The Heckscher-Ohlin versus Linder’s Theory: evidence from Malaysian export

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Abstract
This paper analyzes the export destinations of Malaysia and top six trading partners (an average from 1995 – 2012) using gravity model and pooled ordinary least square (OLS) analysis. As suggested by the pioneer of gravity model (Tinbergen, 1962), the vibrancy of trading activities depend on the resemblance of exporting and importing countries which in parallel with Staffan Linder theory of trade(1961). These include similarities such as GDP per capita, international language, and border sharing and taste in product consume (Morales, Sheu and Zahler, 2014). The theory also highlights that the distance between the two trading countries does give significance effect on trading activities. However, the empirical study in the case of Malaysia proven opposite effect thus allowing Heckscher-Ohlin theory to be highlighted in contrast to Linder theory as H-O theory suggests that a particular country will trade with another country with dissimilar economic performance level. The general finding of this study suggest that Malaysia is more towards Linder theory based on the coefficient sign of GDP per capita differential.

1. Introduction
Quoting numerous studies such as (Bidlingmaier, 2007; Sun & Heshmati, 2010; Wang, Wei and Liu, 2010; Jarreau and Poncet, 2012), international trade without a doubt is one of many reasons a country can developed from time to time. Feder (1983) conducted an empirical study on export and economic growth where he concludes that a country should focus the labor and resources on export sector instead of non-export sector. By doing so, the productivity of exportable goods will increase thus give the country advantage in balance of payment. This strengthens the idea that export does give positive impact on the economic growth as highlighted by theory of comparative advantage by David Ricardo (1817). Being aware of this situation, Malaysia, one of the fastest developing country in Southeast Asia region, take advantage on the wealth of natural resources of the country. US Energy Information Administration reported in 2014 that Malaysia is the second largest exporter of refined petroleum as well as crude palm oil in Southeast Asia region standing after Indonesia. Thus, export activities are crucial in providing growth in Malaysia national income report.

In 2013 alone, Malaysia recorded a value of export at $254 billion enable her to make it into list of 20 largest exporter all over the world (The Observatory of Economic Complexity). The value rose at a rate of 4.2% compare to the year 2008 where the total export only worth $210 billion. This fact alone is enough to proved that Malaysia are aware of the relevancy of export towards her development which in line with statement stated by Yusoff (2005), as an open economy, Malaysia do rely upon her external trade for economic growth. Making into top 20 list of largest exporter, this raise the question of who trade the most with Malaysia and why? Is it involving neighbor countries or does it involve with half way around the world countries. Does distance play a significant role in determining export as suggested by gravity model?

Despite of the positive impact of export on economic growth, the evidence provided by previous studies are more to the exports determinants between the bilateral countries. There is less shed light focus on the application of the two theories of trade which are; (1) Heckscher-Ohlin (H-O) Theory (1933) and (2) Linder Theory (1961). H-O theory suggest that bilateral trade occur between two countries that does not possess the same level of economic development whereas Linder theory argue that bilateral trade will only happens between two countries which possess the same level of economic development. In other to determine the application of these theories, a gravity model developed by Newton theory of gravity and adopted in explaining bilateral trade first by Tinbergen
(1962) and Poyhonen (1963). Although, plethora studies have been published on both theories in the literature, to the best of our knowledge, there is yet evidence pertaining to whether Malaysia’s trade follow either of these theories. Therefore, this study is trying to fill the aforementioned gap and extending the study conducted by Zainal Abidin, Islam and Haseeb (2015) using the gravity model in Malaysia.

The organization of this paper consists of four sections which are (1) literature review; (2) data and methodology; (3) analysis of findings and lastly (4) conclusion and recommendation.

2. Literature Review

The epistemology development on gravity model pertaining to bilateral trade has been investigated in the economics and finance literature since ages ago. To date, gravity model still holds a hypothesis of “the further the distance between two trading countries, the lesser the bilateral trade between them” where it shows a negative relationship of trade with distance (Tinbergen, 1962; Poyhonen, 1963; Bergstrand, 1985; Porojan, 2001; Rahman, 2003; Batra, 2006; Ravishankar and Stack, 2014). In simple words, distance always relate with transportation cost in which according to simple economic law of demand and supply; the higher the cost, the higher the price causing the demand to drop. A study by Linnemann (1966) states that there are three major cost that affecting trade which are; (1) physical shipping cost, (2) time-related cost and (3) cost of cultural unfamiliarity. This study is supported by Frankel, Stein and Wei (1997) stating that shipping cost is the most dominant cost compare to the other two. Thus, this implies that later in the regression, distance variable should bear a negative coefficient sign indicating the aforesaid gravity model of trade.

