

Identifying and Assessing Correlations in Indonesia's 2019 E-Commerce Marketplace

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Abstract: *This study identifies correlations between e-commerce business statistics and household consumer statistics during 2019 (pre-COVID-19) in Indonesia. Data sets representing household consumer behavior and e-commerce business behavior during 2019 in Indonesia is sampled and analyzed using the Spearman R method. Data Set 1 is sampled and structured to compare some of the 2019 household expenditure categories of each province in Indonesia, to 2019 consumer e-commerce transaction methods observed in each province in Indonesia. Data Set 2 is sampled and structured to compare 2019 statistical properties of e-commerce businesses per province in Indonesia, to 2019 household consumer statistics per province in Indonesia. Hypotheses are presented and tested to verify or reject the existence of correlations of interest. After a statistical significance test is performed on the outputs of the Spearman R analysis, hypotheses are either accepted or rejected based on acceptable statistical results. The strongest correlations revealed are as the percentage of 2019 e-commerce E-Wallet transactions increase, 2019 household expenditures for transportation and communication, food and beverage, and health and education also increase. Increased data sharing between the retail financial market and the government is recommended to assist policy makers in preemptively identifying and addressing socio-economic problems.*

Keywords: Regional GDP, E-commerce, Macroeconomics, Indonesia, household expenditure, transactions, Spearman R, business statistics

1. Introduction

1.1. Background

Purchasing products or services through e-commerce channels is more normal in 2021, then it was at the turn of the century. Recently, e-commerce markets have seen an exponential growth in transactions as the “pandemic accelerated” (Evans, 2021, para. 2) the utilization of e-commerce markets. Over the years, as more people engage e-commerce market places, trends arise and disappear which affect the culture of marketplaces and in turn the frequency, value, and type of transactions that occur at market. The size of a country's e-commerce market can play a considerable role in contributing to a country's Gross Domestic Product (GDP) by facilitating the exchange of goods and services for payment across a country's regions. Economic growth, crisis, and government regulation can affect e-commerce market size. One example can be observed in Indonesia, where the value of e-commerce transactions rose from approximately 44.4 trillion Rupiah in 2017 to 266.3 trillion Rupiah in 2020 (Jayani 2021). According to the “e-Conomy SEA 2020 Report” by Google, Temasek and Bain & Company, thirty-seven percent of digital service consumers are new due to the affects of the COVID-19

pandemic (Google, Temasek, Bain & Company 2020). Therefore, being able to assess why such a trend occurred and being able to create and implement preemptive strategies to seize opportunities and brace for shocks, is an issue commonly and constantly faced by businesses, governments, and researchers. Furthermore, in developing countries there are cultural barriers and infrastructural barriers that deter household consumers from engaging the E-Commerce market, or utilizing the digital consumer experience to its full potential. Despite e-commerce stakeholders being aware of such issues, globally there is a lack of transparency and organizational cooperation to combat such problems. Additionally, there is an even greater lack of data sharing amongst private organizations and the public about consumer statistics. Individuals and organizations interested in the performance of particular e-commerce marketplaces, need readily available data to analyze and make informed decisions and relate valuable information to stakeholders.

Despite the lack of data sharing, there is still enough data available that has contributed to ample research regarding branding, consumer behavior, social impact, and business performance of e-commerce markets participants in developed and developing countries. However, there is a relative lack of academic research concerning economic effects of e-commerce marketplaces on developing economies. This is an issue of concern as e-commerce is considered a “driver of economic growth for developing countries” (Zaied, 2012). The main motive of this study is to research and present correlations that may impact the e-commerce marketplace in Indonesia. A case study on Indonesia is of interest because Indonesia can greatly contribute to the development of the Global Halal Economy. Particularly because Indonesia is the largest Muslim majority country by GDP, and also the largest consumer of Halal products (Afifa 2021).

1.2. Objective

The purpose of this study is to identify some correlations between e-commerce business statistics and household consumer statistics in Indonesia and convey them to the public. This is done in an effort to contribute to the pool of data available for the development of Indonesia’s e-commerce market. There are two data sets compiled in this study for analyzation. Data is sampled from several reports from Badan Pusat Statistik (BPS), Indonesia’s federal center for statistics. Variables selected for study are assumed to be drivers for the overall 2019 e-commerce marketplace in Indonesia, and are selected to represent properties or attributes of household consumers and e-commerce businesses. All variables, or attributes of e-commerce marketplace drivers, are paired to the 34 Indonesian provinces to attempt to closely represent a sample of the population.

This paper is organized into five sections. Section one presents the background, interest, and objective of this research. Section two provides background theory and summarizes results from previous studies. Section three explains the selection of data used in this study, model development to test hypotheses, and methodology to analyze the data. Section four presents results, informs the reader how the results are screened for significance, and an analysis of the results is conveyed to readers. Last, Section five summarizes findings in the conclusion of this paper, and presents recommendations based on this study’s results, and based on reviews of literature on e-commerce markets in developing countries.

2. Literature Review

2.1. Background Theory

E-commerce can be understood simply as the exchange of goods or services on digital platforms. Currently, there are platforms available, such as social media that can create an extremely low barrier to enter the market (Paquette 2021). With a virtual presence and data availability, a consumer or business can participate in a transaction of goods and services possibly anytime, anywhere, without physically interacting with another party to an e-commerce transaction. The convenience and opportunity for e-commerce stakeholders to conduct transactions across regions can help stimulate economic growth within a country. Additionally, a region's ability to spend economic resources can greatly affect macroeconomic trends (Badan Pusat Statistik 2020). If the e-commerce market in a country is large enough and influential enough, macroeconomic effects due to the existence of such an e-commerce market can influence a country's development. This is such the case that the United Nations Conference on Trade and Development (UNCTD) mentioned in a 2021 report that e-commerce is increasingly understood by governments and development partners, to provide new ways of facilitating the Sustainable Development Goals (SDGs) set out in the 2030 Agenda for Sustainable Development (United Nations Conference on Trade and Development 2021).

Regarding marketplace relationships, e-commerce marketplaces are affected by the actions of household consumers, business to business (B2B) consumers, and businesses or private sellers that offer their product or services at market. Policy planners in some developing countries understand regulating and nurturing the relationships between stakeholders in the e-commerce market can prove beneficial for economic stability. In some cases, policy makers in developing countries set policy to encourage e-commerce as their country's national economy, in part, depends on the success of Small to Medium Enterprises (SMEs) who operate on e-commerce platforms (Zaied 2012). SMEs understand that they can gain competitive advantage through adopting an e-commerce business model, as it could improve their market performance by having increased access to the market. Often, consumers appreciate the convenience of shopping whenever they want and being able to compare multiple features of a similar product without having to physically visit a store.

2.2 Previous Studies

Previous studies have shown that there is a correlation with social relationships and the operation of e-commerce businesses in developing countries. Maris Martinsons' (Martinsons) work published in 2008 mentions that "poor relationships with the authorities" (Martinsons, 2008, pg. 16) has some correlation with e-business failures in China. A similar correlation is mentioned in the work of Abdel Nasser H. Zaied (Zaied). Zaied conducted a survey to investigate the barriers to e-commerce adoption in SMEs in Egypt. The work published in 2012 revealed that SMEs perceived political barriers as an issue with the implementation of e-commerce operations amongst SMEs in Egypt (Zaied 2012). Another correlation to consider is the correlation of increased e-commerce utilization amongst consumers, based on a consumer's perceived pandemic effect on their livelihood. Lobel Trong Thuy Tran (Tran) in 2021, sampled 617 e-commerce consumers and developed a model of perceived effectiveness of an e-commerce platform (PEEP). This study analyzed consumer consumption behavior. Results found that there is a positive and significant relationship between perceived economic benefits and sustainable consumption based on a consumer's perception of pandemic effects on a consumer's livelihood. Aside household consumers, the pandemic has also affected the behavior of businesses. UNCTD reported in 2021 that the pandemic has accelerated ongoing transitions of businesses from physical markets to online markets.

3. Methodology

In both data sets, variables are paired to each of the 34 provinces in Indonesia. A preliminary review of the data was necessary to determine the scope of the analysis. Scatter plots of each variable in this study versus its respective province were visually reviewed and appear to be monotonic. However, asymmetry of the scatter plots seems to vary depending on the variable considered. A frequent cause for the lack of asymmetry in the scatter plots is due to outliers in the data. In this study, outliers are not removed or ignored in the data sets. Data paired to provinces located on Jawa Island are the most common outliers on most of the scatter plots. This is particularly the case for expenditure graphs and population graphs of the provinces. Removal of the outliers before a correlation analysis between variables is not performed, as this is expected to greatly affect the results of the study. This assumption is based on a preliminary review of the sample data that reveals that provinces on Jawa Island contribute a substantial amount to the country's population and Gross Domestic Product (GDP). Therefore, the application of a Spearman R analysis on the data sets seemed appropriate as the "Spearman coefficient [is] relatively robust against outliers" (Boer, Schober, Schwarte, 2018, pg. 1766). Use of the method in this study is finalized based on the following conditions being met for assumptions of the Spearman R method: the data is derived from a representative sample, each row of data of a variable can be ranked, variables are continuous, jointly normally distributed, and random variables (data points in the scatter plots do not seem to lie close to a curve) (Boer, Schober, Schwarte, 2018).

