RC_Education = 4, Bachelor	18.70	32.84	32.74
	(27.87)	(26.99)	(30.37)
RC_Education = 5, Advanced Degree	13.91	24.64	23.83
	(28.59)	(27.05)	(28.60)
ExtPressure_W	-0.322	1.470	4.021
	(17.23)	(18.47)	(19.89)
Constant	171.8***	470.8***	689.9***
	(56.61)	(65.25)	(86.51)
Observations	1,964	1,964	1,919
R-squared	0.030	0.048	0.057
Province Dummies	No	Yes	Yes
Product Dummies	No	No	Yes
Sample	Group A	Group A	Group A
Robust standard errors in parentheses			
*** p<0.01, ** p<0.05, * p<0.1			

* PercentOnline_A_20_40 is a binary variable that takes the value of 1 for Group A sellers who generate 20 to 40 percent of total sales from online channels. YearsInOperation_A represents the vintage of the firm in years. ExtPressure_W is a binary variable that takes the value of 1 if the seller cited external pressure as motivation to join ecommerce and 0 otherwise.

Table 4 (cont.): Impact on Sellers (Group A)

VARIABLES	(4) Inc_ProfitGrowth	(5) Inc_ProfitGrowth	(6) Inc_ProfitGrowth
PercentOnline_A_20_40	2.613***	2.688***	2.650***
	(0.475)	(0.473)	(0.457)
PercentOnline_A_40_60	3.705***	3.760***	3.779***
	(0.346)	(0.346)	(0.371)
PercentOnline_A_60_80	6.662***	6.692***	6.695***
	(0.524)	(0.526)	(0.526)
PercentOnline_A_80_100	4.574***	4.652***	4.558***
	(0.763)	(0.789)	(0.801)
PriorEmp_A	-0.0938**	-0.0916*	-0.0878*
	(0.0463)	(0.0463)	(0.0495)
YearsInOperation_A	-0.0281*	-0.0315*	-0.0331
	(0.0167)	(0.0175)	(0.0271)
Age	-0.0318**	-0.0339***	-0.0294**
	(0.0128)	(0.0123)	(0.0129)
Male	0.514	0.667	0.688
	(0.566)	(0.561)	(0.490)
RC_Education = 2, High School	1.409	1.622	1.390
	(1.413)	(1.520)	(1.554)
RC_Education = 3, Vocational	1.370	1.754	1.770
	(1.434)	(1.494)	(1.606)
RC_Education = 4, Bachelor	0.875	0.976	0.827
	(1.257)	(1.380)	(1.457)
RC_Education = 5, Advanced Degree	0.783	0.948	0.826
	(1.212)	(1.335)	(1.409)
ExtPressure_W	0.694	0.812*	0.914*
	(0.470)	(0.477)	(0.461)
Constant	1.106	-0.401	0.759
	(1.402)	(1.737)	(2.950)
Observations	2,047	2,047	1,996
R-squared	0.107	0.134	0.147
Province Dummies	No	Yes	Yes
Product Dummies	No	No	Yes
Sample	Group A	Group A	Group A

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 4 (cont.): Impact on Sellers (Group A)

VARIABLES	(7) Inc_RevPerEmp	(8) Inc_RevPerEmp	(9) Inc_RevPerEmp
PercentOnline_A_20_40	6,329*	6,007	6,545*
	(3,217)	(3,634)	(3,748)
PercentOnline_A_40_60	7,966	9,038	9,375
	(5,310)	(5,887)	(6,065)
PercentOnline_A_60_80	10,169**	10,541**	9,180**
	(4,054)	(4,122)	(3,905)
PercentOnline_A_80_100	20,295***	20,836***	21,309***
	(3,249)	(3,473)	(3,745)
PriorEmp_A	143.9	119.9	97.08
	(241.2)	(232.4)	(271.5)
YearsInOperation_A	55.86	17.35	194.2
	(154.6)	(171.0)	(234.8)
Age	68.36	35.70	-5.682
	(209.7)	(206.6)	(221.7)
Male	1,218	901.3	1,684
	(2,523)	(2,767)	(2,893)
RC_Education = 2, High School	2,988	7,432	10,498
	(6,483)	(6,888)	(6,600)
RC_Education = 3, Vocational	3,290	3,263	5,822
	(4,078)	(5,307)	(6,100)
RC_Education = 4, Bachelor	5,310	9,169	10,761
	(5,943)	(6,722)	(6,461)
RC_Education = 5, Advanced Degree	1,778	4,972	4,719
	(4,234)	(4,847)	(4,500)
ExtPressure_W	-1,545	-1,198	610.5
	(1,999)	(2,065)	(2,169)
Constant	-4,664	3,701	14,090**
	(4,260)	(6,153)	(6,177)
Observations	2,043	2,043	1,992
R-squared	0.010	0.048	0.068
Province Dummies	No	Yes	Yes
Product Dummies	No	No	Yes
Sample	Group A	Group A	Group A

