Technical Report

The Fourth Research Dive on
Trade and Competitiveness

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Summary

As the fourth industrial revolution continues to create new industries as well as transform legacy sectors, it is important for Indonesia to acquire more sophisticated productive capabilities. Opportunities abound for access to new markets and for accelerated economic growth, should businesses invest in technological learning.

Digital connectivity enables the digital economy and produces abundant data flows. To understand the complex nature of modern economies, digital data has proven valuable. For instance, e-commerce data is important for mapping the economic impact of digitisation on retail industries, while postal data provides insights on trends of cross-border goods and document flows. Real-time information from which researchers can infer insights on physical connectivity can also contribute to the advancement of operational systems parallel to digital connectivity.

The Government of Indonesia is taking steps to improve national industrial competitiveness to ensure continued economic development. The country is predicted to achieve economic growth worth 150 billion USD each year from digitization alone[1]. Accordingly, the Indonesian Government aims to promote trade and investment, to increase efficiency and transparency, to provide a supportive digital innovation ecosystem, and to enhance logistics competitiveness. To foster digital transformation, it is important to collaborate with a broad category of stakeholders.

To support the efforts of the Government of Indonesia, as well as enhance researchers' familiarity with new types of data, Pulse Lab Jakarta hosted 23 researchers, consisting of economists, data analysts and engineers, for the fourth *Research Dive for Development* on the topic of trade and competitiveness. The participants explored specific datasets, guided by a few senior academics and a trade advisor from the Australia Indonesia Partnership for Economic Governance (AIPEG). The *Research Dive* covered four areas related to trade and competitiveness: (1) port network connectivity; (2) regional connectivity; (3) proxies for economic trends and shocks; and (4) meaningful correlations between postal network data and trade network data.

This report captures the findings from this research sprint and is structured as follows:

1. The first paper provides background information on the different datasets that were assigned to the participants.
2. The second paper discusses *Port connectivity in South-East Asia using Global Marine Vessel Automatic Identification System (AIS) Data*. This study analysed current port connectivity in East and South-East Asia and modeled the integration of existing network in Indonesia under the *Tol Laut* masterplan. Among other findings the research confirms the common perception that a lack of connectivity between Eastern Indonesia and East Asia exists but that the successful implementation of the *Tol Laut* master plan should have the effect of balancing the maritime network within Indonesia.
3. The third paper explores *E-Commerce Based Regional Connectivity in Indonesia* using OLX data. This research investigated inter-city connectivity by analysing price uniformity as a proxy. The research found that most areas in Indonesia still have low connectivity within and between cities.
4. The fourth paper investigates methods for *Constructing Proxies of Macroeconomic Trends Using E-Commerce Data* provided by OLX. This research looked at the possibility of identifying proxies for economic growth. The research found, among others, that e-commerce sales can increase GDP growth indirectly, and that the sell-rent ratio of property indicates that some provinces outside Java have experienced economic growth while areas in Java have experienced a mild downturn over the timeframe of the dataset.
5. The fifth paper involves an *Analysis of Correlations between Postal and Trade Network Data within ASEAN Countries and Beyond.* The study confirms the high correlation between postal network data and trade network data, and each of those data sets with socio-economic indicators.

Pulse Lab Jakarta is grateful for the cooperation of OLX Indonesia, AIPEG, Universitas Indonesia, Universitas Airlangga, World Bank, Universitas Gadjah Mada, Universitas Khairun, Institut Teknologi Indonesia, Institut Teknologi Sepuluh Nopember, Universitas Internasional Semen Indonesia, Universitas Sebelas Maret, Center for Strategic and International Studies, Institut Teknologi Bandung, Universitas Diponegoro, Universitas Brawijaya, the Ministry of Trade of the Republic of Indonesia and the Coordinating Ministry of Economic Affairs of the Republic of Indonesia.

[1] http://www.mckinsey.com/indonesia/our-insights/unlocking-indonesias-digital-opportunity

Advisor Notes

Teamwork for More Trade and More Competitive Indonesia

The research dive was not only benefiting participants though access to a few big dataset but also providing an avenue for them to network. The group, in a very limited time managed to get various big datasets to 'talk'. The participants, young and high-potential researchers with different specialization were very enthusiastic with the tasks assigned to them. They even had identified further research as a follow up to the activities. I am feeling blessed to join this crowd of young and energetic researchers – their energy is contagious. The tasks assigned to them were carefully designed so the result is meaningful. The global marine vessel automatic identification system data for example allows participants to identify busy ports in the eastern part of Indonesia which might be used in selecting potential hub-seaports in the east of Indonesia. The e-commerce data allows participants to draw some conclusion about recent trend in inter-city trade and price disparity. The postal data tells the intensity of intra and extra ASEAN parcels. Noting the importance of e-commerce, I would strongly encourage researchers to cooperate with e-commerce platforms to tell more about Indonesia's economy using e-commerce transaction.

Titik Anas, Ph.D
Advisor on Trade

Titik Anas, Ph.D currently serves as Trade Advisor in AIPEG, Managing Director at PT Rumah Riset Presisi Indonesia, and also as a senior lecturer at Universitas Padjajaran. Her research interest is in the area of international trade issues. Her recent research topics are Evaluating the Business Environment in Indonesia, Missing Middle in Indonesia Manufacturing Exports and The Efficiency of Major Ports in Indonesia, and Impact of Trans Pacific Partnerships on Investment in the Manufacturing Sector. Titik Anas obtained her Ph.D in Crawford School of Economics and Government College of Asia and the Pacific.

Collaboration in Making Sound Analysis of Big Data

This is a great opportunity to be an advisor at Research Dive: Trade and Competitiveness hold by Pulse Lab Jakarta. Research dive is an innovative idea to invite young researchers to explore a non-traditional dataset of Big Data. This is a very challenging activity that forces researchers to think innovatively and creatively in utilizing and exploring a big data to answer or explain the recent issue on trade and competitiveness. Making "Big Data" becoming "Sound" needs collaboration between experts from different disciplines. Therefore, Research Dive initiated by Pulse Lab Jakarta has forced people, researchers, and experts to be more open minded and willing to collaborate with each other.

I am very lucky to supervise a group from diverse background, that are trying to explore OLX database on trading of motorcycle and automobile to answer a relationship between connectivity (infrastructure) and price uniformity. The more uniform price in a region reflects the higher connectivity. Given the available data, this group has nicely explored this issue. I hope the research dive can be continued for introducing "Big Data" to solve the current issues of development in Indonesia.

Teguh Dartanto, Ph.D
Advisor on Economics

Teguh Dartanto is Director of Undergraduate Program in Economics, Faculty of Economics and Business, University of Indonesia and Head of Poverty and Social Protection, Institute for Economic and Social Research (LPEM), University of Indonesia. His specialization is in poverty analysis, development economics, applied general equilibrium, and microeconometrics. He received Monbukagakusho Scholarship and earned his master of Economics degree at Hitotsubashi University and PhD in International Development at Nagoya University. Before starting his career at University of Indonesia, Dr. Dartanto was a research associate at Japan International Cooperation Agency (JICA) Research Institute in Tokyo and starting from April 2015, he became a visiting scholar at JICA.

Advisor Notes

Utilizing Big Data to Design Sound Public Policies

The Research Dive: Trade and Competitiveness conducted by UN Pulse Lab Jakarta is an excellent program to unearth complex problems in trade and competitiveness. A good policy should be based on empirical evidence, and the design of the research dive is like a "hackathon" activity in utilizing big data to design sound public policies in some important areas such as regional trade, port connectivity, and e-commerce activity. I am also impressed with the quality and determination of all participants. They come from different backgrounds and are eager to work for long hours for three consecutive days to answer the challenging questions in their research. Their skill in data analytic is also amazing so that they are able to find relevant data in a big database for their research. I strongly suggest the research dive to be conducted more frequent and across different sectors.

Yudo Anggoro, Ph.D
Advisor on Industrial Competitiveness

Yudo Anggoro, Ph.D, is the Deputy Director of School of Business and Management, Institut Teknologi Bandung for the Jakarta campus. He received his Ph.D in Public Policy and Economic Competitiveness from University of North Carolina. Selected research from his portfolio covers: Industry Clusters to Drive Economic Competitiveness in Indonesia, Governance and Government Performance in Latin America, and Industrial Competitiveness in Indonesia.

Big Data for Recent Indonesian Trade

The first time I was invited by PLJ as a research advisor and being told that these events used big data to produce any productive insights, I was very interested. I think it's very challenging to collect and analyze large datasets that have been given to the participants to generate useful information for the policy makers especially in trade.

Trade pattern has changed tremendeously in the last two decades including in Indonesia as a small open economy. In Indonesia's emerging market, the middle class is set to become the primary purchasing force as their income rises. By 2030, Indonesia's middle class is expected to expand to around 20 million households, with a disposable income of $11,300 per household – huge growth from the middle class that sat at 17 million households with $6,300 disposable income per household in 2014.

With the rising purchasing power of the middle, the country's e-commerce is increasing significantly. In 2016 Indonesians spent about $228 per user on online shopping. Many transactions of everdaylife have been engaged using online shopping especially in big cities.

It is interesting to correlate the big data such as global marine vessel automatic identification system data, e-commerce data provided by OLX and postal network data, with economic activities. As an advisor, it is important to remind the participants to focus on the data and its related issues. The participants had to face challenges such the difficulties to correlate data from OLX with other data sources from BPS, and Bank Indonesia.

I am honoured to be part of this event. It is a pleasure to meet and discuss with PLJ members, academics, practitioners, and all participants that commit to succed this event. Finally I look forward to the final report. Hopefully the report can be used as materials for the decision makers to create policy that related with trade and competitiveness issues. Thank you PLJ, thank you all colleagues and participants.