The Spearman R analysis conducted on each of the data sets is performed using TIBCO Spotfire (build version 11.4.0.78). The correlation values (r_s), are calculated in the program based on the following equation:

$$r_s = \frac{1 - \frac{6}{N^3 - N} \left(D + \frac{1}{12} \sum_k (f_k^3 - f_k) + \frac{1}{12} \sum_m (g_m^3 - g_m) \right)}{\left(1 - \frac{\sum_k (f_k^3 - f_k)}{N^3 - N} \right)^{1/2} \left(1 - \frac{\sum_m (g_m^3 - g_m)}{N^3 - N} \right)^{1/2}} \quad (1)$$

where:

N = the number of valid pairs of measurements (x_i, y_i),

f_k = the number of ties in the k^{th} group of ties among the Y-column values,

and g_m = the number of ties in the m^{th} group of ties among the X-column values (TIBCO Software Inc., 2021).

It is important to note that Rank R, in the software's output table of the Spearman R Analysis, is the equivalent of r_s (one of the results of interest). Aside this, it is also important to note that this study assumes correlation values of over 0.85 to be very strong correlations, values over 0.75 to 0.85 to be strong correlations, values over 0.6 to 0.75 to be moderate correlations, values at 0.4 to 0.6 to be weak correlations, and values below 0.4 to be very weak correlations. Aside calculating correlation values between the variables, TIBCO Spotfire also calculates p-values, which are used to determine if the data collected and analyzed in a practical case is statistically significant. P-values are calculated in accordance with the Spearman R method (TIBCO Software, Inc., 2018). The p-values represent the probability of observed correlations in the analysis occurring due to chance. In this study, multiple hypotheses tests are conducted simultaneously on each data set. This can increase the number of false significant results. At one point in this study, correction for multiple comparisons was considered. However, some statisticians do not recommend correcting for multiple comparisons. One reason for this, is that although methods for correcting multiple comparisons can reduce the type one errors for null

associations, it can also increase the type two errors for those associations that are not null (Rothman, 1990). Ultimately, it was decided to forgo correction of multiple comparisons, especially since the number of simultaneous comparisons conducted are not so many that the possibility of false positives is likely to inflate greatly. Instead, statistical parameters that are outputted as results for each analysis of the data sets are provided in this paper for those interested in an alternative review of statistical significance. Aside this, it is important to note that this study assumes an α value threshold of 0.05 to compare to p-values to assist in determining the statistical significance of the results. For any given case for testing of a hypothesis in this study, whenever p-values are at or below α , there is at least a 95% probability that the null hypothesis being tested is wrong for a case in question. Alternatively, one can consider this also means there is a 5% chance of mistakenly rejecting a true null hypothesis.

Aside the calculations already mentioned, the output of Spearman R analysis in TIBCO Spotfire also provides R squared, degrees of freedom, and F-statistic (FStat) for each comparison. These results and the parameter, degrees of freedom, are automatically included in the software output tables and are included in the result tables of this study. However, there are only two types of results of the Spearman R Analysis that is of interest in this study: the calculated r_s (or R Rank as labeled in the output tables) and the p-values. These two results are needed to understand the strength of any correlations observed and to assess the acceptance or rejection of any hypothesis respectively. Regarding R squared for any variable comparison, this parameter is not addressed in this study because the non-parametric analysis does not assume a particular parameterized model generated any of the data.

3.1. Data

The purpose of compiling Data Set 1 is to have a reliable source of data to identify any possible trends in Indonesian household consumer behavior during 2019. The sampling and arranging of data are structured to compare some of the 2019 household expenditure categories as arranged by BPS for each province in Indonesia, to 2019 consumer e-commerce transaction methods observed in each province in Indonesia. Additionally, the purpose of compiling Data Set 2 is to have a reliable source of data to identify e-commerce marketplace trends. The sampling and arranging of data are structured to be able to compare some of the 2019 statistical properties of e-commerce businesses per province in Indonesia, to some 2019 household consumer statistics per province in Indonesia. It is important to note that this study assumes that not all 2019 household expenditures occurred with the utilization of e-commerce platforms. Also, this study assumes that not all internet usage in 2019, via various devices, was utilized only for e-commerce transactions. Last, this study does not take into account the effect of B2B consumers or private sellers in the e-commerce marketplace. Rather, the data selected is associated only between household consumers and businesses offering goods and services to look for relations only between the two entities.

For those interested in investigating the data sources or further reading, readers should note that data compiled in both data sets are sourced from the following BPS reports: (1) "Statistik E-Commerce 2020", (2) "Jumlah Penduduk Hasil Proyeksi Menurut Provinsi dan Jenis Kelamin (Ribuan Jiwa), 2018-2020", (3) "Produk Domestik Regional Bruto Provinsi-Provinsi di Indonesia Menurut Pengeluaran", (4) "Statistik Kesejahteraan Rakyat 2019", (5) "Tingkat Pengangguran Terbuka Menurut Provinsi (Persen), 2018-2019", and (6) "Proyeksi Penduduk Indonesia 2015 - 2045 Hasil SUPAS 2015".

3.2. Model Development

Null hypotheses are structured in such a manner to assume there is no correlation whatsoever between any of the variables in question. Null hypotheses are designated by H with a subscript “0” followed by a letter (designated in alphabetical order). There is a total of 10 null hypotheses addressed in this study.

Alternate Hypotheses however, are structured to assume there is a correlation between any of the compared variables in question. There is a total of 10 alternative hypotheses addressed in this study. The null hypotheses and alternative hypotheses that are tested in this study are as follows:

- H_{0a} = A correlation does not exist between any of the percentages of occurrence of e-commerce transaction methods in Indonesia during 2019 and the percent of people in Indonesia who accessed the internet as of January 2019 using a desktop computer, notebook/tablet, cellphone, or other device.
- H_{1a} = There is a correlation between any of the percentages of occurrence of e-commerce transaction methods in Indonesia during 2019 and the percent of people in Indonesia who accessed the internet as of January 2019 using a desktop computer, notebook/tablet, cellphone, or other device.
- H_{0b} = A correlation does not exist between any of the percentages of occurrence of e-commerce transaction methods in Indonesia during 2019 and the 2019 projected size of the population in Indonesia.
- H_{1b} = There is a correlation between any of the percentages of occurrence of e-commerce transaction methods in Indonesia during 2019 and the 2019 projected size of the population in Indonesia.
- H_{0c} = A correlation does not exist between any of the percentages of occurrence of e-commerce transaction methods in Indonesia during 2019 and the open unemployment rate in Indonesia as of August 2019.
- H_{1c} = There is a correlation between any of the percentages of occurrence of e-commerce transaction methods in Indonesia during 2019 and the open unemployment rate in Indonesia as of August 2019.
- H_{0d} = A correlation does not exist between any of the percentages of occurrence of e-commerce transaction methods in Indonesia during 2019 and Indonesia’s 2019 household expenditures for: food and beverages, clothing and footwear, housing and household equipment, health and education, transportation and communication, restaurants and hotels, miscellaneous goods, and total amount of household expenditures.
- H_{1d} = There is a correlation between any of the percentages of occurrence of e-commerce transaction methods in Indonesia during 2019 and Indonesia’s 2019 household expenditures for: food and beverages, clothing and footwear, housing and household equipment, health and education, transportation and communication, restaurants and hotels, miscellaneous goods, and total amount of household expenditures.
- H_{0e} = A correlation does not exist between the percent of businesses that export products and between any of the percentages of occurrence of e-commerce transaction methods in Indonesia during 2019 nor the percent of businesses that do not export products and between any of the percentages of occurrence of e-commerce transaction methods in Indonesia during 2019.
- H_{1e} = There is a correlation between the percent of businesses that export products and between any of the percentages of occurrence of e-commerce transaction methods in Indonesia during 2019 and the percent of businesses that do not export products and

