

Impact of Cross-Border Digital Transmissions on MSMEs in Thailand

Table of Contents

Executive Summary	2
Background.....	3
Importance of Digitalization to Thailand Economy	4
Impact Assessment of Digital Transmissions on the Economy.....	6
Negative Impact of Cross-Border Transmission Tariffication on Thailand's Economy	6
Duty Free Cross-Border Electronic Transmissions Help Rather Than Hurt An Importing Thailand's Economy	7
Empowering Thailand's MSMEs: Challenges, Policies, and the Digital Frontier	8
Data Sources and Methodology.....	9
Data Sources	9
Methodology	10
Results.....	12
Data Analysis.....	12
Correlation Matrix: Analysis	18
Panel Data Regressions	19
Conclusion	21
Appendix I	22

Executive Summary

This study sheds light on the profound benefits reaped by the Thai economy, particularly its Micro, Small, and Medium-sized Enterprises (MSMEs), due to the World Trade Organization's (WTO) e-commerce moratorium. The major focus is on the meticulous analysis of how the digital imports has orchestrated a significant enhancement in the performance of various MSME sectors within Thailand.

After gaining an in-depth understanding of the digital transmissions, we meticulously curated time-series data at the sectoral level of Thailand's MSMEs leveraging the credible and reliable data sources such as the Asian Development Bank (ADB) coupled with the data on imports of digital products from OECD Input-Output tables. This data-driven approach enabled us to pinpoint the precise contribution of digital imports.

Following data collection, our analysis employed econometric panel regression techniques to assess the impact of imported digital transmissions on the productivity, employment, and output dynamics of Thailand's MSMEs over time. Our econometric regressions suggest that for every 1% increase in digital imported inputs by MSMEs:

1. MSME GDP increases by 0.47%
2. MSME Employment increases by 0.11%
3. Number of MSMEs increases by 0.56%
4. Labor productivity as defined by MSME GDP per employee increases by 0.17%
5. Employees per MSME (size based on employment) increases by 0.03%
6. GDP per enterprise (size based on GDP) increases by 0.65%

In essence, the digital imports leveraged by the MSMEs brings about numerous positive outcomes. This includes boosting economic growth, increasing employment opportunities, and expanding the number of businesses. Additionally, it enhances labor productivity. For policymakers, this finding has profound implications as it may eliminate the long-standing dilemma of choosing between productivity, business size, and job creation. In the context of digital imports, it seems that a harmonious balance exists, challenging conventional trade-offs. To sum it up, the rise in digital imports has the potential to not only stimulate the GDP, employment rates, and the number of businesses among small enterprises but also elevate labor productivity and scalability, paving the way for a transformative paradigm shift in the realm of Thailand's MSMEs.

Background

The WTO's moratorium on electronic transmissions, which has been in place since 1998, is a commitment among WTO members to refrain from imposing customs duties on electronic transmissions. This moratorium has played a vital role in fostering the growth of e-commerce globally, benefiting the overall global economy. If the WTO moratorium on electronic transmissions were to be ended, it would have a negative impact on the global economy.

According to a study conducted by the European Centre for International Political Economy (ECIPE), terminating the moratorium would result in substantial negative effects, particularly in developing countries. In such countries, the loss of GDP would amount to a staggering US\$4.5 billion annually, accompanied by job losses and a decline in overall well-being. Thailand, as a developing nation with a burgeoning e-commerce sector, would not be exempt from these adverse impacts. The same study revealed that Thailand could potentially lose US\$1.3 billion in GDP per year, leading to the loss of 100,000 jobs.

Developing countries like Thailand would be hit hardest by the termination of the WTO moratorium because they rely more heavily on e-commerce than developed nations. Consequently, they would be particularly vulnerable to higher prices and reduced consumption resulting from tariffs on electronic transmissions. In light of the data analysis presented in this paper, it is evident that Thailand's SMEs have been benefiting from the current moratorium. They actively participate in the digital economy and rely on digital imports and tools for their growth and prosperity. In summary, ending the WTO moratorium on electronic transmissions would not only have detrimental effects on the global economy but also disproportionately impact developing nations like Thailand. The associated economic losses, job cuts, and decreased well-being underscore the importance of maintaining this moratorium

Importance of Digitalization to Thailand Economy

Digitalization, the integration of digital technologies into business processes, operations, and customer interactions, stands as a pivotal driver of 21st-century economic growth. Embracing digitalization is paramount for Thailand's competitiveness in the global economy. The advantages it offers to the Thai economy are manifold:

- **Enhanced Productivity and Efficiency:** Digital technologies facilitate task automation, streamlined communication, and more efficient processes. These advancements translate into significant productivity boosts for businesses, ultimately resulting in cost savings that can be passed on to consumers in the form of reduced prices.
- **Supporting All Economic Sectors and Creating Jobs:** Digital services and technologies bolster the functioning and growth of all sectors of the global economy, including manufacturing and agriculture. A growing proportion of services are becoming digitally-enabled, with the ICT sector now surpassing the auto sector in its contributions to global GDP.
- **Promoting Small Business Expansion:** The uptake of digitally enabled services tools has experienced an exponential surge among small enterprises in both developing and developed markets. A notable illustration comes from a 2021 survey in Indonesia, where over 90% of MSMEs have seamlessly integrated digital services into their business operations. Leveraging these digital tools, respondents reported an average 20% reduction in marketing expenditures and a noteworthy 17% cut in delivery costs. These digitally enabled service tools are catalysts, providing small businesses with greater accessibility to both domestic and international markets. Furthermore, they help facilitate necessary access to financial services, insurance, and distribution networks.
- **Improved Access to Financial Services:** Digital technologies are democratizing access to financial services like banking and insurance. This reduction in financial exclusion contributes to economic expansion.
- **Fostering Innovation:** Digitalization enables novel forms of innovation, giving rise to new products, services, and business models. This innovation drive stimulates economic growth and generates fresh employment opportunities.
- **Promoting Environmental Sustainability and Mitigating Climate Change:** Digitally-enabled services play a vital role in advancing clean economies and addressing climate change. Technologies such as satellite tracking and data analytics aid in weather forecasting and energy production optimization. AI and the internet of things enhance transportation efficiency. Advanced architectural models improve building design and construction

efficiency. In agriculture, sensor technologies combined with advanced computing minimize water usage and optimize land management.

- **Facilitating Sustainable and Resilient Supply Chains:** In times of crisis, like the recent pandemic, digitally-enabled services are crucial for managing stressed supply chains. They ensure the availability of essential medical goods, disaster relief resources, and vital services.

