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To cite this article: Rezzy Eko Caraka *et al* 2018 *J. Phys.: Conf. Ser.* **1025** 012117

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Postal and trade network data within ASEAN countries and beyond

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Abstract. This study mainly examines the statistical analysis of 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. 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. Moreover, we are using statistical analysis just like the correlation to measure the variables post from and post to data with life expectancy, CPI, mobile subscriber, Internet penetration, fixed phone, HDI, GDP and CO^2 emission. After getting the correlation value. The next step we do partial least square (PLS) on the model we have built before. Just as getting 3 cluster component based on the data. Also, Matrix of the intensity connection is used to understand also compare the positions of countries within the different networks several socioeconomic indicators

1. Introduction
In the history of humanity, long-distance communications network through physical postal commodity has been established since the last century [4]. Physical postal can represent the characteristics of individual behavior, local, regional and national economic activity and international economic relation [5]. Although, presently digital commodity may disrupt and replace the network flow of physical postal commodity, however, it is still being used mainly for certain trading goods and activities. Previous work has studied flows of physical and digital commodities that affect the wealth, resilience and function of a social system on global, regional, national and sub-national levels. 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. Data Analytics
In this study, we explore over three years from 2011 to 2013 of carrier data records between all countries by focusing on ASEAN countries. We then assess the correlation between the postal data

network and trade data as well as other critical socioeconomic indicators using statistical analysis. PLS regression is a recent technique that generalizes 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 [2]. PLS are well-known projection methods for analysis of multivariate data [1]. They result in scores and loadings that may be visualized in a score loading plot (score plot) and used for process monitoring Statements of the relation between concepts express regularities relating different categories [6]. 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 sometimes lead to the 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 [3]. 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. Matrix of the intensity connection is used to understand also compare the positions of countries within the different networks several socioeconomic indicators [4]. Community multiplexity index from countries (i,j) can be written as:

$$cmi(i,j) = \sum_{G \varepsilon M}^{m} \delta(c_i^G, c_j^G)$$

where c_i the index cluster of country which is discrete variable, also the equivalent of network is G. Two are equivalent countries. Kronecker delta function can be given from network G therefore can evaluates equivalency of both nodes.

3. Discussion

PDN (Postal Data Network) consists of three types of articles, namely letter, package and EMS (Express Mail Service). In this paper, the analysis of PDN 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 PDN, from and to ASEAN is 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 visualization of relations between countries (intra-ASEAN and ASEAN vs. non-ASEAN) is also done through the level of line width and opacity. The broader and darker lines indicate the higher the quantity/intensity of postal activities that occur among the countries involved.
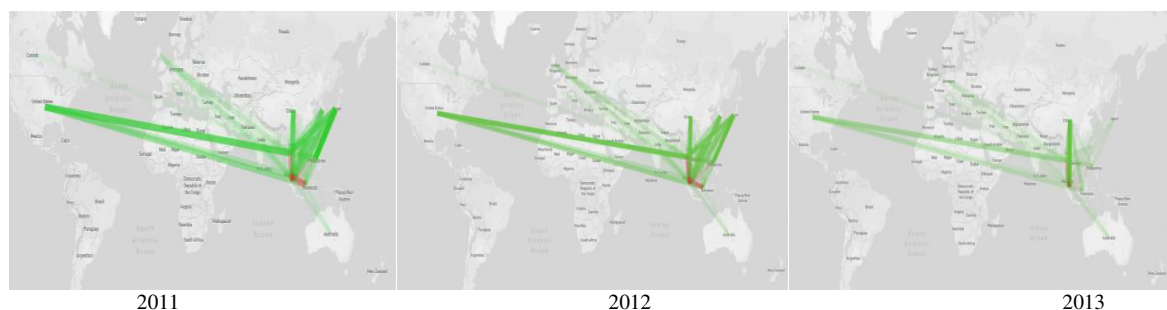

| 2011 | 2012 | 2013 |

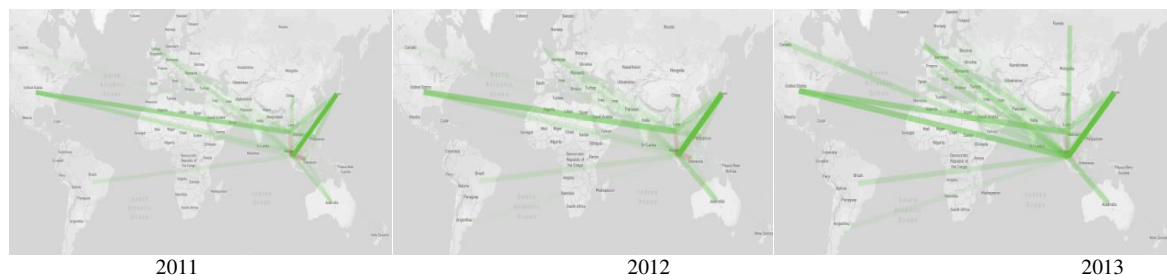**Figure 1.** Postal Data Network from World (to) ASEAN (2011-2013)