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 5: Change in Employment After Adopting E-Commerce (Group A)

Change in Employment	Group A	
	Freq.	%
Decrease in Employment	180	8.8%
No Change	1,482	72.3%
Increase in Employment	387	18.9%
Total	2,049	100.0%

Table 6: Impact on Sellers (Group B)

VARIABLES	(1) IncreaseHHInc	(2) IncreaseHHInc	(3) IncreaseHHInc
Ln_CurrentRev_B	0.391***	0.401***	0.395***
	(0.0197)	(0.0225)	(0.0208)
CurrentEmp	0.0992***	0.104***	0.114***
	(0.0268)	(0.0272)	(0.0268)
YearsOnline	-0.00404	-0.00853	-0.00919
	(0.0103)	(0.0105)	(0.0110)
PrimaryEarner	0.540***	0.558***	0.542***
	(0.0688)	(0.0646)	(0.0701)
Constant	-2.694***	-3.136***	-2.372**
	(0.115)	(0.181)	(0.966)
Observations	4,763	4,747	4,651
R-squared	0.133	0.148	0.149
Province Dummies	No	Yes	Yes
Product Dummies	No	No	Yes
Sample	Group B	Group B	Group B

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 7: Share of Sellers Selling Outside Own Region

Location of Seller	Share of sellers selling outside own region		
	Before online	Current period	Change in share (pp)
Bangkok	37.92%	71.86%	33.94%
Central Thailand	57.17%	86.87%	29.70%
East Thailand	49.23%	86.15%	36.92%
North Thailand	44.10%	91.93%	47.83%
Northeast Thailand	41.18%	85.78%	44.61%
South Thailand	38.41%	84.76%	46.34%
West Thailand	47.76%	86.57%	38.81%
Whole of Thailand	44.46%	80.87%	36.41%

Table 8: Average Number of Trade Connections

Location of Seller	Average number of trade connections		
	Before online	Current period	Increase
Bangkok	2.16	3.98	1.82
Central Thailand	2.21	4.47	2.26
East Thailand	2.12	3.78	1.66
North Thailand	1.98	4.28	2.30
Northeast Thailand	1.88	4.48	2.60
South Thailand	2.26	4.48	2.22
West Thailand	1.88	4.39	2.51
Whole of Thailand	2.12	4.21	2.09

Table 9: Share of Households that Report Income Increase by Region

Location of Seller	Percentage of Households that Report an Increase in Income		
	Group A	Group B	Whole Sample
Bangkok	83.4%	64.6%	69.6%
Central Thailand	79.9%	69.8%	72.8%
East Thailand	77.7%	67.6%	70.5%
North Thailand	86.1%	72.0%	76.6%
Northeast Thailand	83.8%	70.7%	75.5%
South Thailand	85.7%	70.8%	76.9%
West Thailand	75.8%	72.9%	73.9%
Whole of Thailand	82.4%	67.5%	72.0%

Table 10: Use of Profit*

	Personal Reasons	Business Reasons	Mixed Reasons	Total Responses
Group A	2372 (55.7%)	1412 (33.2%)	473 (11.1%)	4357
Group B	5295 (60.6%)	2700 (30.9%)	741 (8.5%)	8736

* Personal uses of profits include saving them, using them to pay for education, and using them to help care for the family. Business uses of profits include reinvesting them into the business, hiring more employees and increasing employees' salaries. Mixed reasons refer to using profits to repay outstanding loans, where it is not possible to determine whether the loan is personal or business related. Respondents to this question are allowed to select multiple answers, with no minimum or maximum limit to the number of choices selected. Therefore, the Total Responses, can either be larger or smaller than the total number of respondents.

Table 11: Motivation for Entering into E-Commerce*

	Personal Reasons	Business Reasons	Total Responses
Group A	4334 (53.2%)	3812 (46.8%)	8146
Group B	9711 (59.9%)	6491 (40.1%)	16202

* Personal motivations include ease of online shop set-up, flexibility of working hours, greater time for household work, shorter commute, and better quality of life. Business motivations include the ability to expand the business, lowering business costs, external pressure (e.g. other companies are going online), financial security and to reduce business risk. Respondents to this question are allowed to select multiple answers, with no minimum or maximum limit to the number of choices selected. Therefore, the Total Responses, can either be larger or smaller than the total number of respondents.