Recognizing the pivotal role of digitalization, the Thai government has incorporated it into its economic development strategy. The government has invested in essential digital infrastructure, such as broadband internet, and has implemented policies to encourage the adoption of digital technologies among businesses and consumers. Thailand's economic landscape is well-suited to reap the benefits of digitalization. The nation boasts a young, tech-savvy population and serves as a regional trade and investment hub. By continuing to embrace digitalization, Thailand has the potential to become a leading digital economy in Southeast Asia.

Tangible Benefits of Digitalization in Thailand:

Several concrete examples underscore how digitalization is already benefitting the Thai economy:

- **Rapid Growth in E-commerce:** Thailand's e-commerce sector is experiencing rapid expansion, with a 68% growth rate in 2021. This trajectory is propelled by the widespread use of mobile phones and the surging popularity of online shopping. The market is anticipated to reach a remarkable US\$100 billion by 2025.
- **Digital Banking Advancements:** Thailand's digital banking sector is also on the ascent, with a 40% surge in digital banking users in 2021. This growth is driven by the convenience of digital banking services and the increasing availability of mobile banking apps.
- **Digitization in Agriculture:** Thailand's agriculture sector is harnessing digital technologies. Farmers employ drones for land surveys and pesticide and fertilizer application. Additionally, they use sensors to monitor crop growth and forecast weather conditions.

These instances represent just a glimpse of how digitalization is already generating substantial benefits for Thailand. As digital technologies continue to evolve, their potential for positive impact on the economy is bound to expand even further. In the following sections, we discuss the impact assessment of Digital transmissions on the Thai economy. Additionally, we highlight the myriad challenges confronting MSMEs within Thailand, as well as the strategic policies devised to mitigate these challenges and facilitate the seamless adoption of digital technologies among MSMEs.

Impact Assessment of Digital Transmissions on the Economy

Digital transmissions have exerted a profoundly positive influence on Thailand's economy, bringing about tangible improvements in productivity, employment, and overall economic growth. A prime illustration is the burgeoning e-commerce sector, which has catalyzed job creation across various domains such as logistics, marketing, and customer service. One of the key drivers behind this economic boost is the expansion of market reach facilitated by digital transmissions. Businesses now have the capacity to connect with a broader audience of potential customers through online channels, resulting in increased sales and profits. This, in turn, has acted as a catalyst for further economic growth.

This transformative impact of digital transmissions is poised to gain even more momentum in the future. As digital technologies continue to evolve, businesses will discover innovative ways to harness their potential for process enhancement and the creation of novel products and services. This onward march is expected to trigger further productivity gains, job generation, and economic expansion. Beyond the economic realm, digital transmissions have contributed significantly to Thai society. They have played a pivotal role in improving access to education and healthcare services, making it easier for people, even in remote areas, to engage with the economy and connect with one another. In the following sub-sections, the negative impact of tariffication of cross-border transmissions on importing Thailand's economy and the benefits of the duty free cross-border electronic transmissions are briefly described.

Negative Impact of Cross-Border Transmission Tariffication on Thailand's Economy

Conversely, the imposition of tariffs on cross-border transmissions would bear detrimental consequences for Thailand's economy, particularly within the importing sector. Several adverse outcomes can be anticipated:

1. **Increased Prices for Imported Goods:** Tariffs would elevate the cost of imported products, rendering them more expensive for both consumers and businesses. This would potentially dampen demand for imported goods, leading to adverse effects on import-focused enterprises and potentially resulting in job losses.
2. **Diminished Competition:** Tariffs could tip the scales against foreign businesses, making it challenging for them to compete with domestic counterparts. The scarcity of imported goods might cause prices to surge, negatively impacting consumers and creating an environment of economic inefficiency.

3. **Supply Chain Disruption:** Tariffs have the potential to disrupt the supply chains of imported goods, impeding businesses' access to necessary resources. This disruption could lead to shortages and increased prices, exacerbating the economic strain.
4. **Damage to Reputation:** The imposition of tariffs might tarnish Thailand's reputation as a business-friendly destination, possibly discouraging foreign investment and thereby hampering economic growth.

It's imperative to note that these potential negative consequences are not exhaustive and may vary in magnitude depending on the specific context.

Duty Free Cross-Border Electronic Transmissions Help Rather Than Hurt An Importing Thailand's Economy
In contrast, duty-free cross-border electronic transmissions offer several advantages to Thailand's economy:

1. **Increased Competition:** By allowing businesses in Thailand to import goods without incurring import duties, duty-free transmissions grant them a competitive edge. This can translate into lower prices for consumers and businesses, driving economic competitiveness.
2. **Enhanced Efficiency:** Duty-free transmissions streamline the importation process, reducing operational costs for businesses. These cost savings can be passed on to consumers, resulting in more affordable goods.
3. **Fostering Innovation:** Access to new technologies and products from abroad, made possible by duty-free transmissions, can stimulate innovation and productivity within Thailand.
4. **Boosting Trade:** Duty-free transmissions simplify trade between Thai businesses and their international counterparts, fostering increased exports and imports that can stimulate economic growth.
5. **Employment Opportunities:** The import sector stands to benefit from duty-free transmissions, potentially leading to job creation in areas such as logistics and customer service.

The societal benefits of duty-free cross-border electronic transmissions are equally noteworthy. They can improve access to goods and services, promote economic development in rural regions, and contribute to overall social progress. In conclusion, digital transmissions have been an unequivocal boon to Thailand's economy, fostering productivity, job creation, economic growth, and social advancement. However, the imposition of tariffs on cross-border transmissions could yield detrimental consequences, particularly in the importing sector. In contrast, the promotion of duty-free cross-border electronic transmissions promises economic growth, cost efficiencies,

innovation, trade expansion, and employment opportunities, underlining their positive influence on both Thailand's economy and society. These advantages should be leveraged to propel Thailand into a digitally prosperous future.

Empowering Thailand's MSMEs: Challenges, Policies, and the Digital Frontier

Micro, small, and medium-sized enterprises (MSMEs) stand as the backbone of the Thai economy, constituting over 90% of businesses and providing employment to approximately 60% of the population. However, these MSMEs grapple with a host of challenges:

Access to Finance: Securing financial support proves to be a formidable task for MSMEs, often viewed as risky propositions by traditional banks. This financial constraint impedes their capacity to invest in cutting-edge technologies and expand their operations.

Skills and Training Gap: A significant portion of Thai MSMEs lacks the requisite skills and training to harness digital technologies effectively. This knowledge gap hinders them from seizing the opportunities presented by digitalization.

Competition from Corporate Giants: MSMEs find themselves in a David-and-Goliath scenario, competing with large corporations armed with more extensive resources and often the ability to offer lower prices, posing a substantial challenge.

Regulatory Hurdles: Burdened by an array of regulations, MSMEs in Thailand face cumbersome compliance processes that consume both time and resources, acting as a roadblock to their growth.