Rossanto Dwi Handoyo, Ph.D
Advisor on Economics

Rossanto Dwi Handoyo, Ph.D, graduated from the School of Economics, Universiti Kebangsaan Malaysia. Currently Rossanto is a lecture at the Faculty of Economics and Business, Universitas Airlangga. He has conducted research on the Impact of Monetary Policy and Fiscal Policy on Indonesian Stock Market and Mapping of Potentials, Capacity Building and Assist the Micro, Medium and Small Enterprise in East Java

Research Dive

Advisors

Titik Anas	Australia Indonesia Partnership for Economic Governance (AIPEG)
Teguh Dartanto	Universitas Indonesia
Yudo Anggoro	Institut Teknologi Bandung
Rossanto Dwi Handoyo	Universitas Airlangga

Researchers

Group 1 – Analysis of port network connectivity, national or ASEAN-wide

Hafida Fahmiasari	World Bank
Budhi Sholeh Wibowo	Universitas Gajah Mada
Chairullah Amin	Universitas Khairun
Silvia Merdikawati	Institut Teknologi Indonesia
Dwi Kristianto	Institut Teknologi Sepuluh Nopember
George Hodge	Pulse Lab Jakarta

Group 2 – Analysis of inter-city connectivity in Indonesia

Siti Nurminarsih	Universitas Internasional Semen Indonesia
Khresna Bayu Sangka	Universitas Sebelas Maret
Tengku Munawar Chalil	Osaka University
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Group 3 – Analysis of proxies in e-commerce data for city-level and national economic trends and shocks

Ahmad Syarif	Universitas Gajah Mada
Grace Citra Dewi	Centre for Strategic and International Studies (CSIS)
Ilwa Nuzul Rahma	Universitas Indonesia
Riska Pujiati	Kementerian Perdagangan Indonesia
Hervind	OLX Indonesia

Group 4 – Analysis of correlations between postal network data and trade network data within ASEAN

Rezzy Eko Caraka	Bina Nusantara University
Nurrohman Wijaya	Institut Teknologi Bandung
Muhammad Mujiya Ulkhaq	Universitas Diponegoro
Putu Mahardika Adi Saputra	Universitas Brawijaya
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Research Dive: Data Description and Research Tasks

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ABSTRACT

Globalization is a fundamental feature of the modern economy, and the fourth industrial revolution is accelerating integration. The emergence of new communications technology, as well as networks of physical devices, the so-called 'internet of things', is enhancing digital connectivity and enabling the digital economy. Indonesia, as a developing country with a growing digital ecosystem, places a strong focus on economic and trade development. The Government of Indonesia is developing policies and programs to leverage digital connectivity to these ends.

In order to support the government, Pulse Lab Jakarta organized a Research Dive for Development, where 23 researchers were invited to analyze global marine vessel Automatic Identification System (AIS) data, e-commerce data, and postal network data, with a view to generating insights on trade and economic structure. This paper describes the data sets in detail and helps to contextualize the technical papers that follow. The data were provided by Pulse Lab Jakarta and its partners, in particular OLX Indonesia.

1 INTRODUCTION

International trade is perceived to be an enabler of inclusive economic growth and sustainable development under the post-2015 development agenda[1]. Global connectivity, already extensive, is being enhanced by the fourth industrial revolution which is creating more channels for the flow of finance, technology and ideas. The penetration of new digital technologies and their acceptance across the world, is facilitating an increase in global supply chain efficiency and an associated decrease in costs. For instance, online platforms enable new forms of production and cross-border exchanges, even by small players such as individuals and SMEs.

While it is broadening economic opportunities, digital connectivity is also generating huge data reserves and flows. These abundant digital data are valuable for understanding macro issues, such as global economic landscape, as well as micro issues, such as consumer preferences. Digital transactions from e-commerce, for example, hold potential as a proxy to measure macroeconomic indicators such as purchasing power and inflation. The cross-border flow of documents and goods from postal or shipping data may represent the strength of connectivity between countries. Real-time information from which any physical connectivity can be inferred, may also contribute to the advancement of operational systems parallel to digital connectivity.

Indonesia is a developing country which targets trade to drive its impressive economic growth, as well as hosts a vast and growing digital ecosystem. Based on World Bank data from 2016, trade has contributed to 37% of GDP. In turn the economic impact of the digital ecosystem has continuously accelerated, such that in the second quarter of 2017, the information and communication sector contributed to 10.88% of growth in production side[2]. Projecting this trend forward, the country is predicted to gain an economic impact worth 150 billion USD each year from digitization[3].

Responding to the opportunities, the Government of Indonesia is taking steps to improve national industrial competitiveness to ensure a significant economic growth. The Government continues to build upon its existing series of economic policy packages, including easing permit requirements and simplifying export requirements, developing a road-map for e-commerce, and improving logistics. These economic policies aim to promote trade and investment, to increase efficiency and transparency, to provide a supportive innovation ecosystem, and to enhance the competitiveness of the logistics sector.

One of the challenges now is how to make the best use of the manifold data generated by the ongoing digital transformation, how to translate the data into insights and how to best support the government to understand and act upon the opportunities in the current economic landscape in Indonesia and beyond. Utilizing the digital data is important especially for the Government as it further fosters structural transformation of the economy.

In collaboration with OLX Indonesia, Pulse Lab Jakarta organized Research Dive for Development, by hosting 17 academics and researchers from diverse disciplines, including economists, data analysts and engineers, for a research sprint. The objective was to extract insight from digital data related to trade and economic structure, which may support the efforts of the Government of Indonesia to improve national competitiveness and ensure continued economic growth.

Researchers were given access to global marine vessel Automatic Identification System (AIS) data, e-commerce data, and postal network data. The participants were divided into four groups with different tasks; (a) to analyze port connectivity using vessels data, (b) to infer city inter-connectivity based on e-commerce data, c) to investigate proxy for economic shock and trend using e-commerce data, and (d) to analyze the correlation between postal network and trade network.

2 DATASETS

In this section, we briefly explain three types of data were made available under non-disclosure agreements to the participants for analysis during the Research Dive for Development.

[1] http://unctad.org/meetings/en/SessionalDocuments/cid33_en.pdf

[2] https://en.tempo.co/read/news/2017/08/07/056897794/BPS-Announces-Q2-Economic-Growth-at-501

[3] http://www.mckinsey.com/indonesia/our-insights/unlocking-indonesias-digital-opportunity

Table 1: Example of AIS Data

Column name	Column description	Example of value
device_id	Device id from orbcomm	rORBCOMM104
timestamp	Timestamp in second	4/1/16 7:00
mmsi	9 digits of Maritime Mobile Service Identity	355929000
sog	Speed over ground	14.80000019
cog	Course over ground	348.3999939
x	lat	152.1626892
y	lon	1.448551655

2.1 Global Marine Vessel Automatic Identification System (AIS) Data

The Global Marine Vessel Automation Identification System (AIS) is an automatic and autonomous tracking system which is used in the maritime world for exchange of navigational information between AIS-equipped terminals. AIS transponders (located on vessel stations) include a GPS (Global Positioning System) receiver that record subject's position and movement details.

AIS information is used for several purposes, for instance collision avoidance, fleet monitoring and tracking, and vessel traffic services, among others. Nowadays, this information also used for the purposes of research. For this Research Dive for Development, Pulse Lab Jakarta acquired historical AIS data, collected in April 2015 by TerraMar Networks. This data includes a world-wide data set and contains 345,800,000 records of AIS raw data such as device ID, the Maritime Mobile Service Identity, the subject's location in latitude and longitude format, the subject's course over ground, and time information (in milliseconds).

2.2 E-commerce Data

In partnership with OLX Indonesia, for the purposes of the Research Dive, PLJ made an e-commerce data set collected olx.co.id from January 2016 until June 2017 available to the participants. We provide the aggregated data set at category-level following the category structure of the OLX Indonesia platform itself.

The aggregated data is segregated by several attributes such as a seller type (individual / company), time (weeks) and category-level (three steps, as used by the OLX Indonesia platform). We then calculate related information such as the number of product listings, average price (advertised price and sale price), trimmed average price (excluded top and bottom 5% of data), total number of viewers and total number of contacts. The variables are described in table 2.

Besides the aggregated data, Pulse Lab Jakarta also shared listing level data for three main categories, namely Property, Car and Motorcycle. This information includes special attributes for each category for instance property type, plot area, building area for property and car / motorcycle type for car and motorcycle categories. Table 3 shows an example of listing data we released for during the Research Dive.

Table 2: Example of E-commerce Data

Column name	Column description	Example of value
year	Year	2016
week	ISO week	1
listing_city_id	Reference to city id	10
category_id	Reference to category id	88
category_level	Category level (1, 2 or 3)	1
seller_type	Seller type	high
total_seller	Total seller	3
total_listing	Total listing	5
avg_price	Average price	147700000
avg_price_sold	Average price item sold	112666666
avg_price_trimmed	Average price trimmed (5% bottom and 5% upper)	398000000
std_price	Standard deviation of price	147840961.8
total_sold	Total sold	3
total_liquid	Liquid = Dalam 7 hari pertama dapat kontak minimal dari 3 orang	0
total_viewer	Total view	332
total_contact	Total contact	2

Table 3: Example of Property Listing Data

Column name	Column description	Example of value
year	Year	2016
week	ISO week	37
listing_city_id	Reference to city id	24
category_id	Reference to category id	5158
property_type	Property type	rumah
category_name	category_name	Dijual
category_level	category_level	3
seller_type	seller_type	high
listing_id	listing_id	287925931
price	price	300000000
plot_area	land area	60
net_area	property area	45
sold	sold	0
liquid	liquid	0
viewer	viewer	6
buyer	buyer	0

2.3 Postal Network Data

This data set contains the information about postal packages at the country level, from October 2010 to June 2015. It includes origin country and destination country, category of packages such as letter, parcel, EMS, others and the normalized value of package count and weight. Detailed information related to the variables, and a sample of the data is shown in Table 4.

Table 4: Example of Postal Network Data

Column name	Column description	Example of value
Origin	Country origin (2 letter standard format - ISO 3166-1 alpha-2)	AE
destination	Country origin (2 letter standard format - ISO 3166-1 alpha-2)	BN
mailclass	classname	C
year	year	2014
week	ISO week	2
weightnorm	Weight of package (normalize)	0.1764
Itemsnorm	Number of package / items (normalize)	0.5
classname	Classname detail from mailclass	Parcel

3 DATA AND TASK MAPPING

At the Research Dive for Development, we defined the broad research questions along with the data sets. In addition, participants could use their own data sets to answer the research questions.