Appendix

Appendix 1: Survey Questionnaire

Demographic		
Questions	**Options**	**Type of variable**
1. What is your gender?	F/M	
2. When were you born?	DD/MM/YYYY	Date option in SurveyGizmo
3. What is your highest level of education that you have attained?	No schooling/Elementary/Junior high/Senior high/Vocational/Bachelor/Higher than Bachelor/Others	
4. Are you the primary income earner of your household?	Yes/No	
5. How many people are there in your household?	Fill in: _____ (number)	From 1 to maximum 20
6. What is your current employment status?	Employed full time (35 hours/week or more) / Employed part-time (less than 35 hours/week) / Self-employed or Work for my own business / Unemployed - Looking for work / Not employed - Student / Not employed - Doing household work or take care of dependents / Not employed - Retired / Others (please specify)	
7. Is e-commerce your primary source of income?	Yes/No	
8. What is your estimated monthly household income?	Appendix 2	Dropdown option
9. Which province are you currently located?	Appendix 3	Dropdown option
10. When did you start selling online?	DD/MM/YYYY	Date option in SurveyGizmo
11. Do you have an offline business?	Yes/No	

If Question 11 answer "Yes" go to Question 12

If Question 11 answer "No", go to Question Group B

12. Did you start selling offline before selling online?	Yes/No	

If Question 12 answer "Yes", go to Question Group A

If Question 12 answer "No", go to Question Group B

Economic and Social Impact of E-commerce		
Questions Group A: (Traditional Business Goes Online)		
Questions and options		**Type of variable**
13. When did you start selling offline?		
DD/MM/YYYY		Date option in SurveyGizmo
14. Question about monthly sales of your business (online + offline):		
Currently, your business has average sales per month of:	[Local currency] _____	number
Just right before your business went online, your business had an average sales per month of:	[Local currency] _____	number
15. Online sales as % of total monthly sales of your business is currently:		
Percentage (%): _____ (0% to 100%)		Percentage: 0% to Maximum 100%
16. Question about number of employees of your business:		
Currently, the number of employees hired by your business is:	Number _____	No negative number
Just right before your business went online, the number of employees hired by your business was:	Number _____	No negative number
17. Question about increasing profits of your business:		
Currently, average profit increases per year by:	No increase / Increase by 1-3% / Increase by 4-6% / Increase by 7-9% / Increase by 10-12% / Increase by 13-15% / Increase by 16-18% / Increase by 19-21% / Increase by 22-24% / Increase by 25-27% Increase by 28-30% / More than 30%	Dropdown option
Just right before your business went online, average profits increased per year by:	No increase / Increase by 1-3% / Increase by 4-6% / Increase by 7-9% / Increase by 10-12% / Increase by 13-15% / Increase by 16-18% / Increase by 19-21% / Increase by 22-24% / Increase by 25-27% Increase by 28-30% / More than 30%	Dropdown option
18. How has selling online changed your household income?		
a) Increased significantly b) Increased somewhat c) Not much impact d) Decreased somewhat e) Decreased significantly		
19. Which regions do your customers come from?		
Currently	Appendix 4	
Just right before your business went online	Appendix 4	

Questions Group B: (Businesses That Launched Straight Online)		
Questions and options		**Type of variable**
13. Question about monthly sales of your business:		
Currently, your business has sales revenue per month of:	[Local currency] _____	number
When you just started your online business, your business had average sales per month of:	[Local currency] _____	number
14. Question about number of employees of your business:		
Currently, the number of employees hired by your business is:	Number _____	No negative number
When you just started your online business, the number of employees hired by your business is:	Number _____	No negative number
15. Question about increasing profits of your business:		
Currently, average profit increases per year by:	No increase / Increase by 1-3% / Increase by 4-6% / Increase by 7-9% / Increase by 10-12% / Increase by 13-15% / Increase by 16-18% / Increase by 19-21% / Increase by 22-24% / Increase by 25-27% Increase by 28-30% / More than 30%	Dropdown option
When you just started your online business, average profits increased per year by:	No increase / Increase by 1-3% / Increase by 4-6% / Increase by 7-9% / Increase by 10-12% / Increase by 13-15% / Increase by 16-18% / Increase by 19-21% / Increase by 22-24% / Increase by 25-27% Increase by 28-30% / More than 30%	Dropdown option
16. How has selling online changed your household income?		
a) Increased significantly b) Increased somewhat c) Not much impact d) Decreased somewhat e) Decreased significantly		
17. Which regions do your customers come from?		
Currently	Appendix 4	
When you just started your online business	Appendix 4	