In response to these hurdles, the Thai government has implemented measures to support MSMEs:

Digital Economy Promotion Agency (DEPA): Established in 2017, DEPA serves as a government agency dedicated to fostering the adoption of digital technologies among MSMEs. It extends support through various programs and services, encompassing training, grants, and loans.

National e-Commerce Roadmap: This government initiative aspires to position Thailand as a leading digital economy in Southeast Asia. Among its strategies, it grants MSMEs access to digital infrastructure and provides them with training on digital technology usage.

Streamlined Regulations: The Thai government has embarked on simplifying regulatory processes for MSMEs. This entails reducing the number of licenses and permits, effectively easing the compliance burden and facilitating business expansion.

Embracing digitalization can usher in a multitude of opportunities for Thai MSMEs, including:

Heightened Productivity: Digital technologies empower MSMEs to automate tasks, enhance communication, and optimize operations, leading to substantial productivity gains.

Exploration of New Markets: The digital realm offers MSMEs the prospect of venturing into previously untapped markets, both domestically and internationally. This expansion can catalyze business growth and bolster profits.

Enhanced Customer Service: Leveraging digital technologies enables MSMEs to provide superior customer service, encompassing features like online chat support. This enhances customer retention and attracts new clientele.

Cost Savings: Digital tools empower MSMEs to trim expenditures by automating operations and leveraging cost-effective solutions like cloud computing. The resources thus freed up can be reinvested in business growth.

In the 21st-century economy, MSMEs in Thailand that embrace digitalization are better poised for success. The Thai government stands steadfast in its commitment to supporting MSMEs on this digital journey, offering a comprehensive suite of programs and services designed to facilitate their seamless adoption of digital technologies.

Data Sources and Methodology

Data Sources

This study uses data from many different sources. They include 1) ADB Asia SME Monitorⁱ 2) OECD's Inter-Country Input-Output (ICIO) tablesⁱⁱ and 3) World Development Indicators of the World Bankⁱⁱⁱ.

This study includes a diverse set of variables, including MSME GDP, MSME Employment, MSME Number of Enterprises, Digital Imports for MSMEs, MSME Labor Productivity, as well as additional size-related metrics like GDP per MSME and Employee per MSME. Our analysis is underpinned by a comprehensive dataset consisting of time series data on MSMEs at the sectoral level. This data was sourced from the 2022 ADB Asia SME Monitor, covering the years 2007 to 2020. Our analysis covers five broad MSME sectors, namely Agriculture, Forestry, and Fisheries, Manufacturing, Wholesale and Retail Trade, Other Services, and Others, where the 'Others' MSME sector subsumes domains like Mining and Electricity, Gas, and Water Supply. Furthermore, MSME sectors such as Transportation and Communication, as well as Construction, fall within the purview of the 'Other Services' category. To ensure consistency and relevance, all monetary values have been adjusted to the 2007 baseline using the GDP deflator obtained from the World Development Indicators (WDI). The selection of 2007 as the base year for MSME data is attributed to its comprehensive coverage of essential macroeconomic data pertaining to MSMEs.

OECD's ICIO data (OECD, 2022) is used to arrive at the digital imports for Thailand. The classifications of THA_J61 and THA_J62_63, corresponding to Telecommunications and IT and Other information services, respectively, are taken as representative sectors for all digital products of Thailand. The digital input into different sectors of Thailand can be identified as input rows in the table that end with _61 or _J62_63 with columns being different sectors in Thailand. Digital imports into Thailand can be inferred to be any such row from a country other than Thailand. The summation of a column will be the total digital imports into different sectors of Thailand. The exports of Thailand can be inferred to be rows starting with THA_ with columns of sectors of other countries. The summation of the row is the total exports of Thailand. The digital imports into different MSME sectors (as per ADB SME sectors) are assumed to be proportional to the digital imports into different sectors of Thailand (as per OECD-ICIO classification of sectors). The mapping between ICIO classification and sectors in ADB SME monitor can be found in Appendix I.

Methodology

The Pearson correlation coefficient is used to measure linear correlation between a pair of variables. It is defined as:

$$r_{xy} = \frac{\sum_{i=1}^n (x_i - \bar{x})(y_i - \bar{y})}{\sqrt{n \sum x_i^2 - (\sum x_i)^2} \sqrt{n \sum y_i^2 - (\sum y_i)^2}}$$

Where n is sample size, x_i and y_i are individual sample points, \bar{x} and \bar{y} are individual means.

This study undertakes panel data regression to assess the impact of MSME Digital Imports on different variables such as GDP, Employment, productivity and size variables pertaining to MSMEs over the study period (2007-2021). Panel regression is an econometric technique that is widely used to understand cross-sectional changes over time. Panel data models can be pooled, fixed, or random illustrating the assumptions behind each model (Colonescu, 2016).

The pooled model can be represented simply as

$$y_{it} = a_1 + a_2x_{2it} + \dots + a_kx_{kit} + e_{it}$$

Where t is the time period, i is the individual cross-sectional observation, and a_k is the coefficient of the k^{th} variable.

The fixed effects model can be represented as

$$y_{it} = a_{1i} + a_{2i}x_{2it} + \dots + a_{ki}x_{kit} + e_{it}$$

Where t is the time period, i is the individual cross-sectional observation, and a_{ik} is the coefficient of the k^{th} variable in the i^{th} cross-section.

The random effects model can be represented as

$$\begin{aligned} a_{1i} &= \bar{a}_1 + u_i \\ y_{it} &= \bar{a}_1 + a_{2i}x_{2it} + \dots + a_{ki}x_{kit} + \epsilon_{it} \\ \epsilon_{it} &= u_i + e_{it} \end{aligned}$$

Where t is the time period, i is the individual cross-sectional observation, \bar{a}_1 is population average and u_i is individual cross section specific error term.

The following econometric equations (numbered 1-6) are estimated at a sectoral level as classified in ADB SME monitor.

$$\ln(GDP_{it}) = a_0 + a_1 * \ln(Employment_{it}) + a_2 * \ln(Number\ of\ Enterprises_{it}) + a_3 * \ln(Digital\ Imports_{it}) + e_{it} \quad \dots (1)$$

The employment in different sectors is analysed with the specification as in eqn. (2)

$$\begin{aligned} \ln(Employment_{it}) &= a_0 + a_1 * \ln(Number\ of\ Enterprises_{it}) + a_2 * \ln(Digital\ Imports_{it}) + e_{it} \quad \dots (2) \end{aligned}$$

The MSME Number of Enterprises in different sectors is analysed with the specification as in eqn. (3)

$$\ln(Number\ of\ Enterprises_{it}) = a_0 + a_2 * \ln(Digital\ Imports_{it}) + e_{it} \quad \dots (3)$$