The Global Marine Vessel Automatic Identification System (AIS) data was given to the first group. The first group used the AIS data to analyze the current network of the maritime transport in South East Asia. E-commerce data was shared with the second and third group. The second group use the second-hand price variation data to indicate the inter-city (and inter-region) connectivity. The third group analyze the e-commerce data to identify proxies for macroeconomic trends. Postal network data was shared with the fourth group to analyze the correlation with trade network data across ASEAN.

The researchers invited to the Research Dive for Development included economists, industrial engineers with expertise in logistics, urban and regional planners with expertise in regional economics development, and marine engineers.

The event was a "hackathon"-like research sprint, where the high-potential researchers demonstrated their skills and creativity, as the following technical papers demonstrate.

Analyzing Port Connectivity in South-East Asia using Global Marine Vessel Automatic Identification System Data

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ABSTRACT

Maritime transport plays a critical role in economic development for the littoral member states of the Association of Southeast Asian Nations (ASEAN). In the era of big data, the global marine vessel automatic identification system (AIS) is an important instrument for analyzing the maritime transport network. Aligned with this potential, the Government of Indonesia (GoI) envisions a greater role for the country as the global maritime axis, by setting up several maritime development plans, including "Tol Laut". This study aims to analyze current port connectivity in South-East and East Asia and the further integration of the existing network under the *Tol Laut* development plan. We use two approaches: betweenness centrality and network efficiency. Betweenness centrality analysis suggests that *Tol Laut* could reduce ASEAN maritime transport dependency on Singapore. The network efficiency analysis suggests that should Bitung became a hub port in Eastern Indonesia, it would lead to a 20% increase in network efficiency when compared to the status quo, as well as when compared to the model for Sorong as a hub port.

1 INTRODUCTION

Maritime transportation is the lifeblood of the world economy. Between 1990 and 2013 worldwide maritime trade more than doubled, with total volumes in 2013 reaching nearly 9.6 billion tons [8]. There is substantial pressure on the road and air networks and limited possibilities for extending them, while transportation by ship continues to experience rapid growth. Today, more than 80% of international trade in goods is carried by sea [7]. In South-East Asia, ASEAN member states recognize that maritime transport, as a critical logistics and services support sector, is a catalyst for economic development and international competitiveness [2]. The economic integration of ASEAN prioritizes the development of transport in order to link better and bind its member states.

Alongside ASEAN, Indonesia is a focus of this study. This country has near unique opportunities and challenges deriving from its scale as an archipelagic state. Consistent with ASEAN's focus on the development of transport, the Government of Indonesia has prioritized maritime connections under its broader strategy for national and local economic development. *Tol Laut*, the backbone container network program, is a current priority, which is initiated with a view to balancing economic development from the western to the eastern part of the country [3].

In the context outline above, this study aims: (i) to analyze the current port connectivity in East and South-East Asia, including ASEAN, (ii) to compare scenarios for the implementation of the *Tol Laut* network.

2 RESEARCH METHODOLOGY

2.1 Data

The study uses a worldwide satellite and terrestrial-based Automatic Identification System (AIS) data set, collected in April 2016 by TerraMar Networks. AIS is a ship collision avoidance technology, mandated by the International Maritime Organization (IMO) to be installed on ships exceeding 300 gross tonnes. It transmits information such as the Maritime Mobile Service Identity (MMSI), latitude, longitude, speed over ground (SOG), and course over ground (COG) via a VHF transmitter every few seconds. The signals are received and collected by AIS transceivers fitted on other ships or land based systems, such as VTS. The data set used in the study stands at 44 gigabytes (GB) and has more than 360 million rows of data, including the global position of vessels from all around the world every few seconds for one full month. Since the objective of this study is to analyze the port connectivity in East and South-East Asia, the data set is filtered to include these sub-regions which comprises about 15% of the total data set. See Figure 1 for a snapshot of global marine vessel positions drawn from the data set.

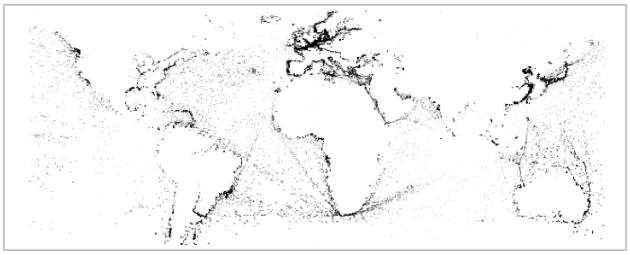


Figure 1: Snapshot of global marine vessel positions from AIS data

2.2 Methodology

Concerning data processing, since we are only interested in port connectivity, we limit the data to Class A AIS message type 1, 2 and 3 which are used to report ship position. The time frame of the data covers April 2016. The study focuses on the the East and South-East Asia sub-regions, so we limit the data using latitude and longitude to include only ship movements within this area. Furthermore, we use an in-house data fingerprint to limit and remove duplicated data rows. The fingerprint is the result of the MD5 hash function of latitude, longitude, speed over ground (SOG) and course over ground (COG). We also round the latitude and longitude to the nearest five decimal digits to increase the fingerprint effectiveness.

We then select 47 strategic ports in the East and South-East Asia sub-regions. Using the coordinates for these ports, we create a virtual area at each port with a radius 20 km from the port center. Processing the ship movement data, we use the virtual port areas to generate source and destination data on ship voyages. Using the port name and ship MMSI, we limit duplicated ship visits at each port.

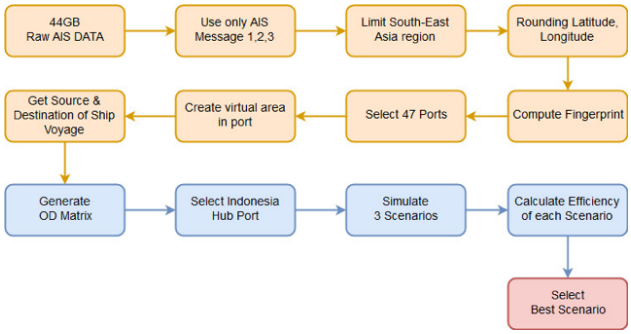


Figure 2: Research Methodology

By using the data pocessing technique described above, we generate information on the origin and destination of the ship voyage from AIS data. The generated Origin/Destination (O/D) matrix can be translated into a graph $G = (V, E)$, where V is a set of nodes and E is a set of edges. The graph serves as starting point in network connectivity analysis.

We analyze port connectivity in East and South-East Asia based on two approaches. The first approach is to measure network centrality based on the betweenness centrality method [1] [4] [5]. This method measures centrality based on the total number of shortest paths between the pairs of nodes in the graph. Therefore, in this case, it will identify the centrality of ports in East and South-East Asia based on the generated O/D matrix. Betweenness centrality of a node v is defined as the sum of the fraction of all-pairs shortest paths that pass-through v:

$$C_B(v) = \sum_{s,t \in V} \frac{\sigma(s,t|v)}{\sigma(s,t)}$$

where V is the set of nodes, $\sigma(s,t)$ is the number of shortest (s,t)-paths, and $\sigma(s,t|v)$ is the number of those paths passing through some node v other than (s,t). If $s = t, \sigma(s,t) = 1$ and if $v \in s,t, \sigma(s,t|v) = 0$.

Table 1: Betweenness centrality of ports in East and South-East Asia

Port	Betweenness Centrality
Singapore	67%
Tanjung Priok	51%
Kaohsiung	31%
Tanjung Perak	25%
Hongkong	22%
Manila	11%
Makassar	11%
Sorong	10%
Shanghai	7%
Laem Chabang	5%

The second approach is to measure network efficiency. Network efficiency is the ratio of useful work performed by several interconnected nodes and edges in operations [6]. It is formulated as follows:

$$\varepsilon = \frac{\sum_{w \in W} \frac{d_w}{\lambda_w}}{n_w}$$

where ε is network efficiency, d_w is demand in O/D pair w, λ_w is minimum cost in path w (we use transport time in this case), and n_w is the number of O/D pairs inside the network. The equation shows that the efficiency of the network is proportional to the sum of ratio between demands in O/D pair w to minimum cost in path w, but inversely proportional to the number of O/D pair w.

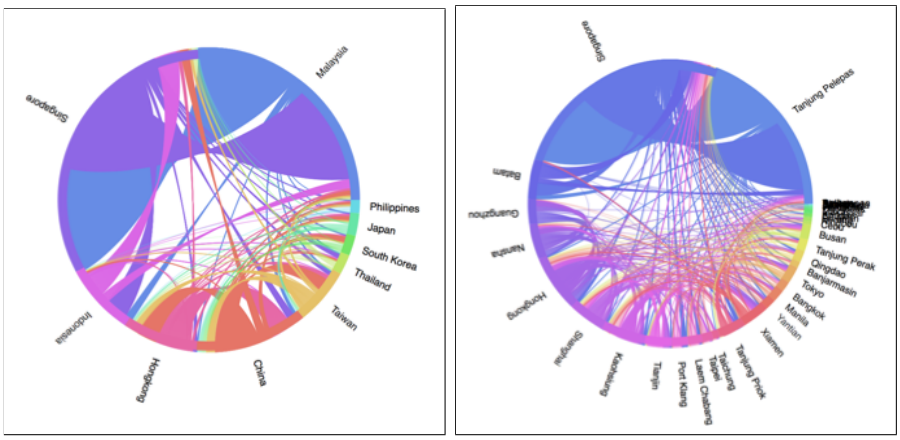
3 RESULTS AND DISCUSSION

The O/D matrix approximation generates 317 O/D pairs from 47 strategic ports in East and South-East Asia. Figure 3a and 3b show the chord diagram of O/D matrix generated from the AIS data. It depicts ports connectivity and actual trip distribution of the vessels at country and port levels.

It can be seen from figure 3 that Singapore-Malaysia route has the highest trip traffic. Their ports serve more than 900 trips per month between them alone. The Indonesia-Singapore route comes next with 215 trips per month, and then Hong Kong-China route with 190 trips per month.

Figure 4 shows the O/D matrix in the form of a graph. It reveals that there is lack of connectivity between east Indonesia and East Asia. It shows that almost every shipment from east Indonesia routes through Singapore to perform shipments to Hong Kong, Kaohsiung, or Tokyo.