- between any of the percentages of occurrence of e-commerce transaction methods in Indonesia during 2019.
- H_{of} = A correlation does not exist between the percent of businesses that export products and between the open unemployment rate in Indonesia as of August 2019 nor between the percent of business that do not export products and the open unemployment rate in Indonesia as of August 2019.
- H_{if} = There is a correlation between the percent of businesses that export products and between the open unemployment rate in Indonesia as of August 2019 and between the percent of businesses that do not export products and the open unemployment rate in Indonesia as of August 2019.
- H_{og} = A correlation does not exist between the percent of businesses that export products and between any of Indonesia's 2019 household expenditures for: food and beverages, clothing and footwear, housing and household equipment, health and education, transportation and communication, restaurants and hotels, miscellaneous goods, and total amount of household expenditures. Nor is there a correlation between the percent of businesses that do not export products and between any of Indonesia's 2019 household expenditures for: food and beverages, clothing and footwear, housing and household equipment, health and education, transportation and communication, restaurants and hotels, miscellaneous goods, and total amount of household expenditures.
- H_{ig} = There is a correlation between the percent of businesses that export products and between any of Indonesia's 2019 household expenditures for: food and beverages, clothing and footwear, housing and household equipment, health and education, transportation and communication, restaurants and hotels, miscellaneous goods, and total amount of household expenditures. And there is a correlation between the percent of businesses that do not export products and between any of Indonesia's 2019 household expenditures for: food and beverages, clothing and footwear, housing and household equipment, health and education, transportation and communication, restaurants and hotels, miscellaneous goods, and total amount of household expenditures.
- H_{oh} = A correlation does not exist between the percent of businesses that commenced commercial operations before 2010 any of the percentages of occurrence of e-Commerce transaction methods in Indonesia during 2019. Nor is there a correlation between businesses that commenced commercial operations from 2010 through 2016 and any of the percentages of occurrence of e-commerce transaction methods in Indonesia during 2019. Nor is there a correlation between businesses that commenced commercial operations from 2017 through 2019 and any of the percentages of occurrence of e-commerce transaction methods in Indonesia during 2019.
- H_{ih} = There is a correlation between the percent of businesses that commenced commercial operations before 2010 and any of the percentages of occurrence of e-commerce transaction methods in Indonesia during 2019. And there is a correlation between businesses that commenced commercial operations from 2010 through 2016 and any of the percentages of occurrence of e-commerce transaction methods in Indonesia during 2019. And there is a correlation between businesses that commenced commercial operations from 2017 through 2019 and any of the percentages of occurrence of e-commerce transaction methods in Indonesia during 2019.
- H_{oi} = A correlation does not exist between the percent of businesses that commenced commercial operations before 2010 and the open unemployment rate in Indonesia as of August 2019. Nor is there a correlation between businesses that commenced commercial operations from 2010 through 2016 and the open unemployment rate in

Indonesia as of August 2019. Nor is there a correlation between businesses that commenced commercial operations from 2017 through 2019 and the open unemployment rate in Indonesia as of August 2019.

H_{ij} = There is a correlation between the percent of businesses that commenced commercial operations before 2010 and the open unemployment rate in Indonesia as of August 2019. And there is a correlation between businesses that commenced commercial operations from 2010 through 2016 and the open unemployment rate in Indonesia as of August 2019. And there is a correlation between businesses that commenced commercial operations from 2017 through 2019 and the open unemployment rate in Indonesia as of August 2019.

H_{0j} = A correlation does not exist between the percent of businesses that commenced e-commerce operations before 2010 and between any of Indonesia's 2019 household expenditures for: food and beverages, clothing and footwear, housing and household equipment, health and education, transportation and communication, restaurants and hotels, miscellaneous goods, and total amount of household expenditures. Nor is there a correlation between businesses that commenced e-commerce operations from 2010 through 2016 and between any of Indonesia's 2019 household expenditures for: food and beverages, clothing and footwear, housing and household equipment, health and education, transportation and communication, restaurants and hotels, miscellaneous goods, and total amount of household expenditures. Nor is there a correlation between businesses that commenced e-commerce operations from 2017 through 2019 and between any of Indonesia's 2019 household expenditures for: food and beverages, clothing and footwear, housing and household equipment, health and education, transportation and communication, restaurants and hotels, miscellaneous goods, and total amount of household expenditures.

H_{ij} = There is a correlation between the percent of businesses that commenced e-commerce operations before 2010 and between any of Indonesia's 2019 household expenditures for: food and beverages, clothing and footwear, housing and household equipment, health and education, transportation and communication, restaurants and hotels, miscellaneous goods, and total amount of household expenditures. And there is a correlation between businesses that commenced e-commerce operations from 2010 through 2016 and between any of Indonesia's 2019 household expenditures for: food and beverages, clothing and footwear, housing and household equipment, health and education, transportation and communication, restaurants and hotels, miscellaneous goods, and total amount of household expenditures. And there is a correlation between businesses that commenced e-commerce operations from 2017 through 2019 and between any of Indonesia's 2019 household expenditures for: food and beverages, clothing and footwear, housing and household equipment, health and education, transportation and communication, restaurants and hotels, miscellaneous goods, and total amount of household expenditures.

3.3. Method

3.3.1. Data Set 1 Sampling and Analyzation

The five x-variable categories considered for the Spearman R analysis are the percent of 2019 household consumer e-commerce transactions conducted in each province in: (1) Cash; (2) ATM, Internet and Mobile Banking; (3) Debit, Credit, Electronic Money Card; (4) E-wallet; and (5) Other e-commerce transactions. The fourteen y-variable categories considered for the Spearman R analysis are: (1) Projected 2019 Province Population (in thousands); (2) 2019 Total Household Consumption Expenditure (in Rp Millions); the percent of the population that accessed the internet as of January 2019 using a (3) Desktop, (4) Notebook or Tablet, (5)

Cellphone, and (6) Another Device; (7) the Open Unemployment Rate as of August 2019; (8) 2019 household expenditures (in Rp Millions) for Food and Beverages, (9) Clothing and Footwear, (10) Housing and Household Equipment, (11) Health and Education, (12) Transportation and Communication, (13) Restaurants and Hotels, and (14) Miscellaneous Goods.

3.3.2. Data Set 2 Sampling and Analyzation

The eight x-variable categories considered for the Spearman R analysis are 2019 e-commerce business statistics consisting of the percent of businesses that: (1) export products; (2) that do not export products; commenced commercial operations (3) before 2010, (4) from 2010 through 2016, and (5) from 2017 through 2019; commenced e-commerce services operations (6) before 2010, (7) from 2010 through 2016, and (8) from 2017 through 2019. The fourteen y-variables considered for the Spearman R analysis are 2019 household consumer metrics consisting of: (1) percent of cash E-Commerce transactions; (2) percent of ATM, Internet and Mobile Banking E-Commerce transactions; (3) percent of Debit, Credit, Electronic Money Card e-commerce transactions; (4) percent of E-wallet transactions; (5) Other e-commerce transactions; (6) 2019 Total Household Consumption Expenditure (in Rp Millions); (7) the Open Unemployment Rate as of August 2019; 2019 household expenditures (in Rp Millions) for (8) Food and Beverages, (9) Clothing and Footwear, (10) Housing and Household Equipment, (11) Health and Education, (12) Transportation and Communication, (13) Restaurants and Hotels, and (14) Miscellaneous Goods.

4. Results And Analysis

4.1. Results

4.1.1 Noteworthy Correlations from Data Set 1

Regarding results from Data Set 1, there is a negative weak correlation (Rank R = -0.4312) between e-commerce cash transactions and the use of desktops by the population to access the internet during 2019 in Indonesia. Also, there is a weak positive correlation (Rank R = 0.4102) between debit, credit, electronic money card e-commerce transactions and the use of other devices to access the internet during 2019 in Indonesia. Additionally, there is a weak positive correlation (Rank R = 0.4080) between E-Wallet e-commerce transactions and the use of other devices to access the internet during 2019 in Indonesia. And, there is a very weak correlation (Rank R = 0.3976) between ATM, internet, and mobile banking e-commerce transactions and the use of other devices to access the internet during 2019 in Indonesia.

Furthermore, there is a moderate positive correlation (Rank R = 0.7045) between E-Wallet e-commerce transactions and the 2019 Province Population Projection.

Aside this, there is a negative moderate correlation (Rank R = -0.6559) between cash on delivery e-commerce transactions and the 2019 Province Population Projection. And, there is a positive weak correlation (Rank R = 0.5865) between ATM, internet, and mobile banking e-commerce transactions and the 2019 Province Population Projection. Nearly all comparisons between E-Wallet e-commerce transactions and household expenditure variables resulted in either a positive strong or positive moderate correlation ranging primarily with a magnitude of Rank R values of 0.7758 to 0.6675. The second strongest relationships were observed between cash on delivery e-commerce transactions and household expenditure variables. All but one of the correlations are negative and moderate in nature, ranging from Rank R of -0.6889 to -0.5917. Last, correlations between ATM, internet, and mobile banking e-commerce transactions and household expenditures and also debit, credit, electronic money card e-

commerce transactions and household expenditures resulted in moderate to weak correlations that are positive in nature. The following four tables (Tables 1 through 4) display the output of Data Set 1's analysis.