The productivity and size in a sector is analysed with the specification as in equations below:

$$\begin{aligned} \ln(GDP\ per\ Employee_{it}) &= a_0 + a_1 * \ln(Digital\ Imports_{it}) + a_2 * \ln(Employee\ per\ MSME_{it}) + a_3 * \ln(Employment_{it}) + e_{it} \quad \dots (4) \end{aligned}$$

$$\ln(GDP\ per\ MSME_{it}) = a_0 + a_1 * \ln(GDP\ per\ Employee_{it}) + a_2 * \ln(Digital\ Imports_{it}) + a_3 * \ln(Employment_{it}) + e_{it} \quad \dots (5)$$

$$\begin{aligned} \ln(Employee\ per\ MSME_{it}) &= a_0 + a_1 * \ln(GDP\ Per\ MSME_{it}) + a_2 * \ln(Digital\ Imports_{it}) + e_{it} \quad \dots (6) \end{aligned}$$

The study explores these relationships using different panel data regression models. F test, Hausman test and LM test are used to determine which among the models best describes the relationship. F test is used to determine the better among pooled and fixed effects models, while Hausman test is used to determine the better among fixed and random effects models (Colonescu, 2016). The Breusch-Pagan Lagrange multiplier (LM) test helps us decide between a random effects regression and a simple OLS regression.

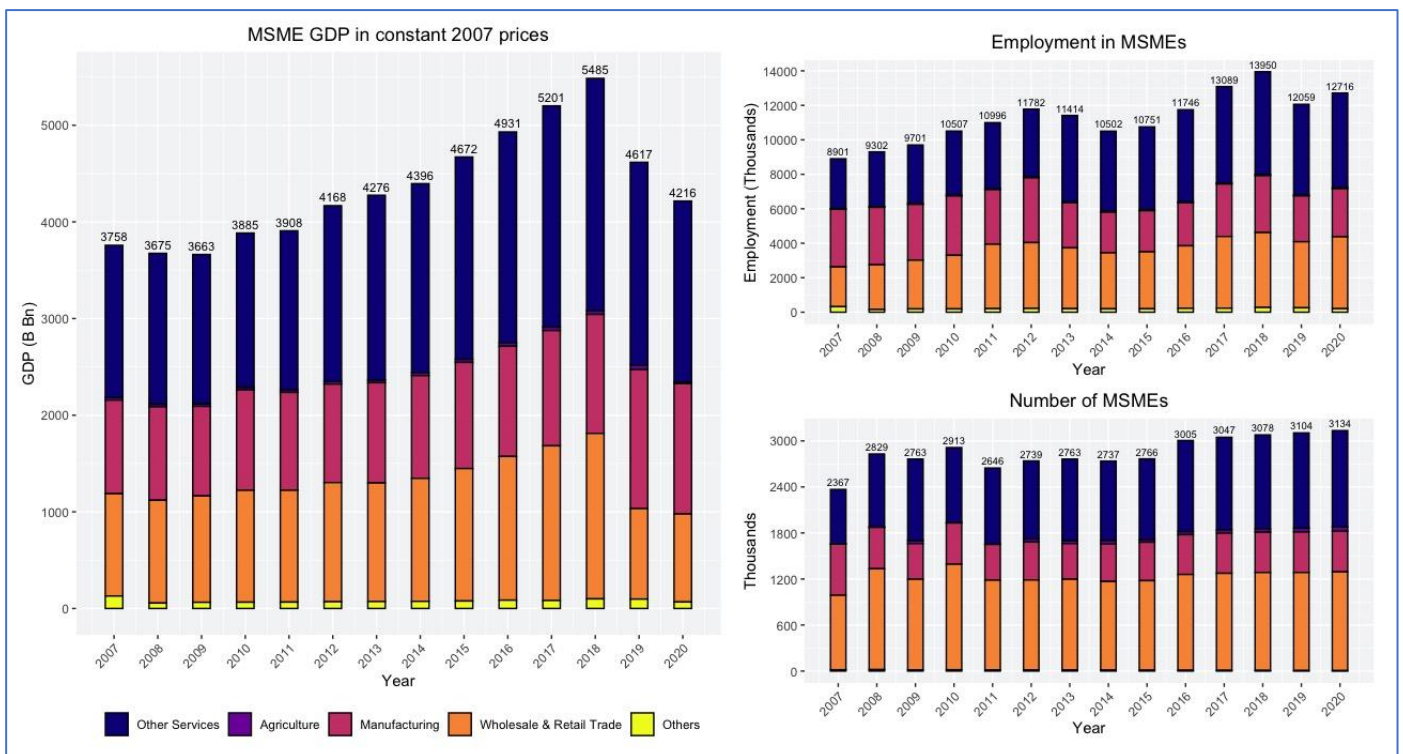
Results

Data Analysis

Figure 1 provides an overview of key macroeconomic variables, including MSME GDP, employment, and the number of MSMEs, within five major sectors: Agriculture, Manufacturing, Wholesale and Retail Trade, Other Services, and Others.

Over the period spanning from 2007 to 2020, Thailand's MSME GDP exhibits a consistent growth trend. However, it is important to note a decline in MSME GDP in 2019 and 2020, which can likely be attributed to the impact of the Covid-19 pandemic. Among these sectors, Manufacturing, Wholesale and Retail Trade, and Other Services (including Construction, Transportation, and Communication) emerge as crucial components of Thailand's economy in terms of MSMEs. Together, these three sectors contribute approximately 98 percent of the MSME GDP in 2020, marking an increase from 95 percent in 2007. Conversely, the Agriculture sector and Others (including Mining, Electricity, Gas, and Water Supply) do not significantly contribute to the MSME GDP between 2007 and 2020.