Motivations in e-commerce, and criteria in choosing e-commerce platforms		
Continue from Question Group A + B		
Questions and options		**Type of variable**
19. What are your main motivations for choosing to sell on e-commerce? (Click all that applies)		
a) Ease of setting up an online business	f) External pressure (others are doing it)	
b) Flexibility and better work-life balance	g) Shorter commute to work	

c) More time to handle household work and take care of children	h) Quality of life
d) Opportunity for expanding the business	i) Financial security
e) Lower cost of doing business	j) Reduced risks

20. How do you use profits gained through e-commerce? (Click all that applies)	
a) Reinvest back into e-commerce business	e) Pay down loans (eg. mortgage and car loans)
b) Hire more employees	f) Pay for education
c) Increase employee salaries and/or benefits	g) Caring for family members (eg. supporting dependents)
d) Save the additional profits	h) Others, please specify _____

21. How many platforms do you use to sell your goods? Include both ecommerce and social media platforms. (To fill in the blanks)	
No. of platforms: _____	No negative number

22. Please rank the top 3 platforms in terms of how good you think they are (Rank 1 to 3. 1 being the best)	Rank in SurveyGizmo
___Shopee ___ Lazada ___JD Central ___Instagram ___Twitter ___Facebook	

23. Please rank the top 5 most important criteria when considering an ecommerce platform to sell on. (Rank 1 to 5. 1 being the best)	Rank in SurveyGizmo
___ Customer traffic ___ Ease of use ___ Used or recommended by peers ___ Logistics support ___ Free shipping ___ Workshops and training ___ Chat and social related functions ___ Ability to link with Instagram / Facebook ___ Support and promotion campaign ___ Advertising services ___ Ease of payments ___ Financing and loan products	

24. Please rank the top 3 most crucial aspects that require business support. (Rank 1 to 3. 1 being the best)	Rank in SurveyGizmo
___ Funding ___ Business Knowledge ___ Operation Management ___ Sales & Marketing ___ Distribution Channel ___ Logistic ___ Customer & Business Insights ___ Connection & Business Community	

Appendix 2: Household Income Brackets

Monthly Household Income	
Less than 2,500 Baht	70,001 - 90,000 Baht
2,500 - 5,000 Baht	90,001 - 110,000 Baht
5,001 - 7,500 Baht	110,001 - 130,000 Baht
7,501 - 10,000 Baht	130,001 - 150,000 Baht
10,001 - 30,000 Baht	More than 150,000 Baht
30,001 - 50,000 Baht	Prefer not to say
50,001 - 70,000 Baht	

Appendix 3: Thailand Provinces

Thailand Provinces		
Amnat Charoen	Nakhon Pathom	Rayong
Ang Thong	Nakhon Phanom	Roi Et
Bangkok	Nakhon Ratchasima	Sa Kaeo
Bueng Kan	Nakhon Sawan	Sakon Nakhon
Buri Ram	Nakhon Si Thammarat	Samut Prakan
Chachoengsao	Nan	Samut Sakhon
Chai Nat	Narathiwat	Samut Songkhram
Chaiyaphum	Nong Bua Lam Phu	Saraburi
Chanthaburi	Nong Khai	Satun
Chiang Mai	Nonthaburi	Si Sa Ket
Chiang Rai	Pathum Thani	Sing Buri
Chon Buri	Pattani	Songkhla
Chumphon	Phangnga	Sukhothai
Kalasin	Phatthalung	Suphan Buri
Kamphaeng Phet	Phayao	Surat Thani
Kanchanaburi	Phetchabun	Surin
Khon Kaen	Phetchaburi	Tak
Krabi	Phichit	Trang
Lampang	Phitsanulok	Trat
Lamphun	Phra Nakhon Si Ayutthaya	Ubon Ratchathani
Loei	Phrae	Udon Thani
Lop Buri	Phuket	Uthai Thani
Mae Hong Son	Prachin Buri	Uttaradit
Maha Sarakham	Prachuap Khiri Khan	Yala
Mukdahan	Ranong	Yasothon
Nakhon Nayok	Ratchaburi	

Appendix 4: Thailand Regions*

Thailand Regions	
Province of Residence	Other Provinces in the Eastern Region
Bangkok	Other Provinces in the Western Region
Other Provinces in the North Region	Other Provinces in the Central Region
Other Provinces in the Northeast Region	Other Provinces in the Southern Region

* Regions are macro regions and includes option for "Province of Residence" and Capital City