4.1.2 Noteworthy Correlations from Data Set 2

Regarding results from the analysis of Data Set 2, there are several correlations that are revealed. There are weak correlations between the 2019 percent of businesses that export products and some of the 2019 household expenditure variables, and also between the 2019 percent of businesses that do not export and some of the 2019 household expenditure variables. The polarity of Rank R in the types of comparisons just mentioned, alternated with Rank R values ranging from 0.4527 to -0.3644. Also, there are moderate correlations that exist between the 2019 percent of businesses that export products and some of the other categories of Indonesia's 2019 household expenditures, and also between the 2019 percent of businesses that do not export products and between some other categories of Indonesia's 2019 household expenditures. These correlations range from Rank R = 0.6369 to -0.6369. Furthermore, there is a correlation between the percent of businesses that commenced commercial operations from 2010 through 2016 and the percentage of occurrence of 2019 debit, credit, electronic money card e-commerce transactions. This correlation is positive and weak, with a Rank R value of 0.4370.

Another correlation that is similar in case, is between the percent of businesses that commenced commercial operations from 2017 through 2019 and the percentage of occurrence of 2019 debit, credit, electronic money card e-commerce transactions. This correlation however is negative and very weak, with a Rank R value of -0.3565. In addition, there are correlations between the percent of businesses that commenced e-commerce operations before 2010 and between all of the 2019 household expenditure variables, except for 2019 transportation and communication household expenditures. All of these comparisons have either very weak or weak correlations, with Rank R ranging from 0.4691 to -0.4527 (with one of the correlations being negative). The only other correlation observed was between the percent of businesses that commenced e-commerce operations from 2017 to 2019, and 2019 housing and household equipment expenditures. The correlation for this case is negative and very weak with a Rank R of -0.3792. The following four tables (Tables 5 through 9) display the output of Data Set 2's analysis.

4.2. Robustness Test

To check the statistical significance of the Spearman R Analysis results calculated with TIBCO Spotfire, the calculated p-values of the variable comparisons are compared to α (0.05). For this purpose, each set of results in the output tables is sorted by increasing p-value. Afterwards, the output tables are imported into Microsoft Excel 2019 (Build 16.0.14131.20296) and each variable comparison is designated a number to allow for quick reference for a robustness test and analysis of the results. According to the results of the analysis on Data set 1, only variable comparison result numbers 1 through 39 present p-values lower than α . Thus, only result numbers 1 through 39 are considered statistically significant enough to provide evidence, with their respective parameters, to accept or reject null hypotheses and alternate hypotheses.

Additionally, results of the analysis on Data Set 2 reveal that only variable comparison result numbers 1 through 40 present p-values lower than α . In this case, only result numbers 1 through 40 are considered statistically significant enough to provide evidence, with their respective parameters, to accept or reject the null hypotheses and alternate hypotheses.

4.3. Analysis

Regarding H_{0a} and H_{1a} , H_{0a} is rejected and H_{1a} is accepted due to the parameters found in result numbers 29, 33, 34 and 37 of Data Set 1 (see Table 2). Each one of these four comparison cases reveals a correlation between percentages of occurrence of an e-commerce transaction method in Indonesia during 2019, and the 2019 projected size of the population in Indonesia. These correlations range from weak to very weak. The highest correlation (R Rank = -0.4312) is between the percentage of 2019 e-commerce cash transactions and the percent of users that utilized a desktop to access the internet in 2019. Regarding these correlations, it is not unreasonable to consider that in places with higher cash expenditures there may be a large middle-class present which can afford to own a laptop. For the needs of the average computer user a laptop is more convenient to use than a desktop. However, laptops are much more expensive to own than a desktop with similar performance features.

Moving on, regarding hypotheses H_{0b} and H_{1b} , H_{0b} is rejected and H_{1b} is accepted due to the parameters found in result numbers 7, 13, and 20 (see Table 1). There were moderate to weak correlations between the percentages of occurrence of e-commerce transaction methods in Indonesia during 2019, and the 2019 projected size of the population. One of the notable trends is a positive moderate correlation (R Rank = 0.7045) where as an increase in 2019 e-commerce E-Wallet transactions occurred, there was an increase in the projected 2019 projected population. However, another notable correlation is observed where as there is an increase in 2019 e-commerce cash transactions, there is a decrease in 2019 projected population (Rank R = -0.6559). It is unclear why either of these trends are observed, perhaps more information about the demographics of the provinces may provide a clue.

Regarding H_{0c} and H_{1c} , H_{0c} is accepted and H_{1c} is rejected. This is because, none of the comparisons for this hypotheses test met the required statistical significance threshold of $p\text{-value} < 0.05$. Therefore, it is assumed there is no correlation between any of the percentages of occurrence of e-commerce transaction methods in Indonesia during 2019, and the open unemployment rate in Indonesia as of August 2019. Regarding H_{0d} and H_{1d} , H_{0d} is rejected and H_{1d} is accepted due to the parameters found in result numbers 1 through 6, 8 through 12, 14 through 19, 21 through 28, 30 through 32, 35, 36, 38, and 39 (see Tables 1 and 2). Accordingly, there are several strong and moderate correlations between several of the percentages of occurrence of e-commerce transaction methods in Indonesia during 2019 and several categories of Indonesia's 2019 household expenditures. One of the most interesting correlation is that as the percent of occurrence of 2019 e-commerce cash transactions increase, there is a decrease in several 2019 household expenditure values. It is possible that regions that have lower regional gross domestic product may not be as technologically adept than regions that have a higher regional gross domestic product. Alternatively, there may be cultural differences in regions with lower regional gross domestic product whereas they prefer cash transactions regardless of participating in e-commerce transactions or not. In some instances e-commerce experiences lack personal face-to-face interaction, feeling and touching the product before purchasing, bargaining, and etc. that appeal to consumers in some cultures (Dedrick, Gibbs, Kraemer, 2003). Such a cultural sentiment may exist in Indonesia to a large extent. If so, this theory would explain why cash e-commerce transactions (cash on delivery) were so prevalent in the 2019 Indonesian e-commerce marketplace.

Aside this, it is important to note that the remaining transactions in the same comparison test were electronic, and increased along with household consumer expenditures. The reason for this is unclear. However during 2020, in Indonesia's Halal E-commerce Marketplace, electronic money and bank transfers were amongst the most dominant payment method at

“42.1%” (BI, 2021, pg.44) and “23.08%” (BI, 2021, pg.44) respectively. It is possible that the effects of the pandemic contributed to this, or perhaps most of the halal e-commerce consumers belong to the millennial and gen-Z demographic, who engage more in digital transactions than older generations.

The next test to review regards H_{0e} and H_{1e} . According to the results H_{0e} is rejected and H_{1e} is accepted due to the parameters found in result numbers 19, 20, 23, 24, 33, and 34 (see Tables 5 and 6).

These results confirm there is a correlation between the percent of businesses that export products and those that do not, and the percent occurrence of e-commerce cash, E-Wallet, ATM, and internet and mobile banking transaction methods in Indonesia during 2019. However, these correlations at best are mainly weak, the strongest being Rank R 0.4527. Regarding hypotheses H_{0f} and H_{1f} , H_{0f} is accepted and H_{1f} is rejected. This is because, none of the comparisons for this test met the required statistical significance threshold of p-value < 0.05. Therefore, it is assumed there is no correlation between the percent of businesses that export products and between the open unemployment rate in Indonesia as of August 2019. Also, it is assumed there is no correlation between the percent of businesses that do not export products and the open unemployment rate in Indonesia as of August 2019. Regarding hypotheses H_{0g} and H_{1g} , H_{0g} is rejected and H_{1g} is accepted due to the parameters found in result numbers 1 through 16 (see Table 5). There are moderate correlations between 2019: total household consumption, housing and household equipment, and clothing and footwear expenditures with percent of businesses that export or do not export products. As there is an increase in the percentage of businesses that export products, there is also an increase in expenditures for the expenditure categories previously mentioned. It could be that regions that export products have higher income due to business operations in their respective regions and household consumers in those regions have more income in part due to the business atmosphere. This suggestion is not unreasonable, but more evidence is required to be able to support such a claim.

Regarding hypotheses H_{0h} and H_{1h} , H_{0h} is rejected and H_{1h} is accepted due to the parameters found in result numbers 22 and 35 (see Table 5 and 6). There is a weak positive correlation between businesses that commenced commercial operations from 2010 through 2016 and debit, credit, electronic money card transactions. Also, there is a very weak correlation where as the percent of businesses that commenced commercial operations from 2017 through 2019 increase, the percentage of debit, credit, electronic money card transactions decrease. Regarding hypotheses H_{0i} and H_{1i} , H_{0i} is accepted and H_{1i} is rejected because none of the comparisons for this test met the required statistical significance threshold of p-value < 0.05. Therefore, it is assumed there is no correlation between the percent of businesses that commenced commercial operations before 2010 and the open unemployment rate in Indonesia as of August 2019. Nor is there a correlation between businesses that commenced commercial operations from 2010 through 2016 and the open unemployment rate in Indonesia as of August 2019. Nor is there a correlation between businesses that commenced commercial operations from 2017 through 2019 and the open unemployment rate in Indonesia as of August 2019.