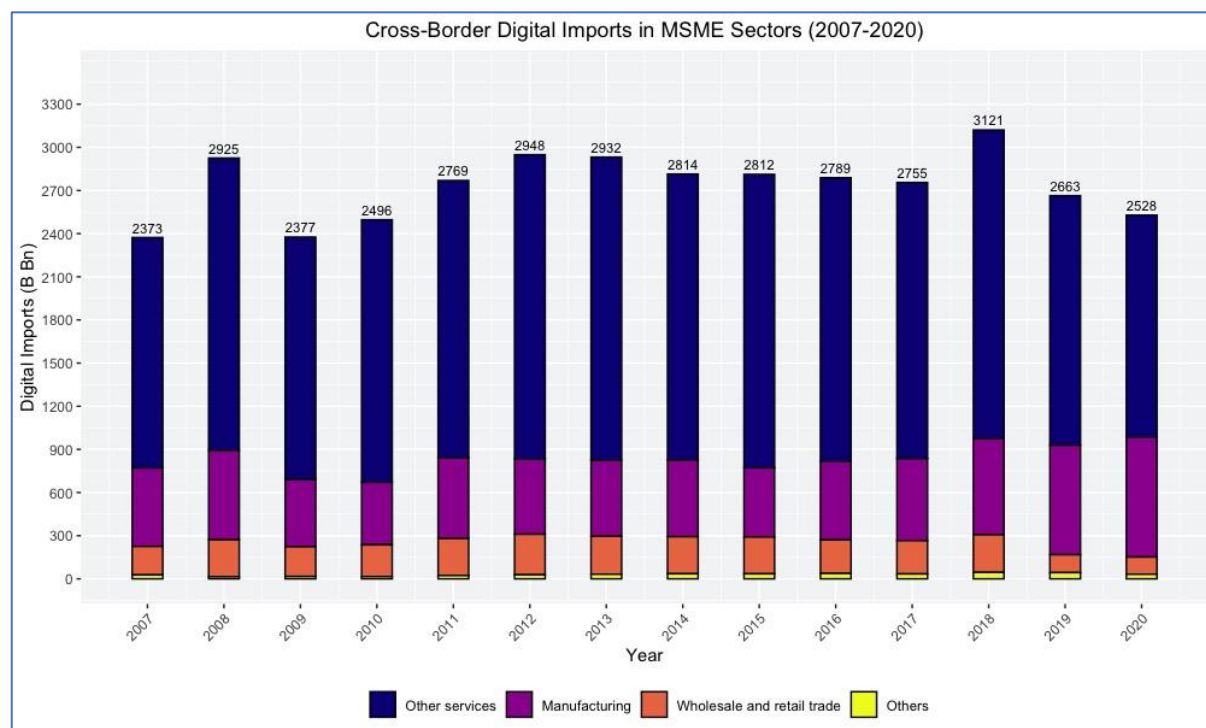
Figure 1: MSME GDP, Employment, Number of Enterprises: Sectoral level (2007-2020)



A parallel trend is observed in MSME employment. Employment in MSMEs reached its peak in 2018, as illustrated in the graph below. Notably, the 'Other Services' sector within MSMEs provides the highest level of employment, followed closely by Wholesale and Retail Trade. Combined, these two sectors account for nearly 75 percent of all MSME employment in 2020, a substantial increase from 58 percent in 2007. Although the share of manufacturing in MSME employment experiences fluctuations over the years, it consistently contributes around 27 percent on average throughout the 14-year period from 2007 to 2020. In contrast, Agriculture and the 'Others' sector employ significantly fewer individuals compared to the other sectors.

Furthermore, it's intriguing to observe that the number of MSMEs in different sectors follows a comparable pattern. The Wholesale and Retail Trade sector boasts the highest number of MSMEs, surpassing all other sectors. 'Other Services' MSMEs are a close second in terms of number of enterprises. In contrast, manufacturing firms are notably fewer in number compared to the other two aforementioned sectors. Additionally, the agriculture sector has a significantly lower number of firms compared to these sectors. This analysis highlights the dynamic interplay between key macroeconomic indicators and various sectors within Thailand's MSME landscape, shedding light on the relative contributions of each sector to the country's economic fabric.

Figure 2: Cross-Border Digital Imports: Sector-wise



The graph above illustrates the digital imports into various MSME sectors across several years. A discernible pattern of consistent growth in digital imports can be observed, underscoring the MSMEs increasing reliance on digital resources/ imports. However, it's worth noting a deviation from this growth trajectory in two specific years, 2019 and 2020. This dip in digital imports coincides with a trend previously observed in MSME GDP, suggesting a potential connection between these two variables.

This observation aligns with the trends depicted in earlier graphs, which also indicated a similar pattern of fluctuation in MSME GDP, employment, and the number of enterprises during the same time frame. Taken together, these findings point toward a broader positive correlation between digital imports by MSMEs and their overall performance.

In essence, the data suggests that MSMEs tend to fare better when they engage in higher levels of digital imports. While the fluctuations in certain years may be attributed to various external factors, the overarching trend showcases the importance of digital resources in enhancing the performance and competitiveness of MSMEs.

Figures 3, 4, and 5 offer a comprehensive insight into the trajectory of digital imports with each of the macroeconomic variable (MSME GDP, Employment, and Number of Enterprises) at the sectoral level over the period spanning from 2007 to 2020.

Figure 3: MSME GDP versus MSME Digital Imports for different sectors from 2007 to 2020 (Left Vertical Axis – MSME GDP, Right Vertical Axis – Digital Imports, Figures in Billion Thai Baht (B))