The betweenness centrality for ports is shown in table 1. Singapore has the highest rank with betweenness centrality of 67%. It means that 67% of vessels in the network route via Singapore to reach other destinations. This value confirms Singapore's dominance in maritime logistics, where more than half of ports in East and South-East Asia are dependent on Singapore port. The betweenness centrality values are also represented in Figure 4 as the size of the red nodes.



(a) Country level **(b) Port level**

Figure 3: Chord diagram of O/D matrix

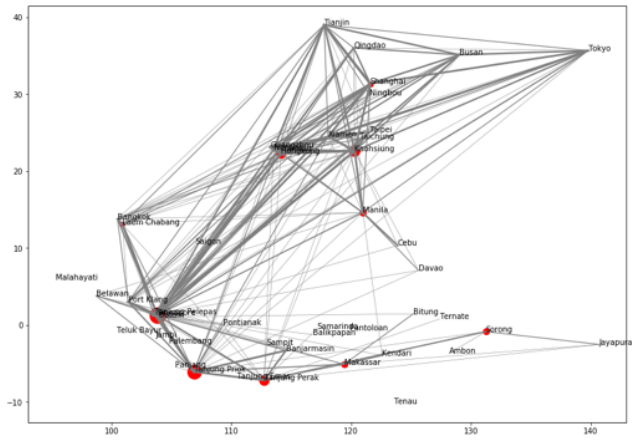


Figure 4: Ports networks in East and South-East Asia based on AIS data

3.1 Scenario Analysis

One of the aims of the study is to evaluate the impact of the *Tol Laut* plan on network connectivity. The idea of *Tol Laut* is to connect the western and the eastern parts of Indonesia through a hub-feeder network. In this study, we formulate two possible scenarios where either Bitung port or Sorong port become the international hub in the eastern part of Indonesia. Scenario 1 models Bitung as the hub port, while in Scenario 2, Sorong is the alternative. Both scenarios assume that there will be at least one vessel per week passing through each port on the *Tol Laut* route. The network difference between those two scenarios can be seen in Figure 5.

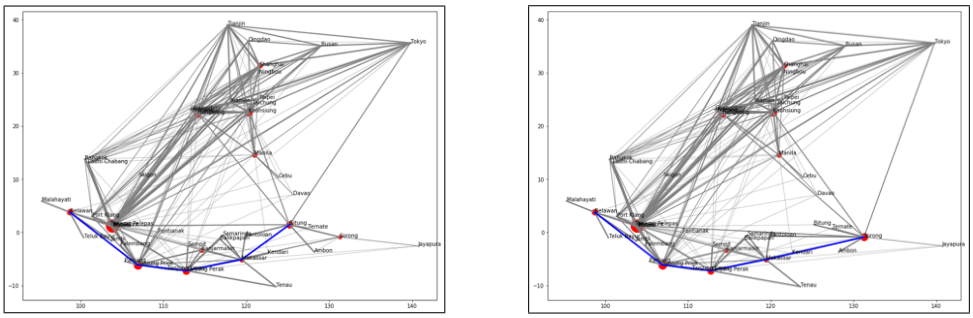
The result of betweenness centrality analysis for the two scenarios can also be seen in Figure 6. It shows that the implementation of *Tol Laut* can reduce network dependency on Singapore by 8% and on Tanjung Priok by 24%. *Tol Laut* not only increases centrality distribution to the east, but it also increases centrality in the west such as in the ports of Belawan and Batam by about 12%. The result of network efficiency analysis shows that current network and Scenario 2 each have an efficiency of 2.5 trips/day. Scenario 1, with Bitung as a hub, results in 3 trips/day efficiency. Thus, Scenario 1 increases the efficiency by 20% from both the current network and Scenario 2.

4 CONCLUSIONS

The research confirms the common perception that a lack of connectivity between Eastern Indonesia and East Asia exists. Based on the betweenness centrality, the implementation of *Tol Laut* can reduce network dependency on Singapore by 8% and on Tanjung Priok by 24%. This suggests that successful implementation of the *Tol Laut* master plan should have the effect of balancing the maritime network within Indonesia. In terms of network efficiency, when Bitung becomes a hub port for Eastern Indonesia, as foreseen by *Tol Laut*, the study suggests that this should lead to an increase in efficiency by 20% when compared to the current network and Scenario 2 which models Sorong as the hub port. This confirms the relevance of *Tol Laut* to Indonesia's broader economic development agendas.

5 LIMITATION AND FURTHER RESEARCH

This study only considered AIS data from a short time frame and a limited geographic area. Thus, we suggest to repeat the research using a wider time frame, preferably three years of AIS data as the most common time frame for maritime network research, and a global scope. Under this study, we only used class A AIS data. Under future studies we propose to use the dynamic AIS message types, including 1, 2, 3, 18, 19, and 27, covering more ship classes. In the term of shipping operations, we propose to compute average and standard deviations of delay time (between ship arrival and departure) for all ports. Finally, our suggestion for the Government of Indonesia is to build an AIS data center with nation-wide coverage to facilitate further research and improve policy.



(a) Scenario 1 (b) Scenario 2

Figure 5: Route Comparison of Scenario 1 and 2

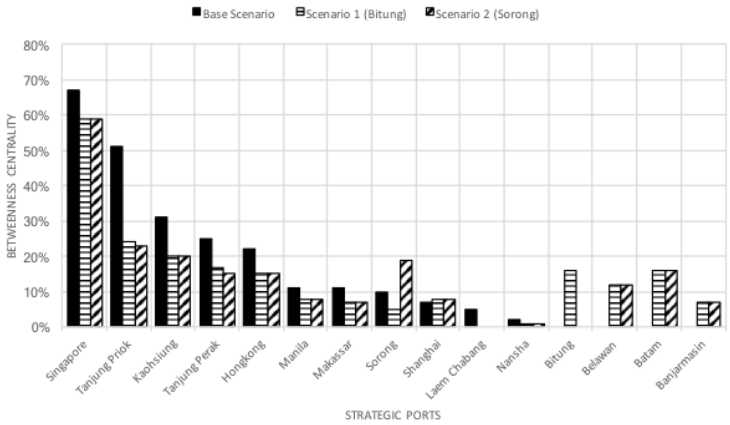


Figure 6: Betweenness Centrality of ports in East and South-East Asia for each scenario

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E-Commerce Based Regional Connectivity in Indonesia

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ABSTRACT

Rapid deployment of e-commerce which over the last two decades led to the emergence of a number of factors which related to buying decision and market orientation from both customer's and seller's perspectives. This affected not only for the new brand products but to the used or second-hand ones as well. As e-commerce is characterised by borderless trading between and among regions, it also spurred inter-connectivity among regions. Drawing from the idea of utilising big data for addressing whether or not e-commerce spurs inter-city connectivity, this research investigates sellers' preferences to measure customers' willingness to purchase using price uniformity as proxy. Employing statistical methods to measure standard deviation of the secondhand products, the study found that price uniformity could be utilised to indicate whether inter-connectivity exists in classified ads. The finding implies that price uniformity is useful in contributing to the decision-making processes of policy concerning e-commerce and could be applied to other commodities as well.

KEYWORDS

e-commerce, classifieds, big data, inter-connectivity

1 INTRODUCTION

For the last ten years the growth of online classified advertisement has been increasing rapidly. Particularly in emerging markets, online advertising enjoyed double-digit annual revenue growth rates, while in more mature markets, annual revenue growth rates were not far behind, as the rate was estimated at almost 10 percent [7]. The development of this media/platform has replaced conventional media such as printing materials and newspaper. This dramatic leap from print to digital version was inevitable and has proven itself to be quite beneficial for digital players [9] [2]. The direct consequences of this is the growing utilization of available big data. This is not only for data storage in huge data warehouse inventory, but also could be used as data supplier for many different activities [1].

Classified advertisement is designed to capture local market by reducing transportation cost and risk of un-matching supply-demand needs [7]. On the other hand, the uniformity price of goods is correlated to the expectation of getting similar goods at the same or similar price. Uniformity implies consistency in lack of variation between the items being compared, over a long period and across a wide range [4].

Seeking the inter-city connectivity by overcoming the relative weight or average of price, distance, regional GDP and their variance is a big challenge for this research to shape the understanding in how the city correlate to other cities [8]. This can be achieved by accommodating a statistical approach to find the standard deviation of tested products.

This study aims to investigate whether the availability of big-data can be used to develop a descriptive statistic model in order to design a set of policies to improve local competitiveness using e-commerce based inter-region connectivity. Drawing from this argument, this paper tries to answer the following research question: *Is there any difference between region X and region Y regarding the sellers' reference in order to allow their businesses to gauge the willingness of consumers' awareness to make purchase?*

1.1 Research description

Rapid growth of online trading in the last ten years or more lead providers or business owners to innovate their platform to cope with the market and create big-data that could be used in different sectors. This research focused on the seller or advertiser on OLX platform (the biggest Indonesia classified site) to analyze various possibilities of using e-commerce data to address economic development trends, issues and concerns. As such, customer buying power, consumer price index, and market purchasing power are determined by several factors.

Drawing from this argument, we posit that the uniformity price of goods is associated with the inter-city connectivity by overcoming the relative weight or average of price, distance, regional GDP and their variances. The standard deviation from regression analysis of a specific product also could be used as a proxies to determine the inter-city connectivity.

2 RATIONALE OF PRICE UNIFORMITY AS PROXY OF CONNECTIVITY

Relevant studies explain connectivity as interaction between two or more nodes (in this case, interaction between two or more cities/regions) that indicates by flows of goods and/or services that reflects economic, social, and human mobility linkages [4] [5]

[6]. Using the above argument on connectivity, we consider it is necessary to employ transaction data which includes origin and destination from node-i to node-j, and vice versa.