Regarding hypotheses H_{0j} and H_{1j} , H_{0j} is rejected and H_{1j} is accepted due to the parameters found in result numbers 18, 21, 26, 29 through 32, and 36 (see Table 5 and 6). These instances are mainly positive weak correlations. In these instances, as the percent of businesses that started e-commerce operations before 2010 increased, household consumer expenditure increased as well. These correlations are weak, with the strongest being Rank R= 0.4691.

Although these correlations are weak, it is interesting to ask why are there correlations primarily with businesses starting e-commerce operations before 2010? Perhaps regions that have businesses that entered the e-commerce market much earlier than other regions had an atmosphere favorable to digital entrepreneurship and consequently, in part have higher amounts of household income due to the region's business environment. One can consider a 2010 case study of SMEs in Gaborone, Botswana. In a study published in 2010, Wole Olatokun and Mogotetsi Kebonye (Kebonye, Olatokun), randomly surveyed 145 SMEs in the capital city that have adopted e-commerce as part of their business model. The results of the survey revealed that approximately half of the SMEs surveyed mentioned that gaining a "competitive advantage" (Kebonye, Olatokun, pg.11, 2010) was the primary factor that urged SMEs to adopt e-commerce in their business models. However, most firms were faced with security challenges, namely equipment, to deal with the theft of credit card information. Such a situation may have occurred in areas in Indonesia as well during 2010. It is possible that during 2010, certain provinces or regions in Indonesia may have faced a lack of cyber infrastructure or hardware availability which hindered the market entry of SMEs in less technological adept areas. Currently, according to Islamic Development Bank Institute, Indonesia's internet use is low at 19.8% and stagnating, while mobile broadband subscriptions is only 36.8 per 100 inhabitants (Islamic Development Bank Institute, 2021). If internet usage amongst the population during 2019 was also as low as what was reported in 2021 by Islamic Development Bank (IsDB), then there may be infrastructure hurdles that are slowing down e-commerce marketplace stakeholders from engaging in more transaction activity.

5. Conclusion And Recommendations

5.1. Conclusion

Twenty hypotheses were tested in this study to attempt provide the general public information on some of the correlations that existed within Indonesia's 2019 e-commerce marketplace. Null hypotheses H_{0a} , H_{0b} , H_{0d} , H_{0e} , H_{0g} , H_{0h} , and H_{0j} are rejected and alternative hypotheses H_{1a} , H_{1b} , H_{1d} , H_{1e} , H_{1g} , H_{1h} , and H_{1j} are accepted by means of statistical significance testing. Likewise, alternative hypotheses H_{1c} , H_{1f} , and H_{1i} are rejected and null hypotheses H_{0c} , H_{0f} , and H_{0i} are accepted by the same testing means. There are some noteworthy correlations revealed in this study concerning 2019 Indonesian household consumer behavior and e-commerce marketplace trends. Some strong correlations revealed are: as the percentage of 2019 e-commerce E-Wallet transactions increase across the provinces sampled, 2019 household expenditures for transportation and communication, food and beverage, and health and education also increase from province to province. Some moderate correlations revealed are: as the 2019 percentage of businesses that export products increase from province to province, the 2019 household consumer expenditures for housing and house hold equipment, clothing and footwear, and total household expenditure increases. Conversely, as the 2019 percentage of businesses that export products decrease from province to province, the 2019 household consumer expenditures for housing and house hold equipment, clothing and footwear, and total household expenditure decreases.

According to BPS, in 2019 DKI Jakarta is the only province with a large ATM, internet and mobile banking share of e-commerce transactions totaling to 47.2%, the largest share amongst all provinces. Also in 2019 DKI Jakarta had the largest share of 2019 E-Wallet e-commerce transactions totaling to 15.69%. Additionally, DKI Jakarta is the only province with shares of e-commerce transaction methods in 2019 somewhat similar in distribution to shares surveyed in 2020. Furthermore, DKI Jakarta is the only province where cash payment on delivery is not the dominant e-commerce payment method in 2019. The last noteworthy point, is that Papua has

the largest share of debit/credit/electronic money transactions in the 2019 e-commerce market. However, Papua had the majority of its 2019 e-commerce transactions carried out in cash payments.

5.2. Recommendations

Based on this study's results and the review of other studies cited in this paper, there are several recommendations that researchers and policy makers may want to consider:

- (a) The development, and public availability, of a regional digital maturity index that is updated monthly could greatly help the public assess investment opportunities.
- (b) Increased data sharing between the retail financial market and the government can assist policy makers to better understand consumer behavior through financial data. This can assist in preemptively identifying and addressing socio-economic problems.
- (c) Incentivizing trade between SMEs and micro-SMEs in different provinces for domestic and international exports can increase and spread cashflow to the broader population.
- (d) Frequently surveying the public to assess the capacity of human capital can help regions strategically develop and introduce high value -added goods and services into the domestic market.
- (e) More encouragement for the public to participate in digital transactions, such as E-Wallet, can result in more commerce conducted across regions due to the benefits of virtual transactions.
- (f) Incentivizing the bank-less community, particularly in rural areas, to participate in e-commerce, even as a private seller, can facilitate business growth even for micro-SMEs.

Table 1: Results of Spearman Rank Analysis on Data Set 1 (Results 1 to 20)

Result No.	Y (numerical)	X (numerical)	p-value	FStat	Rank R squared	Rank R	Df
1	Transportation and Communication 2019 (Expenditure Millions Rp)	E-Wallet Transactions	7.05E-08	48.38224	0.601902	0.775823	32
2	House Hold Consumption 2019 Expenditure (Million Rp)	E-Wallet Transactions	8.73E-08	47.33547	0.596649	0.772431	32
3	Food and Beverages 2019 (Expenditure Millions Rp)	E-Wallet Transactions	2.05E-07	43.28234	0.574934	0.758244	32
4	Health and Education 2019 (Expenditure Millions Rp)	E-Wallet Transactions	2.59E-07	42.22344	0.568869	0.754234	32
5	Housing and Household Equipment 2019 (Expenditure Millions Rp)	E-Wallet Transactions	8.94E-07	36.81168	0.534963	0.731411	32
6	Restaurants and Hotels 2019 (Expenditure Millions Rp)	E-Wallet Transactions	1.30E-06	35.25368	0.52419	0.724009	32
7	2019 Province Population (Projection in 1000s)	E-Wallet Transactions	3.30E-06	31.5465	0.496432	0.704579	32
8	Miscellaneous Goods 2019 (Expenditure Millions Rp)	E-Wallet Transactions	3.86E-06	30.95031	0.491663	0.701187	32
9	Food and Beverages 2019 (Expenditure Millions Rp)	Cash Transactions	6.64E-06	28.90768	0.474615	-0.68892	32
10	House Hold Consumption 2019 Expenditure (Million Rp)	Cash Transactions	1.11E-05	27.03216	0.457923	-0.6767	32
11	Clothing and Footwear 2019 (Expenditure Millions Rp)	E-Wallet Transactions	1.61E-05	25.7251	0.445648	0.667569	32
12	Clothing and Footwear 2019 (Expenditure Millions Rp)	Cash Transactions	1.74E-05	25.46664	0.443155	-0.6657	32
13	2019 Province Population (Projection in 1000s)	Cash Transactions	2.54E-05	24.16319	0.430232	-0.65592	32
14	Miscellaneous Goods 2019 (Expenditure Millions Rp)	Cash Transactions	5.76E-05	21.46396	0.401466	-0.63361	32
15	Restaurants and Hotels 2019 (Expenditure Millions Rp)	Cash Transactions	6.41E-05	21.12111	0.397603	-0.63056	32
16	Transportation and Communication 2019 (Expenditure Millions Rp)	Cash Transactions	6.90E-05	20.88469	0.39491	-0.62842	32
17	Health and Education 2019 (Expenditure Millions Rp)	Cash Transactions	1.57E-04	18.34722	0.364414	-0.60367	32
18	Clothing and Footwear 2019 (Expenditure Millions Rp)	ATM, Internet, and Mobile Banking Transactions	1.72E-04	18.07609	0.360972	0.60081	32
19	Housing and Household Equipment 2019 (Expenditure Millions Rp)	Cash Transactions	2.28E-04	17.24345	0.350167	-0.59175	32
20	2019 Province Population (Projection in 1000s)	ATM, Internet, and Mobile Banking Transactions	2.66E-04	16.78784	0.344099	0.586599	32