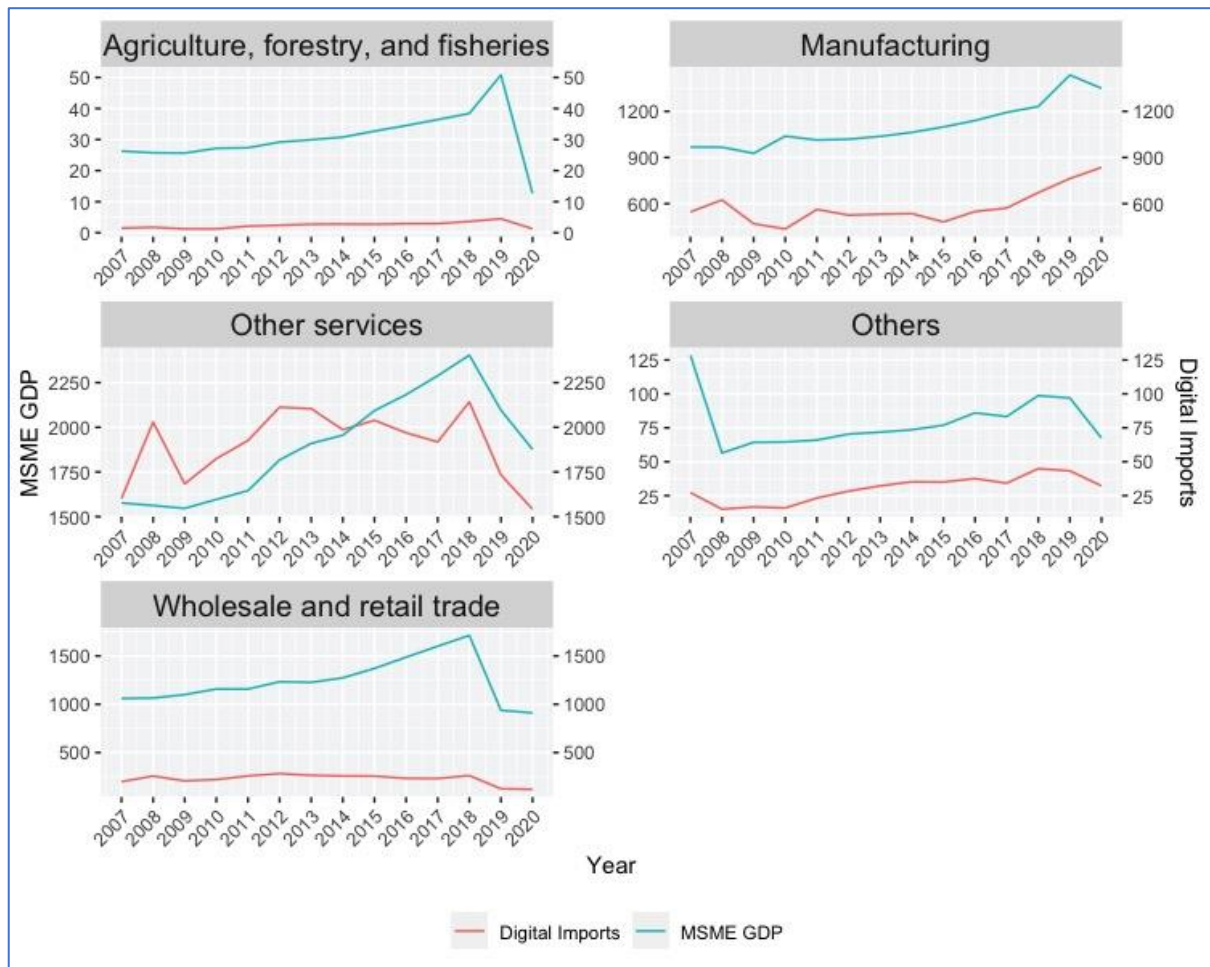
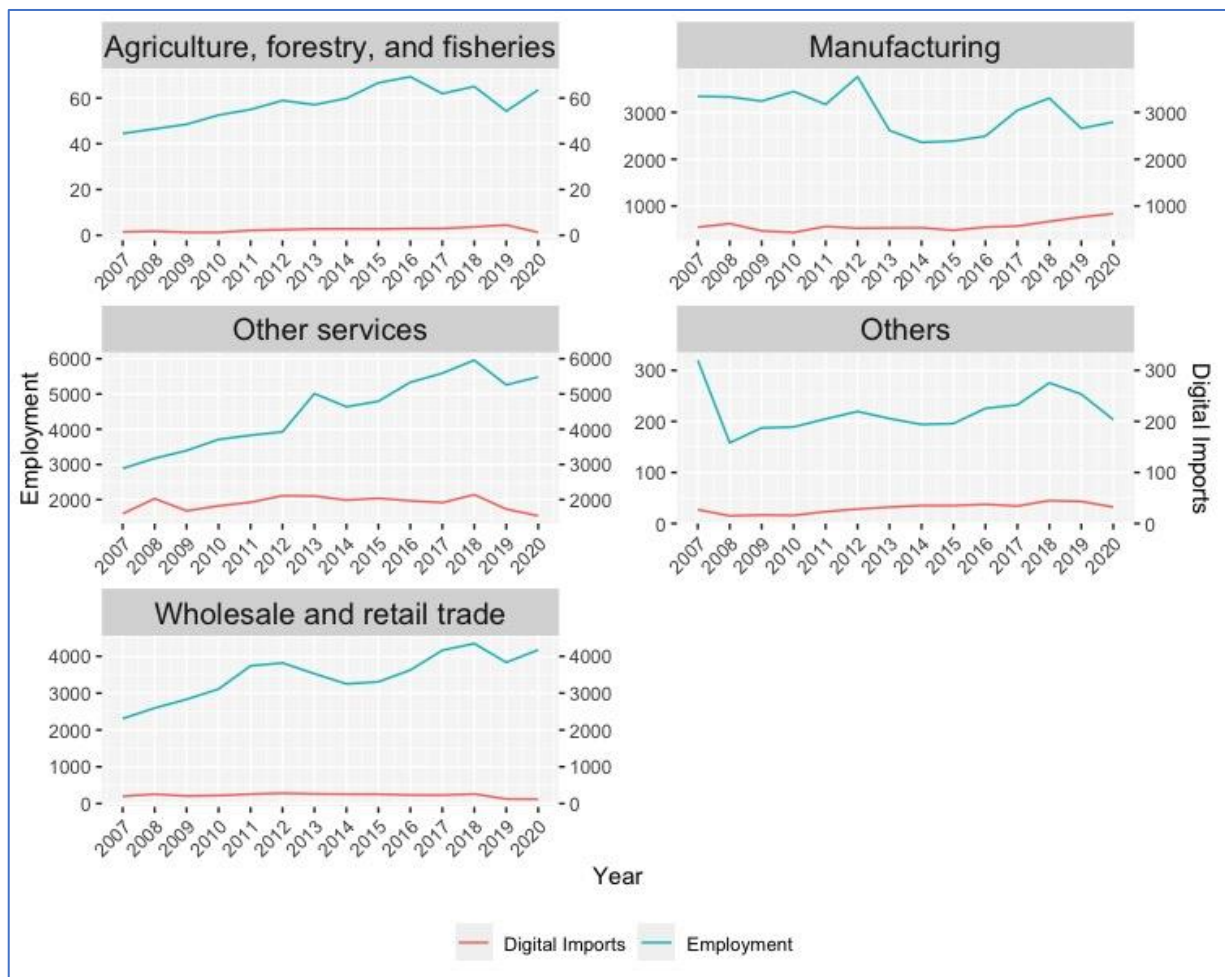


Figure 3 prominently reveals a striking parallel between MSME GDP and their digital imports. The two variables consistently move in tandem, reflecting a strong correlation between digital imports and the economic output of MSMEs. A similar pattern emerges when examining MSME employment and the number of enterprises, as demonstrated in Figures 4 and 5. While there may be occasional deviations, the overall alignment supports the overarching finding that digital imports possess a positive correlation with MSME performance, even when analyzed at a sectoral level.

Delving into sector-specific observations, the 'Other Services' sector notably stands out for experiencing a higher proportion of digital imports relative to MSME GDP, particularly during the initial years of the study period (2007-2014). Conversely, the Agriculture sector registers the lowest digital imports compared to its GDP. In contrast, the Manufacturing sector demonstrates a consistent increase in digital imports since 2015, despite a minor GDP dip in 2020. Additionally, digital imports in 'Wholesale and retail trade' and 'Others' sectors follow exactly the same trend as their respective GDP figures.