Since e-commerce data in this study did not record such criteria, we utilise the theory of Law of One Price (LOOP) as our method in this study. Price uniformity idea comes as proxy of high connectivity among nodes on certain regions [3]. We use the approach of 'Staggering Price model' [10]. Following the log relative price of goods [3] in city i and city j is written as:

$$q_{ij} = ln\frac{P_{i,t}}{Pj,t}$$

where,

$$q_{ij,t} = \lambda q_{ij,t-1} + \frac{(1-\lambda)(1-\lambda\beta)}{(1-\lambda\beta\rho_z)}(2s_{ij}-1)z_{ij,t}$$

$$s_{ij} = \frac{1}{(1+(1+\tau)^{1-\theta})}$$

is home bias, and

$$Z_{ij,t} = ln\frac{Z_{i,t}}{Zj,t}$$

is good price index, λ is random-shock. When $\lambda = 0$, the relative price of two nodes is decreasing in τ (market friction). Here, market friction is depicted as terrain, bad infrastructure and physical factors that exogenously creates price difference. If consumers are homogenous, firms perfectly compete, transportation cost is not a vital factor, and there is no market friction then relative price is one, or there is no price dispersion. Price uniformity implies consistency in lack of variation between the items being compared, over a long period and across a wide range. Price uniformity might be equilibrium but it is above competitive equilibrium. In reality, price dispersion should exist regardless of connectivity, because firms add transportation cost and consumers spend search cost. Even though price uniformity is a utopian-concept, it is still applicable for the purpose of measuring inter-city (inter-region) connectivity.

3 DATA AND METHODOLOGY

In this section, we employed dataset from OLX Indonesia on monthly goods traded for property, car, and motorcycles. To match the concept of price uniformity, the selected goods should satisfy the criteria of LOOP, which are: (1) liquid and exchangeable; (2) consumers preference is only price, independent over features; (3) firms produce the single-identical good and consumers have easy access to the goods; and (4) no asymmetric information.

Based on the criteria, we selected Toyota Avanza and Yamaha Mio as the units of analysis. Toyota Avanza and Yamaha Mio are the two most searched items and traded items in OLX website, as measured by the volume of sales advertised. Each good is manufactured by a single company and relatively identical across regions. We selected 2014 as the year of production for both products to ensure the identical principle.

The data was investigated at the city and district level. The procedure is plotting the price of selected goods into a map to grasp the spatial pattern of price distribution. Further, we also calculated price variance on provincial level as proxy of interconnectivity in each province. The last part is an experiment to interconnectivity using several variable i.e. GDRP, infrastructure, and population.

4 RESULT

Figure 1 shows the price distribution of Toyota Avanza (manufactured at 2014). In this figure, we normalised the price of Avanza by taking the average price of Avanza in central Jakarta as indices. Red dots represent Avanza that were sold cheaper than Jakarta's price and blue dots represent the expensive ones. Similarity of color on certain provinces represents the price uniformity.

Figure 1: Price Distribution of Toyota Avanza

It can be inferred that Java, Bali and Southern Sulawesi have low variation of price, which means that those regions are more connected than other regions, that have higher variance in terms of price. Similar findings can also be found when Yamaha Mio is used as the unit of analysis (Figure 2).

Figure 2: Price Distribution of Yamaha Mio

By looking at the price variation of the secondhand product of Toyota Avanza and Yamaha Mio, most areas in Java, several regions in Sumatera, South Sulawesi, East and South Kalimantan had better

connectivity while remaining areas still lacked of. Only few regions were well-connected compared to the total number of regions in Indonesia. Therefore, we argue that this was one of several reasons why Indonesia has a low competitiveness level, especially in terms of logistics cost.

Province	T. Avanza Price		Y. Mio Price	
	Log Price		Log Price	
	Mean	Std.Dev	Mean	Std.Dev
Aceh	0.03576	0.2375	0.21824	0.326697
Bangka Belitung	-0.03683	0.26484	0.02714	0.313144
Bengkulu	-0.11445	0.250455	0.2576	0.28395
Jambi	-0.04239	0.238836	0.00281	0.51427
Kep. Riau	-0.11119	0.241804	0.03182	0.35275
Lampung	-0.01996	0.224622	0.08747	0.437552
Riau	-0.04711	0.238805	-0.11888	0.226659
Sumatra Barat	-0.14951	0.348268	0.03878	0.282948
Sumatra Selatan	-0.04494	0.243011	0.11977	0.362717
Sumatra Utara	0.01356	0.261699	0.08273	0.358521
Banten	-0.03649	0.250455	-0.04011	0.361558
Jakarta	0	0.195975	0	0.367891
Jawa Barat	-0.04701	0.245985	0.03131	0.379916
Jawa Tengah	-0.03368	0.173141	0.14922	0.338347
Jawa Timur	0.01816	0.174183	0.15234	0.363599
Yogyakarta	-0.04472	0.173807	0.16486	0.415303
Kalimantan Barat	0.04384	0.15721	0.00621	0.221485
Kalimantan Selatan	-0.05036	0.311832	0.15751	0.494052
Kalimantan Tengah	-0.05348	0.23248		
Kalimantan Timur	-0.0263	0.252619	0.06413	0.492134
Kalimantan Utara	-0.16614	0.256592		
Gorontalo	-0.52247	0.391028		
Sulawesi Barat	0.05743	0.100268	0.03878	0.282948
Sulawesi Selatan	0.01566	0.259313	0.34197	0.353929
Sulawesi Tengah	-0.06389	0.326928	0.28636	0.196182
Sulawesi Tenggara	-0.10096	0.344518		
Sulawesi Utara	-0.18343	0.395954	0.32889	0.447721
Bali	0.06321	0.1307	0.18042	0.410917
NTB	0.0844	0.2	0.26227	0.139412
NTT	0.0774	0.192524		
Maluku	-0.11632	0.301706		
Maluku Utara	-0.17254	0.46848		
Papua	-0.08522	0.258583		
Papua Barat	-0.15367	0.305788		

Figure 3: Price variation of the secondhand Toyota Avanza and Yamaha Mio

5 CONCLUSION

From this research, we can conclude that price uniformity can be used as proxy to indicate the inter-city (inter-region) connectivity. By looking at the data of Avanza and Mio ads, most areas in Indonesia still have low connectivity inside and outside the city. The government can use the connectivity map in this research to develop the issue of inter-city (inter-region) connectivity in Indonesia.

We also argue that this research will be more suitable if we use other products that have more homogenous price as proxy for measuring inter-city connectivity, such as food commodities. Moreover, the result can be refined if we are able to use new product rather than secondhand product and obtain the origin-destination (O-D) data of e-commerce product sales. We recommend that these improvements should be tailored into our method and implemented as future research.

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Constructing Proxies of Macroeconomic Trends Using E-Commerce Data

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ABSTRACT

We explored possible proxies of economic growth using an e - commerce data provided by olx.co.id. Data used in this research was data from 2016 and 2017 city and provincial levels after being adjusted. We constructed three proxies of macroeconomic trends by taking advantage of three main olx's main markets: car, motorcycle, and property. Two proxies were developed to see income and consumption smoothing. One proxy was constructed to see the direction of economic growth at city and province level. We also captured social proxy at the different territory of common goods purchased in three main markets at the city and municipality level with dummy regression.

In this research, we had three findings. First, the sale of e-commerce will encourage the purchase of goods that can increase GDP growth indirectly through consumption. Second, calculation on sell-rent ratio addressed several provinces outside main island Java are experiencing upward economic growth, while Java, in general, is experiencing mild downturn. Third, urban consumers prefer to buy a car, motorcycle, property than municipality consumers. This is possibly the cause of traffic jam in the city meanwhile road area is limited. We recommend an increase in luxury goods and sales taxes for controlling car purchases and re-evaluation of LTV (loan to value) rate for affordable housing prices.

1 INTRODUCTION

E-Commerce is an online buying and selling system, where a buyer does not need to always go to a store or company to buy an item. Currently, e-commerce is one of the alternative options for a company that is particularly engaged in the field of entrepreneurship as a medium of information that facilitates the interaction between sellers and buyers without being limited by space and time. Supported by the increasingly sophisticated information technology development, the development of e-commerce is growing and more and more interested in many companies. Electronic commerce is also defined as those which consists of the buying and selling of products or services over electronic system such as internet and other computer network [1].

Indonesia has the highest e-commerce growth in the world. In recent years, more and more business actors, both large companies and retailers have shifted or expanded their business towards digital. [4] introduced that the growth of Internet technology has enormous potential as it reduces the costs of product and service delivery and extends geographical boundaries in bringing buyers and sellers together.

The development of e-commerce is very interesting because along with the running time, telecommunications industry will be growing both in terms of service range and internet connection speed. As payment system gets easier, electronic transactions or e-commerce activities will grow. Increasing the intensity of e-commerce activities will have an impact on the increasing regional economic value added as reflected through the value of Regional Gross Domestic Product as the intensity of economic activity will be directly proportional to the economic value of the region [2].

In this research, we have a few objectives, to explore possible proxies of economic growth using an e-commerce data provided by olx.co.id. The data used in this research was e-commerce data from 2016 and 2017 at city and provincial levels, after being adjusted. We constructed three proxies of macroeconomic trends by taking advantage of three main olx's main markets: car, motorcycle, and property. Two proxies were developed to see income and consumption smoothing. One proxy was constructed to see the direction of economic growth at city and province level. We also captured at the different territory of common goods purchased in three main markets at the city and municipality level with OLS dummy regression.

2 METHODOLOGY

2.1 Multiple Linear Regression

The multiple linear regression equation is as follows:

$$\hat{Y} = b_o + b_1X_1 + b_2X_2 + \ldots + b_pX_p$$

where $\hat{Y}$ is the predicted or expected value of the dependent variable, X_1 through X_p are p distinct independent or predictor variables, b_0 is the value of Y when all of the independent variables (X_1 through X_p) are equal to zero, and b_1 through b_p are the estimated regression coefficients [5]. Each regression coefficient represents the change in Y relative to one unit change in the respective independent variable. In the multiple regression situation, b_1, for example, is

the change in Y relative to a one unit change in X_1, holding all other independent variables constant (i.e., when the remaining independent variables are held at the same value or are fixed). Statistical tests can be performed to assess whether each regression coefficient is significantly different from zero. In this research, the dependent variable is commonly purchased goods in e-commerce, independent variables are GDP in regional and dummy variable as the social indicator proxy.