Table 2: Results of Spearman Rank Analysis on Data Set 1 (Results 21 to 40)

Result No.	Y (numerical)	X (numerical)	p-value	FStat	Rank R squared	Rank R	Df
21	House Hold Consumption 2019 Expenditure (Million Rp)	ATM, Internet, and Mobile Banking Transactions	6.58E-04	14.24221	0.307992	0.55497	32
22	Food and Beverages 2019 (Expenditure Millions Rp)	ATM, Internet, and Mobile Banking Transactions	7.18E-04	14.00611	0.30444	0.551761	32
23	Health and Education 2019 (Expenditure Millions Rp)	ATM, Internet, and Mobile Banking Transactions	8.76E-04	13.46966	0.296234	0.544274	32
24	Miscellaneous Goods 2019 (Expenditure Millions Rp)	ATM, Internet, and Mobile Banking Transactions	1.52E-03	12.03138	0.273246	0.522729	32
25	Housing and Household Equipment 2019 (Expenditure Millions Rp)	ATM, Internet, and Mobile Banking Transactions	1.99E-03	11.33414	0.261552	0.511422	32
26	Transportation and Communication 2019 (Expenditure Millions Rp)	ATM, Internet, and Mobile Banking Transactions	2.57E-03	10.69931	0.250573	0.500573	32
27	Restaurants and Hotels 2019 (Expenditure Millions Rp)	ATM, Internet, and Mobile Banking Transactions	6.05E-03	8.643171	0.21266	0.461151	32
28	House Hold Consumption 2019 Expenditure (Million Rp)	Debit, Credit, Electronic Money Card Transactions	7.19E-03	8.2467	0.204904	0.452663	32
29	Dekstop	Cash Transactions	1.09E-02	7.308899	0.185935	-0.4312	32
30	Housing and Household Equipment 2019 (Expenditure Millions Rp)	Debit, Credit, Electronic Money Card Transactions	1.11E-02	7.270531	0.18514	0.430279	32
31	Food and Beverages 2019 (Expenditure Millions Rp)	Debit, Credit, Electronic Money Card Transactions	1.11E-02	7.264086	0.185006	0.430123	32
32	Miscellaneous Goods 2019 (Expenditure Millions Rp)	Debit, Credit, Electronic Money Card Transactions	1.21E-02	7.079111	0.181148	0.425615	32
33	Other	Debit, Credit, Electronic Money Card Transactions	1.60E-02	6.475967	0.168312	0.410258	32
34	Other	E-Wallet Transactions	1.66E-02	6.393251	0.16652	0.408069	32
35	Health and Education 2019 (Expenditure Millions Rp)	Debit, Credit, Electronic Money Card Transactions	1.66E-02	6.386684	0.166378	0.407894	32
36	Restaurants and Hotels 2019 (Expenditure Millions Rp)	Debit, Credit, Electronic Money Card Transactions	1.75E-02	6.276453	0.163977	0.404941	32
37	Dekstop	ATM, Internet, and Mobile Banking Transactions	1.99E-02	6.009201	0.158099	0.397616	32
38	Transportation and Communication 2019 (Expenditure Millions Rp)	Debit, Credit, Electronic Money Card Transactions	2.85E-02	5.264753	0.14128	0.375872	32
39	Clothing and Footwear 2019 (Expenditure Millions Rp)	Debit, Credit, Electronic Money Card Transactions	3.61E-02	4.784138	0.13006	0.360638	32
40	Dekstop	E-Wallet Transactions	5.17E-02	4.086355	0.113238	0.336509	32

Table 3: Results of Spearman Rank Analysis on Data Set 1 (Results 41 to 60)

Result No.	Y (numerical)	X (numerical)	p-value	FStat	Rank R squared	Rank R	Df
41	2019 Province Population (Projection in 1000s)	Debit, Credit, Electronic Money Card Transactions	8.22E-02	3.219509	0.091413	0.302345	32
42	Open Unemployment Rate (August 2019)	Other Transactions	8.39E-02	3.182853	0.090466	-0.30078	32
43	Open Unemployment Rate (August 2019)	E-Wallet Transactions	8.51E-02	3.156202	0.089777	0.299627	32
44	Notebook Tablet	ATM, Internet, and Mobile Banking Transactions	1.45E-01	2.232754	0.065223	0.255387	32
45	Other	Other Transactions	1.58E-01	2.08505	0.061172	0.24733	32
46	Miscellaneous Goods 2019 (Expenditure Millions Rp)	Other Transactions	1.59E-01	2.083014	0.061116	-0.24722	32
47	Notebook Tablet	Debit, Credit, Electronic Money Card Transactions	2.10E-01	1.636182	0.048644	0.220553	32
48	Notebook Tablet	Cash Transactions	2.16E-01	1.593164	0.047425	-0.21777	32
49	Open Unemployment Rate (August 2019)	Debit, Credit, Electronic Money Card Transactions	2.21E-01	1.557708	0.046419	0.21545	32
50	Cell Phone	Other Transactions	2.30E-01	1.496131	0.044666	-0.21134	32
51	Restaurants and Hotels 2019 (Expenditure Millions Rp)	Other Transactions	2.71E-01	1.253502	0.037695	-0.19415	32
52	Cell Phone	Cash Transactions	2.72E-01	1.25095	0.037621	0.193963	32
53	Notebook Tablet	E-Wallet Transactions	2.74E-01	1.237542	0.037233	0.192959	32
54	Transportation and Communication 2019 (Expenditure Millions Rp)	Other Transactions	3.01E-01	1.105606	0.033396	-0.18275	32
55	Cell Phone	ATM, Internet, and Mobile Banking Transactions	3.44E-01	0.922355	0.028016	-0.16738	32
56	Other	Cash Transactions	3.69E-01	0.829683	0.025272	-0.15897	32
57	Open Unemployment Rate (August 2019)	Cash Transactions	4.23E-01	0.657963	0.020147	-0.14194	32
58	Open Unemployment Rate (August 2019)	ATM, Internet, and Mobile Banking Transactions	4.35E-01	0.625255	0.019165	0.138437	32
59	Cell Phone	E-Wallet Transactions	4.87E-01	0.493675	0.015193	-0.12326	32
60	Dekstop	Debit, Credit, Electronic Money Card Transactions	5.67E-01	0.335268	0.010369	0.101826	32

Table 4: Results of Spearman Rank Analysis on Data Set 1 (Results 61 to 71)

Result No.	Y (numerical)	X (numerical)	p-value	FStat	Rank R squared	Rank R	Df
61	Cell Phone	Debit, Credit, Electronic Money Card Transactions	5.71E-01	0.32827	0.010154	0.100768	32
62	Food and Beverages 2019 (Expenditure Millions Rp)	Other Transactions	5.93E-01	0.291237	0.009019	-0.09497	32
63	House Hold Consumption 2019 Expenditure (Miilion Rp)	Other Transactions	6.19E-01	0.252736	0.007836	-0.08852	32
64	Clothing and Footwear 2019 (Expenditure Millions Rp)	Other Transactions	6.73E-01	0.181659	0.005645	-0.07513	32
65	Other	ATM, Internet, and Mobile Banking Transactions	7.12E-01	0.138871	0.004321	0.065734	32
66	2019 Province Population (Projection in 1000s)	Other Transactions	7.75E-01	0.082898	0.002584	-0.05083	32
67	Dekstop	Other Transactions	8.55E-01	0.033805	0.001055	0.032485	32
68	Housing and Household Equipment 2019 (Expenditure Millions Rp)	Other Transactions	9.10E-01	0.012914	0.000403	-0.02008	32
69	Notebook Tablet	Other Transactions	9.39E-01	0.005956	0.000186	0.013641	32
70	Health and Education 2019 (Expenditure Millions Rp)	Other Transactions	9.92E-01	9.64E-05	3.01E-06	0.001736	32

Table 5: Results of Spearman Rank Analysis on Data Set 2 (Results 1 to 25)