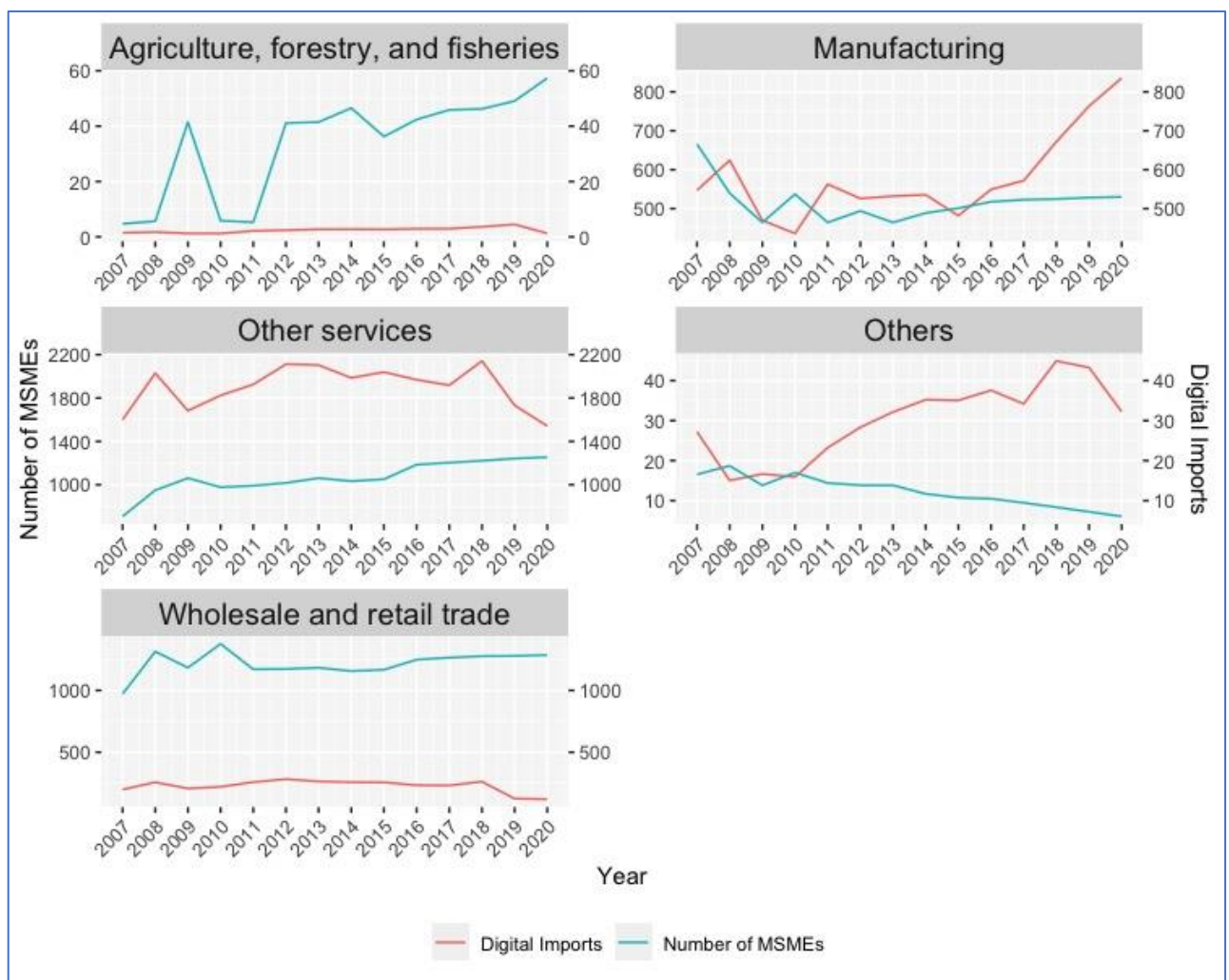
Figure 4: MSME Digital Imports versus MSME Employment plots for different sectors from 2007 to 2020 (Left Vertical Axis – Employment in Thousands, Right Vertical Axis – Digital Imports in Billion Thai Baht (B))



The employment trends across these five broad sectors of MSMEs exhibit a strong alignment with the patterns observed in digital imports. It's worth noting that the manufacturing sector, despite experiencing a decline in employment since 2012, saw a consistent and steady trend in digital imports over the same period. This synchronicity between employment and digital imports is not

limited to manufacturing; it extends to the other three sectors as well – wholesale and retail trade, agriculture, and others. In these sectors, despite noticeable fluctuations in employment figures, digital imports remained relatively stable. However, the 'other services' sector stands out as an exception, where employment and digital imports closely mirror each other. This relationship between the two variables holds true for most years, except for 2020 when employment in this sector saw a modest increase while digital imports experienced a decline.

Figure 5: MSME Digital Imports versus Number of MSMEs plots for different sectors from 2007 to 2020 (Left Vertical Axis – Number of MSMEs in Thousands Right Vertical Axis – Digital Imports in Billion Thai Baht (B))



The number of MSMEs follows distinct patterns across sectors as illustrated in Figure 5. Manufacturing, 'Other Services,' and 'Others' sectors consistently witness a higher proportion of digital imports compared to the number of enterprises throughout the entire period (2007-2020), with minor exceptions. Meanwhile, the number of MSMEs in Agriculture and Wholesale and

Retail trade sectors exhibit more substantial fluctuations in the early years, particularly from 2007 to 2015 for Agriculture and 2007 to 2011 for Wholesale and Retail trade, although digital imports remain relatively stable. Significantly, it's worth mentioning that digital imports in the agricultural sector witnessed a decline in 2020, despite a simultaneous increase in the number of enterprises within this sector. A similar scenario unfolded in the wholesale and retail trade sector, where digital imports began to decrease from 2018 onwards, yet the number of enterprises remained constant during the same period. In essence, this comprehensive analysis underscores the pivotal role of digital imports in influencing various facets of MSME performance at both macro and sectoral levels.

Correlation Matrix: Analysis

Digital imports exhibit a discernible positive correlation with key parameters within the MSME sector, encompassing GDP, employment, and the number of enterprises. However, it's important to note that these correlations, while present, are relatively modest in magnitude. Of these correlations, the highest is observed with GDP, indicating a more pronounced impact on the overall economic output of MSMEs. Following closely behind is the correlation with employment levels, signifying that digital imports also contribute to the sector's workforce. In terms of the sheer number of MSMEs, the correlation with digital imports is also positive, albeit less robust than the aforementioned variables.