2.2 Correlation and Trend Analysis

Pearson's product-moment coefficient is the measurement of correlation and ranges (depending on the correlation) between +1 and -1. +1 indicates the strongest positive correlation possible, and -1 indicates the strongest negative correlation possible. Therefore the closer the coefficient to either of these numbers the stronger the correlation of the data it represents. On this scale 0 indicates no correlation, hence values closer to zero highlight weaker/poorer correlation than those closer to +1/-1 (see figure 1).

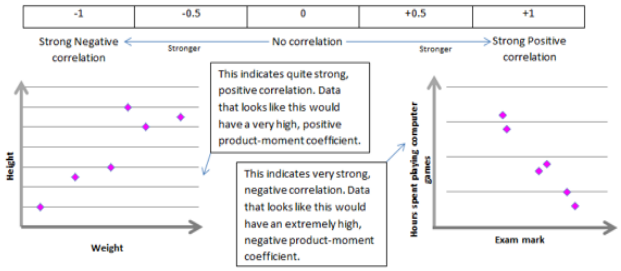


Figure 1: Correlation Sized-Value

Trend analysis is a common trend model for time series data and for forecasting. Trend analysis is an analysis used to observe data trends thoroughly over a fairly long period of time. Trend can be used to predict what condition the data in the future, or can be used to predict the data at a certain time.

In constructing this third proxy, we took advantage of OLX's unique data that to some extent reflect the evolution of the housing market in Indonesia, and thus to some extent the direction of economic growth. Three main features why we chose OLX's online advertised housing market as our ideal context to construct proxy of macroeconomics direction. First, it offers both housing for sale and housing for rent. Second, online market facilitates faster and cheaper price discovery and comparison for buyers, which disincentives sellers to artificially inflate or deflate listed price. Third, OLX's housing market enables us to differentiate listing price by property agent or by non-property agent.

Taking advantage of the aforementioned features, we subset our data as follows. First, we created a dummy variable to indicate if a listing is for sale or for rent. Second, we created a dummy variable to indicate if a listing is posted by a property or non-property agent. We checked the difference between prices listed by property agents vs non-property agent. While we found that the difference was rarely big, to minimise problem of uninformed sellers which artificially deflate/ inflate price in an online e-commerce platform, we only use a subset of the data, only listing by property agents. Third, we aggregated at city-month-year level. Fourth, we calculated price per meter square of listed property. Next, we calculated the ratio of sell to rent price for every city and for every province for every month-year. Fifth, for ease of scaling comparability and due to limited available control variables, instead of using linear regression which boundary is [-∞,∞], for every city and province, to proxy whether there is a downward or upward trend, we estimated the correlation between time and sell to rent ratio. In the absence of adequate control variables, correlation provides the ideal balance of providing scaling comparability since its bound to [-1,1].

3 RESULT AND DISCUSSION

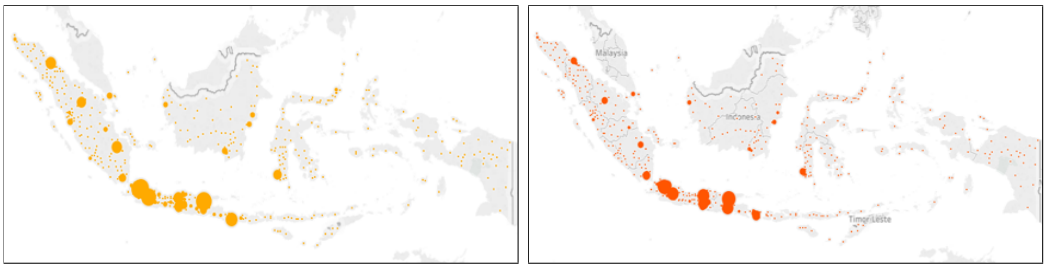
Indonesia's internet is growing faster in recent years. The ease of internet access encourages e-commerce development more rapidly. With the number of internet users reaching 82 million people or about 30 percent of the total population in Indonesia, the e-commerce market has a great business potential in the future. E-Commerce Business continues to grow in various cities in Indonesia, especially in big cities (see fig 1). With a population of more than 250 million people, Indonesia can be one of the largest e-commerce markets in the world.

E-commerce transactions data could be one of indicator in explaining the trend of economic growth. The high level of e-commerce transactions means increasing in purchasing power. A higher purchasing power reflects the increase in welfare that is better economic growth through increasing in consumption. E-commerce data of secondhand goods is not able to describe economic growth directly because the secondhand goods are no longer recorded in current GDP. But the money from secondhand goods transactions can be used to buy new goods calculated in GDP. Therefore the sale of e-commerce of secondhand goods will encourage the purchase of new goods that indirectly can increase GDP growth through increased consumption. For example, some people sell their cars or motorcycle in the secondhand market to buy the new one. The value of the new goods consumption probably is not too big, but could be one of the indicators of economic growth trends.

Based on data from the Association of Automotive Industries (Gaikindo) Car sales in Indonesia in February 2017 rose about 7.5 percent (YoY) to 94,791 units compared to February 2016 of 88,208 units. The increase in the number of new car sales is also in line with the increase in the number of secondhand car sales in February 2017.

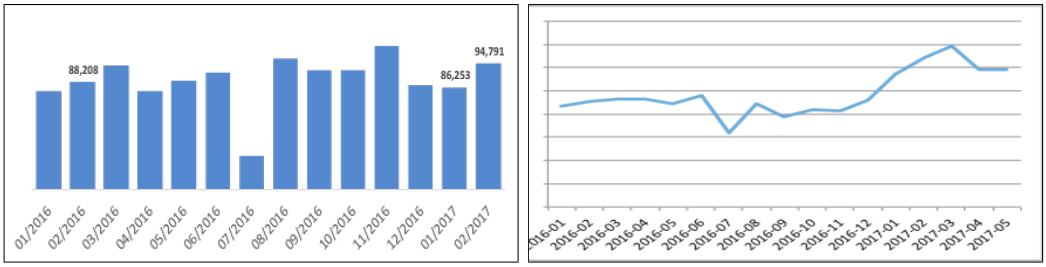
In addition, e-commerce data of secondhand goods can explain the condition of the economy indirectly seen from the price and sales volume of Property. If the price and sales of Property increase, the demand for property also increases. The high demand for property represents the increasing welfare of society. Increased welfare will not only increase the sale of secondhand goods, but will also affect the sale of new properties recorded in the current GDP period.

Next, we conducted a dummy regression for capturing social indicator by assuming liquid good is the most frequently purchased item. The result emphasizes there is a difference of goods purchased by consumers in the city and municipality. In the table above, the car is the goods most often purchased by urban consumers. If we sort the liquid good in e-commerce is car, motor, and property. From



(a) Car Sales (b) Property Sales

Figure 2: E-Commerce Cars and Property Sales in Indonesia



(a) Data from Gaikindo (b) Sales trend from OLX

Figure 3: New Cars and Secondhand Cars Sales Trend

Sub Sektor GDP	2016				2017	
	TW I	TW II	TW III	TW IV	TW I	TW II
Perumahan dan Perlengkapan	0.06	1.15	2.27	0.6	0.07	1.13
Kesehatan dan Pendidikan	-0.07	1.56	3.38	0.35	0.65	0.94
Bangunan	-6.22	1.42	4.36	4.84	-4.6	1.62
Kendaraan	-6.37	11.51	18.98	2.59	-7.9	0.15

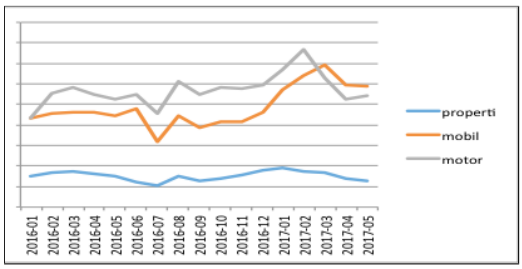


Figure 4: Growth Rate of Several Quarterly-GDP Sub Secoters (q-to-q) compared to OLX Sales Trend

Table 1: OLS Dummy by HAC Covariance and Hessian Matrix Adjusted

Variable	Car	Motor	Property
GDPcap	0.19345	0.30235	0.28575
	(2.3423)	(0.1882)	(0.19442)
Dummy_region	2.15094*	2.13276**	1.92811*
	(8.3602)	(9.6084)	(0.25843)
Intercept	3.90392	2.82385	1.88915
	(2.3943)	(1.8995)	(1.2267)

Note: *sign at 5%, **sign at 10%, ( ) indicates t-statistic

this estimation we can conclude that the possibility of traffic jam is due to uncontrolled purchases of cars and imply productivity reducing.

We also present the result of our calculation on sell-rent ratio at province and at city level. As we can see in figure 5, several provinces outside the main island Java are experiencing upward economic growth, while Java, in general, is experiencing mild downturn. Generally, this is in line with recent consensus that at the aggregate level, GDP growth rate quarter II, 2017 at the aggregate-level is relatively stagnant. While currently we are unable to compare our findings with city and province level longitudinal GDP growth, we would maintain that housing sell/rent price ratio is a tight proxy to economic growth. While the direction of causality between growth and housing price still can go both ways, economic literature maintain supports that there is strong correlation between housing prices and economic growth, thus the trend on housing market remains an ideal proxy of economic growth. The goodness of this proxy depends on two additional factors that currently are