Result No.	Y (numerical)	X (numerical)	p-value	FStat	Rank R squared	Rank R	Df
1	Housing and Household Equipment 2019 (Expenditure Millions Rp)	Export Products	3.89E-05	22.5249	0.40567	0.63692	33
2	Housing and Household Equipment 2019 (Expenditure Millions Rp)	Do not Export Products	3.89E-05	22.5249	0.40567	-0.63692	33
3	Clothing and Footwear 2019 (Expenditure Millions Rp)	Export Products	5.89E-05	21.2025	0.39117	0.62544	33
4	Clothing and Footwear 2019 (Expenditure Millions Rp)	Do not Export Products	5.89E-05	21.2025	0.39117	-0.62544	33
5	House Hold Consumption 2019 Expenditure (Million Rp)	Export Products	1.32E-04	18.7203	0.36195	0.60162	33
6	House Hold Consumption 2019 Expenditure (Million Rp)	Do not Export Products	1.32E-04	18.7203	0.36195	-0.60162	33
7	Health and Education 2019 (Expenditure Millions Rp)	Export Products	1.95E-04	17.5699	0.34744	0.58944	33
8	Health and Education 2019 (Expenditure Millions Rp)	Do not Export Products	1.95E-04	17.5699	0.34744	-0.58944	33
9	Food and Beverages 2019 (Expenditure Millions Rp)	Export Products	2.73E-04	16.5879	0.33451	0.57837	33
10	Food and Beverages 2019 (Expenditure Millions Rp)	Do not Export Products	2.73E-04	16.5879	0.33451	-0.57837	33
11	Miscellaneous Goods 2019 (Expenditure Millions Rp)	Export Products	3.99E-04	15.5246	0.31993	0.56563	33
12	Miscellaneous Goods 2019 (Expenditure Millions Rp)	Do not Export Products	3.99E-04	15.5246	0.31993	-0.56563	33
13	Restaurants and Hotels 2019 (Expenditure Millions Rp)	Export Products	5.77E-04	14.507	0.30537	0.5526	33
14	Restaurants and Hotels 2019 (Expenditure Millions Rp)	Do not Export Products	5.77E-04	14.507	0.30537	-0.5526	33
15	Transportation and Communication 2019 (Expenditure Millions Rp)	Export Products	8.70E-04	13.4053	0.28887	0.53747	33
16	Transportation and Communication 2019 (Expenditure Millions Rp)	Do not Export Products	8.70E-04	13.4053	0.28887	-0.53747	33
17	Debit, Credit, Electronic Money Card Transactions	Started E-Commerce Operations Before 2010	1.64E-03	11.7585	0.26271	0.51255	33
18	Housing and Household Equipment 2019 (Expenditure Millions Rp)	Started E-Commerce Operations Before 2010	4.47E-03	9.31214	0.22008	0.46913	33
19	ATM, Internet, and Mobile Banking Transactions	Export Products	6.31E-03	8.50882	0.20499	0.45276	33
20	ATM, Internet, and Mobile Banking Transactions	Do not Export Products	6.31E-03	8.50882	0.20499	-0.45276	33
21	Health and Education 2019 (Expenditure Millions Rp)	Started E-Commerce Operations Before 2010	7.18E-03	8.21358	0.19929	0.44642	33
22	Debit, Credit, Electronic Money Card Transactions	Started Commercial Operations 2010 to 2016	8.65E-03	7.79355	0.19105	0.43709	33
23	Cash Transactions	Do not Export Products	9.77E-03	7.52318	0.18565	0.43087	33
24	Cash Transactions	Export Products	9.77E-03	7.52318	0.18565	-0.43087	33
25	Debit, Credit, Electronic Money Card Transactions	Started E-Commerce Operations 2017 to 2019	9.83E-03	7.5096	0.18538	-0.43056	33

Table 6: Results of Spearman Rank Analysis on Data Set 2 (Results 26 to 50)

Result No.	Y (numerical)	X (numerical)	p-value	FStat	Rank R squared	Rank R	Df
26	House Hold Consumption 2019 Expenditure (Million Rp)	Started E-Commerce Operations Before 2010	1.33E-02	6.83896	0.17167	0.41432	33
27	Restaurants and Hotels 2019 (Expenditure Millions Rp)	Started Commercial Operations 2010 to 2016	1.64E-02	6.39331	0.16229	0.40286	33
28	Restaurants and Hotels 2019 (Expenditure Millions Rp)	Started Commercial Operations 2017 to 2019	2.08E-02	5.89665	0.1516	-0.38936	33
29	Miscellaneous Goods 2019 (Expenditure Millions Rp)	Started E-Commerce Operations Before 2010	2.25E-02	5.73388	0.14803	0.38475	33
30	Housing and Household Equipment 2019 (Expenditure Millions Rp)	Started E-Commerce Operations 2017 to 2019	2.46E-02	5.54451	0.14385	-0.37927	33
31	Clothing and Footwear 2019 (Expenditure Millions Rp)	Started E-Commerce Operations Before 2010	2.58E-02	5.44978	0.14174	0.37648	33
32	Food and Beverages 2019 (Expenditure Millions Rp)	Started E-Commerce Operations Before 2010	3.10E-02	5.08075	0.13342	0.36527	33
33	E-Wallet Transactions	Export Products	3.14E-02	5.05522	0.13284	0.36447	33
34	E-Wallet Transactions	Do not Export Products	3.14E-02	5.05522	0.13284	-0.36447	33
35	Debit, Credit, Electronic Money Card Transactions	Started Commercial Operations 2017 to 2019	3.55E-02	4.80676	0.12714	-0.35657	33
36	Restaurants and Hotels 2019 (Expenditure Millions Rp)	Started E-Commerce Operations Before 2010	3.89E-02	4.62758	0.12298	0.35069	33
37	Housing and Household Equipment 2019 (Expenditure Millions Rp)	Started Commercial Operations 2017 to 2019	4.01E-02	4.56913	0.12162	-0.34874	33
38	E-Wallet Transactions	Started E-Commerce Operations 2017 to 2019	4.15E-02	4.49793	0.11995	-0.34634	33
39	Debit, Credit, Electronic Money Card Transactions	Started E-Commerce Operations 2010 to 2016	4.58E-02	4.30706	0.11545	0.33978	33
40	Cash Transactions	Started E-Commerce Operations 2017 to 2019	4.80E-02	4.2193	0.11336	0.33669	33
41	House Hold Consumption 2019 Expenditure (Million Rp)	Started Commercial Operations 2017 to 2019	5.46E-02	3.97097	0.10741	-0.32773	33
42	Restaurants and Hotels 2019 (Expenditure Millions Rp)	Started E-Commerce Operations 2017 to 2019	6.25E-02	3.7179	0.10126	-0.31821	33
43	Clothing and Footwear 2019 (Expenditure Millions Rp)	Started Commercial Operations 2017 to 2019	6.32E-02	3.6961	0.10072	-0.31737	33
44	House Hold Consumption 2019 Expenditure (Million Rp)	Started Commercial Operations 2010 to 2016	6.42E-02	3.66829	0.10004	0.31629	33
45	Health and Education 2019 (Expenditure Millions Rp)	Started E-Commerce Operations 2017 to 2019	6.91E-02	3.53166	0.09667	-0.31092	33
46	Food and Beverages 2019 (Expenditure Millions Rp)	Started E-Commerce Operations 2017 to 2019	7.51E-02	3.37886	0.09288	-0.30476	33
47	Housing and Household Equipment 2019 (Expenditure Millions Rp)	Started E-Commerce Operations 2010 to 2016	7.65E-02	3.34474	0.09203	0.30336	33
48	Health and Education 2019 (Expenditure Millions Rp)	Started Commercial Operations Before 2010	7.66E-02	3.34185	0.09196	0.30324	33
49	Transportation and Communication 2019 (Expenditure Millions Rp)	Started E-Commerce Operations Before 2010	8.21E-02	3.21587	0.0888	0.29799	33
50	Health and Education 2019 (Expenditure Millions Rp)	Started Commercial Operations 2017 to 2019	8.26E-02	3.20381	0.08849	-0.29748	33

Table 7: Results of Spearman Rank Analysis on Data Set 2 (Results 51 to 75)