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

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

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

Figure 1 and 2 shows that the primary 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.

4. Results
4.1 Trade Data Characteristic
Export data between countries represent trade data. The characteristics of figures 3 and 4 (trade) have the same descriptions as the characteristics of Fig 1 and Fig 2 (PDN). 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 central 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.

4.2 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 CO_2 can be seen in Table 1 and Table 2

Table 1. Correlation Post to Data Among ASEAN

Variable	postto	life_expectancy	cpi	mobile_subs	Internet_penetration	Fixed_phone	HDI	GDP	CO2_EMISSION
postto	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**
CO2_EMISSION	.600*	.822**	.733**	.556*	.644**	.378	.867**	.822**	1.000

Significant with level α=1%
Significant with level α=5%

Table 2. Correlation Post from Data Among ASEAN

Variable	postfrom	life_expectancy	cpi	mobile_subs	Internet_penetration	Fixed_phone	HDI	GDP	CO2_EMISSION
postfrom	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	.422	.778**	.867**	.511*	.778**	.422	1.000	.956**	.867**
GDP	.467	.733**	.911**	.467	.822**	.378	.956**	1.000	.822**
CO2_EMISSION	.378	.822**	.733**	.556*	.644**	.378	.867**	.822**	1.000

Significant with level α=1%
Significant with level α=5%

1. There is no significant correlation between post from data with all variables
2. There is a significant correlation between Life expectancy on internet penetration, HDI, GDP and CO_2 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.
3. There is a high correlation and significant between CPI with Internet penetration, HDI, GDP, and also CO_2 emission. Besides, there is a high 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.
4. There is a strong correlation between mobile subscriber with life expectancy and other variables are not statistically significant
5. There is a high correlation between Internet penetration to Life expectancy, CPI, HDI, GDP. Also, high correlation between CO_2 emissions and other variables are not statistically significant
6. There is no correlation between fixed phone to all variables
7. 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
8. There is a high correlation between GDP and life expectancy, CPI, Internet penetration, HDI, and CO_2 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
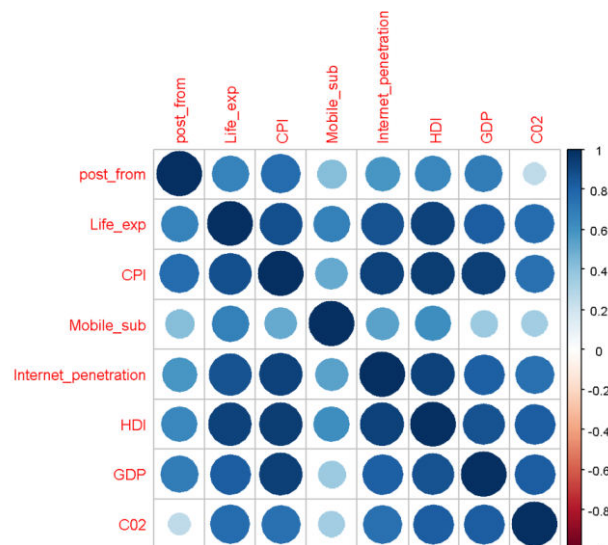
Figure 5. Correlation Post from Data in Asean Countries

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

1. 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

2. 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

3. 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

4. There is a high correlation between mobile subscriber with the post data, life expectancy. What's more, a weak relationship on the variable HDI and CO2 emission

5. 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

6. There is a strong correlation between post-life data with fixed phone and other variables not statistically significant.