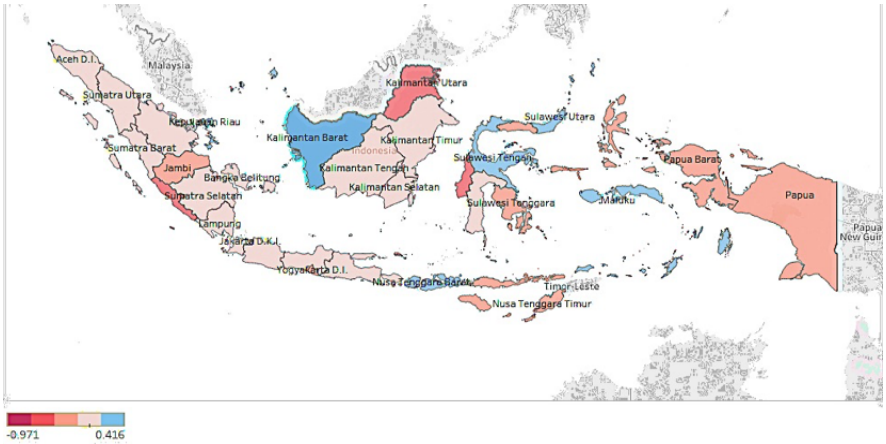


Figure 5: Sell-Rent Price Ratio Overtime Aggregated at Province Level

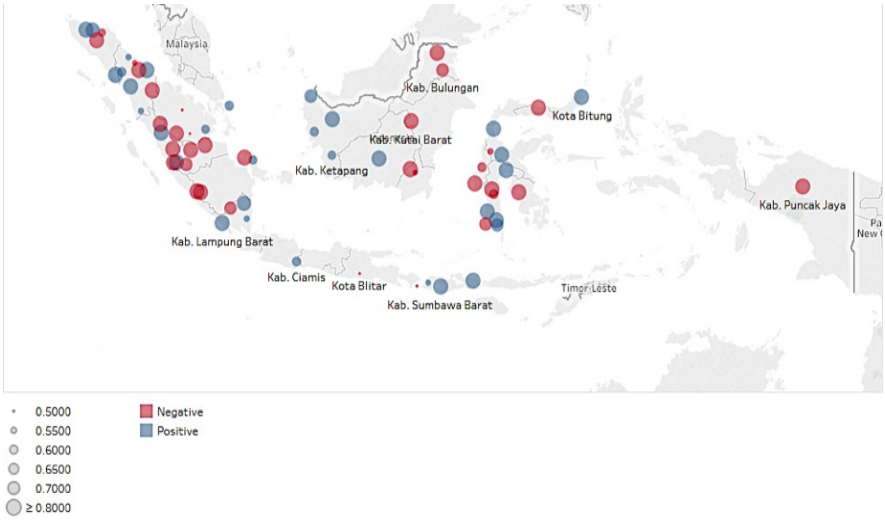


Figure 6: Sell-Rent Price Ratio Overtime Aggregated at City Level

unobserveable: selection bias[1] and possible censoring/truncation[2], and the scope (or representativeness) of the OLX data to reflect the housing market in Indonesia.

From the findings on the sell-price ratio, we can not only infer direction of economic growth, but also infer increase or decrease in housing affordability at city and province level. [3] argued that inequality stems from growth of asset valuation that grows faster than income. If we couple data on income at city and province level over time with our findings, we may be able to infer whether there is any increase or decrease in wealth inequality at city and province level. This way, appropriate and more precisely targeted policy intervention can be accomplished

[1]Selection bias refers to unobservable reasons why people use olx and do not use olx. There are two primary implications: people may avoid using it because they will have to put price that are too low or too high that what they are willing to sell. For the first reason, our estimate will most likely be inflated (higher than it should be), while for the second reason, our estimate will most likely be deflated (lower than it should be), although we tried to anticipate for this by taking the *ratio* of sell-rent price.

[2]Censoring and truncation, if present, may exclude subset of population which real sell and rent prices are too high or too low to enter olx market.

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Analysis of Correlations between Postal and Trade Network Data within ASEAN Countries and Beyond

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ABSTRACT

This study mainly examines the correlation between Postal Network Data (PND) and Trade Data within ASEAN countries and beyond. In addition, based on the previous study on the global network structure, including postal network, as proxies for national well-being, we also assess how the PND can affect the other recent socioeconomic indicators among ASEAN countries.

KEYWORDS

Postal Network Data, ASEAN, Correlation, Trade

1 INTRODUCTION

In the history of mankind, long-distance communications network through physical postal commodity has been established since the last century. Physical postal can represent the characteristics of individual behavior, local, regional and national economic activity and international economic relation [4]. Although presently digital commodity may disrupt and replace the network flow of physical postal commodity, however, it is still being used particularly for certain trading goods and activities. Previous work has studied flows of physical and digital commodities that affect the wealth, resilience and function of social system on global, regional, national and sub-national levels [1][3][5][7]. This study aims to address the general question of whether structural network properties of different flow networks between ASEAN countries can be used to produce proxy indicators for the socioeconomic profile of a country.

2 METHODOLOGY AND DATA

In this study, we explore over three years (from 2011 to 2013) of postal data records between all countries by focusing on ASEAN countries. We then assess the correlation between postal data network and trade data as well as other critical socioeconomic indicators using statistical analysis.

2.1 PLS and Correlation Analysis

PLS regression is a recent technique that generalises and combines features from principal component analysis and multiple regression. It is particularly useful when we need to predict a set of dependent variables from a (very) large set of independent variables. Modelling based on such estimated variables (represented by so-called X- and Y- score vectors) also have the advantage of being suited for graphical visualisation, inspection and interpretation via their associated sets of loadings, i.e. the coefficients describing the relationship between the score vectors and the original variables/parameters [8]. PLS are well known projection methods for analysis of multivariate data. They result in scores and loadings that may be visualized in a score loading plot (score plot) and used for process monitoring. Statements of relation between concepts express regularities relating different categories. Two features are said to correlate when a co-occurrence of specific patterns in their values is observed as, for instance, when a feature's value tends to be the square of the other feature. The observance of a correlation pattern can lead sometimes to investigation of a broader structure behind the pattern, which may further lead to finding or developing a theoretical framework for the phenomenon in question from which the correlation follows [6].

2.2 Matrix of the intensity connection

The statistics of cycles is relevant both from a theoretical and an applicative point of view. From a theoretical perspective, it allows one to understand whether the distribution of cycles observed in a real world network is significantly different from that in a random graph with similar statistics [2]. Also, matrix of the intensity connection is used to understand also compare the positions of countries within the different networks several socioeconomic indicators.

3 RESULT AND DISCUSSION

3.1 PND Characteristic

PND (Postal Network Data) consists of three types of articles, namely letter, package and EMS (Express Mail Service). In this paper, the analysis of PND data can be divided into two types, i.e. the analysis for postal data that sent from world to ASEAN (see Figure 1) and the analysis for postal data that sent from ASEAN to the world (Figure 2). The data spans from 2001-2003. The figure of the intensity of the PND, from and to ASEAN are seen through two different colored lines, where the green line explains the relationship between ASEAN and non-ASEAN countries, whereas the red line explains the relationship among ASEAN member countries.

Beyond that, the visualisation of relations between countries (intra-ASEAN and ASEAN vs. non-ASEAN) is also done through the level of line width and opacity. The wider and darker lines indicate the higher the quantity/intensity of postal activities that occur among the countries involved.

Figure 1 and 2 show that the main pair of ASEAN countries for postal activities are still dominated by the US, China and Japan. China's role is more prominent in its sending activities to ASEAN than receiving posts from ASEAN. Intra-ASEAN postal activities are still very small in intensity, where Singapore holds a central role for such activities.

3.2 Trade Data Characteristic

Trade data are represented by export data between countries. The characteristics of figures 3 and 4 (trade) have the same descriptions as the characteristics of figures 1 and 2 (PND). Intra-ASEAN trade activity seems to have a higher intensity relative to intra-ASEAN postal activity. ASEAN partners also appear to be more diverse for trade activities than postal activities. The Non-ASEAN main partner countries for ASEAN trade activity are not only occupied by the US, China and Japan (as shown by postal activity) but also shared to South Korea, India, Bangladesh, Australia, Namibia, Brazil, and some European countries (UK, France, Germany). For the context of intra-ASEAN trade, the major players, such as Indonesia, Singapore, Malaysia and Thailand are still shown to be the backbone for trade activities within the region.

3.3 Correlation Analysis

We performed a correlation analysis to see the relationship between Post to and post from 10 ASEAN countries using Life expectancy, CPI, Population, Mobile subscribe, Internet penetration, fixed phone, HDI, GDP, and CO2.

- There is no significant correlation between post from data with all variables
- There is a significant correlation between Life expectancy on internet penetration, HDI, GDP and CO2 Emission. In addition, there is a weak correlation to the CPI, and mobile subscribers. At the same time, there is no significant correlation between other variables.
- There is a high correlation and significant between CPI with Internet penetration, HDI, GDP, and also CO2 emission. Besides, there is a strong correlation with Life expectancy and no significant relationship to other variables. That just means that there's no relationship, connection, or interdependence between the two variables.
- There is a strong correlation between mobile subscriber with life expectancy and other variables are not statistically significant
- There is a high correlation between Internet penetration to Life expectancy, CPI, HDI, GDP. Also, high correlation between CO2 emissions and other variables are not statistically significant
- There is no correlation between fixed phone to all variables
- There is a high strong relationship between HDI with Life expectancy, CPI, Internet penetration, GDP and C02 Emission. Besides, other variables are not statistically significant
- There is a high correlation between GDP and life expectancy, CPI, Internet penetration, HDI, and CO2 emission. Also, other variables are not statistically significant

The provided matrix correlation in Figure 5 represents the relationship of post from data with all variables

Meanwhile, we should analysis the pattern and correlation of post to data.

- There is a high correlation between post to data with mobile subscriber and HDI. Besides, there is a moderate correlation in C02 emission and a weak correlation in life expectancy and CPI. Other variables are not statistically significant
- There is a high correlation between Life expectancy against C02 emission. In the same way, there is a high correlation life expectancy relationship to CPI, and Mobile subscribe. Apart from that, There is a weak correlation between life expectancy to post to data, and there is no significant relationship between life expectancy with fixed phone
- There is a high and significant correlation between CPI with life expectancy, Internet penetration, HDI, GDP, and CO2 emission. Consequently, other variables are not statistically significant
- There is a high correlation between mobile subscriber with the post to data, life expectancy. What's more, a weak relationship on the variable HDI and CO2 emission
- There is a high correlation between Internet penetration to CPI, HDI, and GDP. Likewise, also a high correlation with carbon dioxide emissions data and other variables are not statistically significant
- There is a strong correlation between post-life data with fixed phone and other variables not statistically significant.
- There is a high correlation between HDI and life expectancy. CPI, Internet penetration, HDI and CO2 emission. Again, there is a high correlation with mobile subscriberâĂŹs data, and other variables are not statistically significant
- There is a high correlation between GDP to life expenses, CPI, Internet penetration, HDI, and CO2 emissions. Moreover, there is high correlation with post to data, and other variables are not statistically significant
- There is a high correlation between C02 emission data with life expectancy, CPI, Internet penetration, HDI, and GDP. Furthermore, there is a strong correlation with the post to data and mobile subscribers. As well as, other variables are not statistically significant

The provided figure 6 shows correlation about Post To data.