Result No.	Y (numerical)	X (numerical)	p-value	FStat	Rank R squared	Rank R	Df
51	Housing and Household Equipment 2019 (Expenditure Millions Rp)	Started Commercial Operations Before 2010	8.60E-02	3.132	0.08668	0.29442	33
52	Transportation and Communication 2019 (Expenditure Millions Rp)	Started Commercial Operations 2017 to 2019	8.63E-02	3.125	0.08651	-0.29412	33
53	House Hold Consumption 2019 Expenditure (Million Rp)	Started E-Commerce Operations 2017 to 2019	8.70E-02	3.11198	0.08618	-0.29356	33
54	Cash Transactions	Started E-Commerce Operations 2010 to 2016	9.02E-02	3.04742	0.08454	-0.29076	33
55	Food and Beverages 2019 (Expenditure Millions Rp)	Started Commercial Operations 2017 to 2019	9.15E-02	3.02183	0.08389	-0.28964	33
56	Housing and Household Equipment 2019 (Expenditure Millions Rp)	Started Commercial Operations 2010 to 2016	9.34E-02	2.98462	0.08294	0.288	33
57	Miscellaneous Goods 2019 (Expenditure Millions Rp)	Started Commercial Operations 2010 to 2016	9.42E-02	2.96881	0.08254	0.2873	33
58	E-Wallet Transactions	Started Commercial Operations Before 2010	9.70E-02	2.91869	0.08126	0.28506	33
59	E-Wallet Transactions	Started Commercial Operations 2017 to 2019	1.03E-01	2.81859	0.07869	-0.28052	33
60	Miscellaneous Goods 2019 (Expenditure Millions Rp)	Started Commercial Operations 2017 to 2019	1.05E-01	2.77934	0.07768	-0.27871	33
61	Clothing and Footwear 2019 (Expenditure Millions Rp)	Started E-Commerce Operations 2017 to 2019	1.12E-01	2.67163	0.07489	-0.27367	33
62	E-Wallet Transactions	Started E-Commerce Operations 2010 to 2016	1.12E-01	2.66713	0.07478	0.27346	33
63	Clothing and Footwear 2019 (Expenditure Millions Rp)	Started Commercial Operations 2010 to 2016	1.14E-01	2.6371	0.074	0.27203	33
64	Food and Beverages 2019 (Expenditure Millions Rp)	Started Commercial Operations 2010 to 2016	1.16E-01	2.60787	0.07324	0.27063	33
65	Miscellaneous Goods 2019 (Expenditure Millions Rp)	Started E-Commerce Operations 2017 to 2019	1.23E-01	2.50921	0.07066	-0.26583	33
66	ATM, Internet, and Mobile Banking Transactions	Started E-Commerce Operations Before 2010	1.28E-01	2.4347	0.06871	0.26213	33
67	House Hold Consumption 2019 Expenditure (Million Rp)	Started Commercial Operations Before 2010	1.29E-01	2.41953	0.06831	0.26136	33
68	Restaurants and Hotels 2019 (Expenditure Millions Rp)	Started Commercial Operations Before 2010	1.30E-01	2.41396	0.06816	0.26108	33
69	Restaurants and Hotels 2019 (Expenditure Millions Rp)	Started E-Commerce Operations 2010 to 2016	1.34E-01	2.36389	0.06684	0.25854	33
70	Debit, Credit, Electronic Money Card Transactions	Started Commercial Operations Before 2010	1.34E-01	2.36125	0.06677	0.25841	33
71	Transportation and Communication 2019 (Expenditure Millions Rp)	Started Commercial Operations Before 2010	1.48E-01	2.19507	0.06237	0.24974	33
72	Transportation and Communication 2019 (Expenditure Millions Rp)	Started Commercial Operations 2010 to 2016	1.52E-01	2.15102	0.06119	0.24737	33
73	Clothing and Footwear 2019 (Expenditure Millions Rp)	Started Commercial Operations Before 2010	1.54E-01	2.12485	0.06049	0.24596	33
74	Debit, Credit, Electronic Money Card Transactions	Export Products	1.61E-01	2.05651	0.05866	0.2422	33
75	Debit, Credit, Electronic Money Card Transactions	Do not Export Products	1.61E-01	2.05651	0.05866	-0.2422	33

Table 8: Results of Spearman Rank Analysis on Data Set 2 (Results 76 to 100)

Result No.	Y (numerical)	X (numerical)	p-value	FStat	Rank R squared	Rank R	Df
76	E-Wallet Transactions	Started Commercial Operations 2010 to 2016	1.69E-01	1.98213	0.05666	0.23804	33
77	Food and Beverages 2019 (Expenditure Millions Rp)	Started Commercial Operations Before 2010	1.72E-01	1.94901	0.05577	0.23615	33
78	Transportation and Communication 2019 (Expenditure Millions Rp)	Started E-Commerce Operations 2017 to 2019	1.72E-01	1.94872	0.05576	-0.23613	33
79	Open Unemployment Rate (August 2019)	Started E-Commerce Operations 2010 to 2016	1.76E-01	1.91462	0.05484	-0.23417	33
80	Health and Education 2019 (Expenditure Millions Rp)	Started E-Commerce Operations 2010 to 2016	1.86E-01	1.82383	0.05237	0.22885	33
81	Food and Beverages 2019 (Expenditure Millions Rp)	Started E-Commerce Operations 2010 to 2016	2.00E-01	1.71277	0.04934	0.22213	33
82	ATM, Internet, and Mobile Banking Transactions	Started E-Commerce Operations 2017 to 2019	2.20E-01	1.56463	0.04527	-0.21276	33
83	E-Wallet Transactions	Started E-Commerce Operations Before 2010	2.23E-01	1.54267	0.04466	0.21133	33
84	House Hold Consumption 2019 Expenditure (Million Rp)	Started E-Commerce Operations 2010 to 2016	2.26E-01	1.52371	0.04414	0.21008	33
85	Clothing and Footwear 2019 (Expenditure Millions Rp)	Started E-Commerce Operations 2010 to 2016	2.35E-01	1.46486	0.0425	0.20616	33
86	Cash Transactions	Started E-Commerce Operations Before 2010	2.39E-01	1.44029	0.04182	-0.2045	33
87	Miscellaneous Goods 2019 (Expenditure Millions Rp)	Started Commercial Operations Before 2010	2.51E-01	1.36519	0.03973	0.19931	33
88	Health and Education 2019 (Expenditure Millions Rp)	Started Commercial Operations 2010 to 2016	2.55E-01	1.34153	0.03906	0.19765	33
89	ATM, Internet, and Mobile Banking Transactions	Started E-Commerce Operations 2010 to 2016	2.72E-01	1.24633	0.03639	0.19077	33
90	Open Unemployment Rate (August 2019)	Started E-Commerce Operations Before 2010	2.75E-01	1.23298	0.03602	0.18978	33
91	Cash Transactions	Started Commercial Operations 2017 to 2019	2.83E-01	1.1899	0.0348	0.18655	33
92	Other Transactions	Started Commercial Operations 2010 to 2016	2.84E-01	1.18787	0.03475	0.1864	33
93	Miscellaneous Goods 2019 (Expenditure Millions Rp)	Started E-Commerce Operations 2010 to 2016	2.86E-01	1.17514	0.03439	0.18543	33
94	Cash Transactions	Started Commercial Operations 2010 to 2016	2.87E-01	1.16997	0.03424	-0.18504	33
95	Other Transactions	Export Products	3.16E-01	1.0359	0.03044	0.17446	33
96	Other Transactions	Do not Export Products	3.16E-01	1.0359	0.03044	-0.17446	33
97	Transportation and Communication 2019 (Expenditure Millions Rp)	Started E-Commerce Operations 2010 to 2016	3.29E-01	0.98242	0.02891	0.17003	33
98	Open Unemployment Rate (August 2019)	Started E-Commerce Operations 2017 to 2019	3.43E-01	0.92663	0.02731	0.16527	33
99	Other Transactions	Started E-Commerce Operations 2010 to 2016	3.85E-01	0.7742	0.02292	0.1514	33
100	Other Transactions	Started Commercial Operations 2017 to 2019	4.12E-01	0.69185	0.02053	-0.1433	33

Table 9: Results of Spearman Rank Analysis on Data Set 2 (Results 101 to 112)

Result No.	Y (numerical)	X (numerical)	p-value	FStat	Rank R squared	Rank R	Df
101	Other Transactions	Started E-Commerce Operations 2017 to 2019	4.13E-01	0.68766	0.02041	-0.14287	33
102	Cash Transactions	Started Commercial Operations Before 2010	4.49E-01	0.58719	0.01748	-0.13222	33
103	Other Transactions	Started E-Commerce Operations Before 2010	5.48E-01	0.36786	0.01102	0.105	33
104	Open Unemployment Rate (August 2019)	Export Products	5.97E-01	0.28448	0.00855	0.09245	33
105	Open Unemployment Rate (August 2019)	Do not Export Products	5.97E-01	0.28448	0.00855	-0.09245	33
106	ATM, Internet, and Mobile Banking Transactions	Started Commercial Operations 2017 to 2019	6.30E-01	0.23709	0.00713	-0.08446	33
107	ATM, Internet, and Mobile Banking Transactions	Started Commercial Operations 2010 to 2016	6.45E-01	0.21664	0.00652	0.08076	33
108	Other Transactions	Started Commercial Operations Before 2010	6.51E-01	0.209	0.00629	0.07933	33
109	Open Unemployment Rate (August 2019)	Started Commercial Operations 2017 to 2019	6.96E-01	0.15488	0.00467	0.06835	33
110	Open Unemployment Rate (August 2019)	Started Commercial Operations Before 2010	7.65E-01	0.09081	0.00274	-0.05238	33
111	ATM, Internet, and Mobile Banking Transactions	Started Commercial Operations Before 2010	8.66E-01	0.02885	0.00087	0.02956	33
112	Open Unemployment Rate (August 2019)	Started Commercial Operations 2010 to 2016	9.00E-01	0.01617	0.00049	0.02213	33

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