7. 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 subscriber's data, and other variables are not statistically significant

8. 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

9. There is a high correlation between C02 emission data with life expectancy, CPI, Internet penetration, HDI, and GDP. Furthermore, there is a strong correlation between the post to data and mobile subscribers. As well as, other variables are not statistically significant
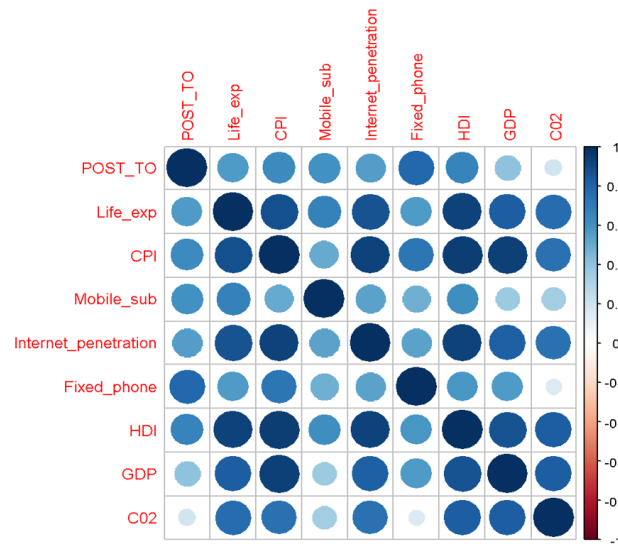
The provided figure 6 shows correlation about post to data

Figure 6. Correlation Post to Data in Asean Countries

4.3 PLS Score Plot

After getting the correlation value. The next step we do 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 is observed, figure 7 gives information on the pattern of PND data. Vietnam. Thailand, Indonesia, Philippine, Myanmar has the same PND characteristics so these countries in the same component (Component 1). In particular, Cambodia forming its components (Component 2). Then, Singapore, Malaysia, and Brunei Darussalam share the same PND characteristics (Component 3). As a result, with R-square 96.2%
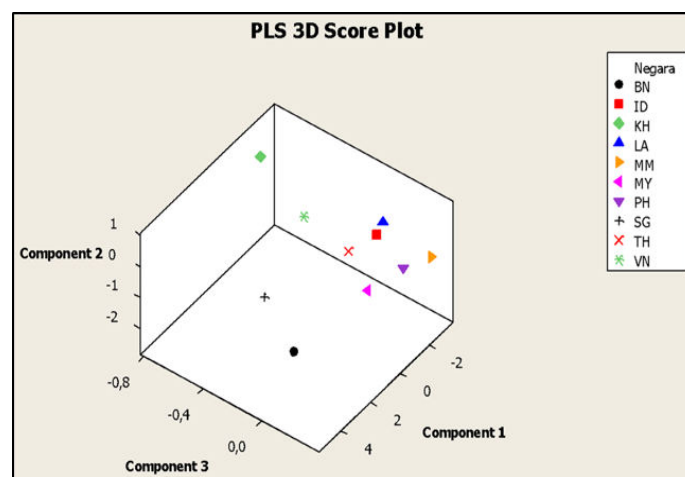

Figure 7. Score Plot PND(to) Data with Socio-Indicators in ASEAN Countries

On the other hand, we also want to see the pattern PND(from) data. Based on Figure 8, Brunei Darussalam forming its components (Component 1). Apart from that, Philippine, Cambodia, Indonesia, Laos, and Vietnam have the same PND (from) data. So, these 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 evidence with R-square 94.2%.
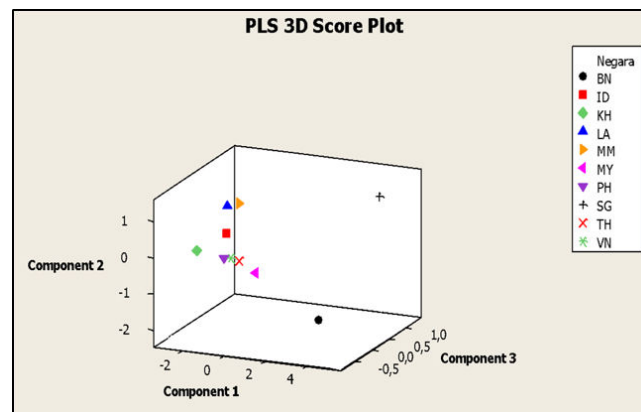
Figure 8. Score Plot PND(from) Data with Socio-Indicators in ASEAN Countries

4.4 Intensity Connection

To see the relationship ASEAN countries can be regarded in Figure.9. There is a high correlation (strong) between Malaysia and Singapore (1.000) it can be identified that based on 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.

					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 9. Matrix of Intensity Connection

5. Conclusion

In a nutshell, 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 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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