After getting the correlation value. Next step, we did partial least square (PLS) on the model we have built before. Just as getting 3 cluster components based on Post from data (Y1) and Post To data (Y2) in comparing with independent variables (Life Expectancy, CPI, Mobile, Subscription, Internet Penetration, Fixed Phone, HDI, GDP, CO2 Emission)

As observed, figure 7 gives information on the pattern of PND data. Vietnam. Thailand, Indonesia, Philippine, Myanmar has the same PND characteristics so these countries are in the same component (Component 1). In particular, Cambodia forms its own components (Component 2). Then, Singapore, Malaysia, and Brunei

(a) Year 2011 (b) Year 2012 (c) Year 2013

Figure 1: Postal Network Data from World (to) ASEAN (2011-2013)

(a) Year 2011 (b) Year 2012 (c) Year 2013

Figure 2: Postal Data Network (from) ASEAN to World (2011-2013)

(a) Year 2011 (b) Year 2012 (c) Year 2013

Figure 3: Trade Data from World (to) ASEAN (2011-2013)

(a) Year 2011 (b) Year 2012 (c) Year 2013

Figure 4: Trade Data (from) ASEAN to World (2011-2013)

Darussalam share the same PND characteristics (Component 3). As a result with R-square 96,2%.

On the other hand, we also want to see the pattern PND (from) data. Based on Figure 8, Brunei Darussalam forming its own components (Component 1). Apart from that, Philippine, Cambodia, Indonesia, Laos, and Vietnam have the same PND (from) data. So,these

Table 1: Correlation Post to Data Among ASEAN

Variable	post to	life expectancy	cpi	mobile subs	Internet penetration	Fixed phone	HDI	GDP	CO_2 emission
post to	1,000	.511*	.511*	**.689****	,422	.600*	**.644****	.600*	.600*
life expectancy	.511*	1,000	**.644****	**.644****	**.733****	,289	**.778****	**.733****	**.822****
cpi	.511*	**.644****	1,000	,378	**.911****	,289	**.867****	**.911****	**.733****
mobile subs	**.689****	**.644****	,378	1,000	,467	,467	.511*	,467	.556*
Internet penetration	,422	**.733****	**.911****	,467	1,000	,200	**.778****	**.822****	**.644****
Fixed phone	.600*	,289	,289	,467	,200	1,000	,422	,378	,378
HDI	**.644****	**.778****	**.867****	511*	**.778****	,422	1,000	**.956****	**.867****
GDP	.600*	**.733****	**.911****	,467	**.822****	,378	**.956****	1,000	**.822****
CO_2 emission	.600*	**.822****	**.733****	.556*	**.644****	,378	**.867****	**.822****	1,000

* Significant with level α=1%
** Significant with level α=0.5%

Table 2: Correlation Post from Data Among ASEAN

Variable	post to	life expectancy	cpi	mobile subs	Internet penetration	Fixed phone	HDI	GDP	CO_2 emission
post to	1,000	,467	,467	,467	,467	,289	,422	,467	,378
life expectancy	,467	1,000	**.644****	**.644****	**.733****	,289	**.778****	**.733****	**.822****
cpi	,467	**.644****	1,000	,378	**.911****	,289	**.867****	**.911****	**.733****
mobile subs	,467	**.644****	,378	1,000	,467	,467	.511*	,467	.556*
Internet penetration	,467	**.733****	**.911****	,467	1,000	,200	**.778****	**.822****	**.644****
Fixed phone	,289	,289	,289	,467	,200	1,000	,422	,378	,378
HDI .867**		,422	.778**	.867**	.511*	.778**	,422	1,000	.956**
GDP	,467	**.733****	**.911****	,467	**.822****	,378	**.956****	1,000	**.822****
CO_2 emission	,378	**.822****	**.733****	.556*	**.644****	,378	**.867****	**.822****	1,000

* Significant with level α=1%
** Significant with level α=0.5%

countries in the same component (Component 2). Like the previous point, Singapore, Malaysia, Thailand, and Myanmar share the same PND(from) data in component 3. As an evidence with R-square 94,2%.

The relationship between ASEAN countries can be seen in Figure.9. There is a high correlation (strong) between Malaysia and Singapore (1,000) and it can be identified based on the spatial statistics both countries have the same characteristics. In addition, there is also a significant correlation between Malaysia and Brunei Darussalam. At the same time a significant correlation Indonesia with Singapore.

4 CONCLUSION AND RECOMMENDATION

- Singapore dominates the networks in ASEAN. There are high correlations between flows/networks data.(i.e.,PND and trade). Also, there are high correlations between PND and

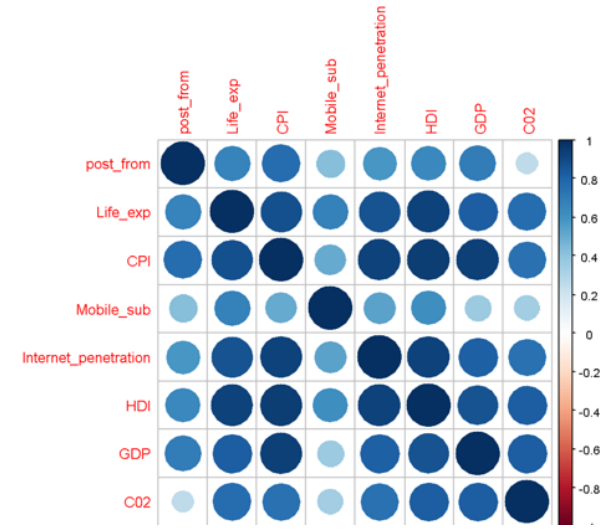

Figure 5: Correlation Post from Data in ASEAN Countries

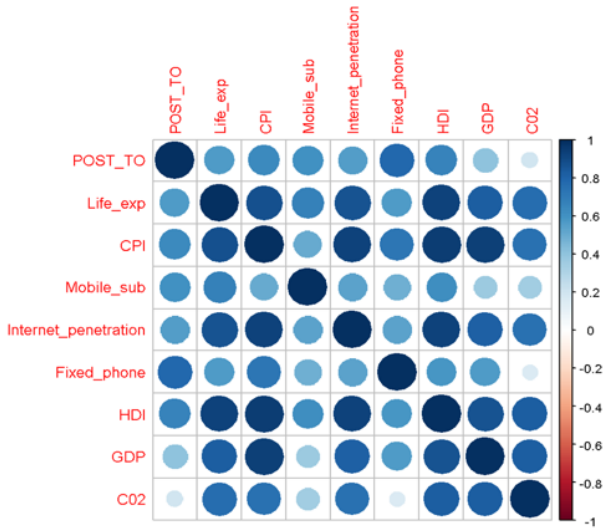

Figure 6: Correlation Post to Data in ASEAN Countries

socio-economics indicators, Trade and socio-economics indicators

- Study the causal relationship between flows/networks data especially PND and the socio-economics indicators. Compare the PND and trade data with other flows/networks, e.g., migration, flights, shipping, etc. Study the behavior of the "low-level" of aggregated PND data

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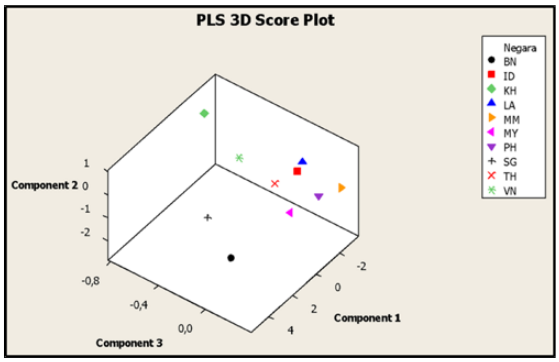
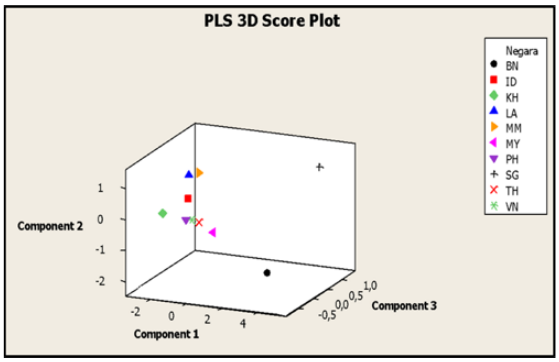


(a) Score Plot PND(to) Data With Socio-Indicators in ASEAN Countries



(b) Score Plot PND(from) Data With Socio-Indicators in ASEAN Countries

Figure 7: Score Plot PND Data With Socio-Indicators in ASEAN Countries

	Origin									
Destination	BN	ID	KH	LA	MM	MY	PH	SG	TH	VN
BN		0.0005	0.0000	0.0000	0.0000	0.0146	0.0002	0.0423	0.0009	0.0000
ID	0.1463		0.0004	0.0004	0.0002	0.0774	0.0004	0.4341	0.0129	0.0003
KH	0.0016	0.0000		0.0009	0.0000	0.0059	0.0000	0.0118	0.0026	0.0003
LA	0.0026	0.0000	0.0002		0.0000	0.0003	0.0000	0.0027	0.0039	0.0004
MM	0.0020	0.0000	0.0001	0.0001		0.0033	0.0000	0.0163	0.0025	0.0002
MY	0.4762	0.0091	0.0010	0.0008	0.0014		0.0015	1.0000	0.0198	0.0039
PH	0.0326	0.0004	0.0004	0.0007	0.0000	0.0113		0.1587	0.0065	0.0009
SG	0.2950	0.0047	0.0011	0.0014	0.0013	0.1345	0.0043		0.0344	0.0025
TH	0.0658	0.0009	0.0025	0.0091	0.0007	0.0172	0.0012	0.3347		0.0024
VN	0.0068	0.0001	0.0005	0.0026	0.0001	0.0063	0.0002	0.0298	0.0062	

Figure 8: Matrix of Intensity Connection

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