Table 1: Correlation matrix between different variables

	MSME GDP	MSME Employment	No. of MSMEs	Labor Productivity	GDP/ MSME	Employee /MSME	Dig Imports by MSMEs
MSME GDP	1						
MSME Employment	0.0009	1					
No. of MSMEs	0.0004	0.0005	1				
Labor Productivity	0.0003	-0.00015	0.00005	1			
GDP/MSME	0.0007	0.0006	0.0003	0.0006	1		
Employee/ MSME	0.0008	0.0011	0.0005	0.00011	0.0023	1	
Dig Imports by MSMEs	0.0004	0.0003	0.0001	0.00003	-0.0002	-0.00007	1

Delving further into the nuanced aspects of MSME performance, additional variables come into play. Labor productivity, for instance, exhibits a small yet positive correlation with digital imports. This implies that as digital imports increase, labor productivity within MSMEs tends to see marginal improvements. However, this effect is not substantial, indicating that other factors also influence labor productivity. Conversely, when considering the size of enterprises based on both GDP and employment, a negative correlation with digital imports is observed. This suggests that as digital imports rise, there's a tendency for MSMEs to consolidate or reduce their size. This intriguing finding highlights that digitalization may lead to a streamlining effect within the sector, potentially resulting in the growth of fewer, but more efficient, enterprises. Furthermore, it's noteworthy that employment levels in MSMEs exhibit a negative correlation with labor productivity. In sum, the interplay between digital imports and MSME performance is complex, characterized by modest yet discernible correlations. The presence of these correlations suggests that digitalization is indeed a factor shaping the sector, but its effects are not uniform across all aspects of MSME operations.

Panel Data Regressions

Pooled, Fixed, and Random effects regressions are estimated for each of the model specifications. These are done in order to analyse the different characteristics of the variables under different assumptions. The best regression model is determined based on F test, Hausman Test and LM test. All the regression variables are in natural logarithms. R software has been used to run these models. The results of aforementioned panel regression models (eqn. 1-6) are presented in the following tables.

Table 2 shows that the digital imports are significant at 10% level, at the minimum, in all the panel regression models stated above in eqn. 1-3. The positive value of the coefficient of digital imports, in all the three panel models, indicates that an increase leads to an increase in MSME GDP, Employment and Number of MSME Enterprises. Thus, a 1 per cent increase in MSME digital imports leads to a 0.47 per cent increase in MSME GDP; 0.56 per cent increase in Number of Enterprises; and 0.11 per cent increase in MSME Employment. It could be observed that the best fit regression model is different in the three panel regression equations. The fixed effects model was found to fit the data well for the eqn. (1) and (2) while the random effects model was found to be appropriate for the eqn. (3).

Table 2: Panel Regressions determining MSMEs' GDP, Employment & No. of enterprises

	MSME GDP		MSME Employment		MSME Number of Enterprises	
	Coeff.	p-value	Coeff.	p-value	Coeff.	p-value
Intercept					5.58	0.005*
MSME Employment	0.36	0.0009**				
Number of MSMEs	-0.06	'0.1098'	0.09	0.0386*		
Digital Imports	0.47	0.0000***	0.11	'0.1587'	0.56	0.001**
Adj. R Square	0.52		0.04		0.14	
Best Model	Fixed Effects		Fixed Effects		Random Effects	

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Digital imports are positively and significantly related to GDP per employee while employment and employee per MSME has a negative impact, as can be inferred from Table 3. A 1 per cent increase in digital imports can increase the GDP per employee by about 0.17 percent. It could also be observed that digital imports have a positive and significant impact on GDP per MSME. A 1 per cent increase in digital imports can increase the GDP per MSME by about 0.65 percent. Similarly, the digital imports has a positive effect on Employee per MSME while being statistically significant. A 1 per cent increase in digital imports can increase the GDP per MSME by about 0.03 percent. The intercept term is positive and significant in all the eqn. 4-6 indicating that there may be some additional variables that impact the relationship.

Table 3: Panel Regressions determining labor productivity and size variables

	MSME GDP Per Employee (labor productivity)		Employee per MSME (Size based on employment)		GDP per MSME (Size based on GDP)	
	Coeff.	p-value	Coeff.	p-value	Coeff.	p-value
Intercept	1.197	0.0000***	0.627	0.0000***	6.068	0.0000***
Employee per MSME	-0.15	0.0000***				
MSME GDP Per Employee					-0.81	0.0305*
Digital Imports	0.17	0.0000***	0.03	0.0440*	0.65	0.0000***
MSME Employment	-0.28	0.0000***			-0.99	0.0000***
GDP Per MSME			0.99	0.000***		
Adj. R Square	0.40		0.92		0.33	
Best Model	Pooled Model		Pooled Model		Pooled Model	

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Conclusion

In the evolving landscape of global trade, digital commerce has emerged as a vital driving force behind the success of MSMEs in Thailand. This paradigm shift has unfolded in parallel with the rapid proliferation of various digital products and services worldwide. Within Thailand's vibrant business ecosystem, small businesses have adeptly harnessed this digital revolution, incorporating imported digital services, such as e-commerce platforms and social media applications, into their core strategies.

The primary insight stemming from our comprehensive study is that digital imports exert a notably positive and statistically significant influence on the performance of MSMEs in Thailand. This positivity resonates across various facets of MSMEs, including their GDP, size, and productivity metrics. Notably, this observation underscores that digital imports have a catalytic role in fostering efficiency enhancements, effectively enabling the scaling up of MSMEs. For policymakers, this finding bears significant implications.

It is imperative for policymakers to carefully consider the implications of any potential measures aimed at curtailing digital imports from abroad. Our quantitative analysis, underpinned by rigorous econometric techniques, clearly demonstrates that such restrictive actions could potentially inflict adverse repercussions upon Thailand's MSMEs. Therefore, a nuanced and strategic approach is warranted when devising policies that pertain to digital trade, one that not only safeguards the interests of domestic industries but also recognizes the instrumental role of digital imports in enhancing the overall competitiveness and sustainability of Thailand's MSME sector.

Appendix I

Mapping between OECD-ICIO and ADB SME sectors

ADB SME Monitor Sectors	ICIO Input Output Table
Agriculture, forestry, and fisheries	IDN_A01_02, IDN_A03
Manufacturing	IDN_B05_06, IDN_B07_08, IDN_B09, IDN_C10T12, IDN_C13T15, IDN_C16, IDN_C17_18, IDN_C19, IDN_C20, IDN_C21, IDN_C22, IDN_C23, IDN_C24, IDN_C25, IDN_C26, IDN_C27, IDN_C28, IDN_C29, IDN_C30, IDN_C31T33
Wholesale and retail trade	IDN_G
Other services	IDN_F, IDN_H49, IDN_H50, IDN_H51, IDN_H52, IDN_H53, IDN_J58T60, IDN_J61, IDN_J62_63, IDN_I, IDN_K, IDN_L, IDN_M, IDN_N, IDN_O, IDN_P, IDN_Q, IDN_R, IDN_S, IDN_T
Others	IDN_B05_06, IDN_B07_08, IDN_B09, IDN_D, IDN_E

ⁱ <https://data.adb.org/dataset/2022-adb-asia-small-and-medium-sized-enterprise-monitor-volume-1-country-and-regional>

ⁱⁱ <https://www.oecd.org/industry/input-output-tables.htm>

ⁱⁱⁱ <https://databank.worldbank.org/source/world-development-indicators>