Twenty cohort study analyzes have examined the gravity model on bilateral trade but exploration of knowledge did not go beyond that where researchers did not particularly highlight on fundamental theories of trade such as Heckscher-Ohlin theory of trade and Linder theory of trade. Referring back to Bergstrand (1985), Rahman (2003) and Batra (2006) where they have discussed on gravity model towards trade determinants, they did mentioned on both of the H-O and Linder theories but just merely mentioned. As for the case of Malaysia international trade, Zainal et. al. (2015) only focusing the gravity model on targeted regional partnership such as Organization of Islamic Countries (OIC) and Association of South-East Asia Nation (ASEAN) but did not highlight the trade theories applicable in the case of Malaysia whether it is based on H-O theory or Linder theory or even neither of the theories.

In conjunction with previous paragraph, H-O theory of trade exist in the year of 1933 by Bertil Ohlin and Eli Heckscher where it emphasized that country with different level tend to trade more compare to country with the same level. This is argued by Staffan Linder (1961) where Linder highlights that country tend to trade with partners who share the same level of development because they tend to enjoy the same preferences but differentiated products. To clarify this argument, we will look at the coefficient of GDP per capita differential as suggested by Frankel et. al. (1997) in their books entitled Regional Trading Blocs in the World Economic System. The book stated that if the coefficient bears the positive sign, it means that the particular country implementing H-O theory. Opposite things happen when the coefficient carries negative sign which represent Linder theory is apply in the particular study. Hence, the second objective of this paper is to identify the theory applicable in the case of Malaysia and top six export destinations.

Over the past years, large number of studies has been conducted on determinants of export between two countries such as Yanikkaya (2003); Jongwanich (2010); Trang and Hieu (2011); Carneiro (2011); Agosin, Alvarez, and Bravo-Ortega (2012); Carrera, Grujovic, and Robert-Nicoud (2015); Zainal et. al. (2015) where among the independent variables included are gross domestic product, gross domestic product per capita, inflation rate, unemployment rate, trade openness, total population and exchange rate between those two trading countries. All of these economic terms influence the production in the country and at the same time influences the export of the nation. A positive coefficient is expected for GDP, GDPPC, trade openness and population as an increase of this variables will results in increase of export activities as reported in previous studies above. In contrast, distance, exchange rate, inflation rate and unemployment rate expected to carry a negative coefficient because these variables are inversely proportional to export level.

Considering all of these literatures and evidences, the general findings suggest that the gravity model produce consistent results on bilateral trade. However, repeating back in the case of
Malaysia, no literatures ever recorded about Malaysia’s trade with six top exporting destination countries are due to H-O theory, Linder theory or neither both of it.

3. Data and Methodology

According to annual reports by MATRADE (an organization responsible for monitoring export activities of Malaysia), the top six export destinations of Malaysia from the year 1995 until 2012 on average are Singapore, China, Japan, United States of America, Thailand and Hong Kong. If we take a look from geographical perspective, only Singapore and Thailand share a border with Malaysia where Singapore are connected by bridge and Thailand are connected by land at northern state of Malaysia. The farthest country is United States of America which located 15,348 kilometers away from Kuala Lumpur. Table 1 presents the value of Malaysia export to top six export destinations and Table 2 presents the distance between Kuala Lumpur and destinations capital city.

<table>
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<tr>
<th>Year</th>
<th>Singapore</th>
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<th>Japan</th>
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Notes: All the values are in USD as reported by The Observatory of Economic Complexity.

<table>
<thead>
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<th>Capital City</th>
<th>Distance</th>
<th>Capital City</th>
<th>Distance</th>
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</thead>
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<tr>
<td>Beijing (China)</td>
<td>4335</td>
<td>Bangkok (Thailand)</td>
<td>1191</td>
</tr>
<tr>
<td>Tokyo (Japan)</td>
<td>5318</td>
<td>Hong Kong</td>
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</tbody>
</table>

Notes: The distance is measured from Kuala Lumpur and values are in kilometers.

For estimation purpose, STATA 11 software is chosen due to accuracy and capability of the software to deal with panel data. There are few advantages of using panel data estimation such as it can capture relevant relationship between countries over time and can monitor unobservable individual effect (Rahman, 2009).

In order to standardize the data, we transformed it into natural logarithm form as presented by the abbreviation of $\ln$. Then, stationarity test was conducted to ensure that the data are not following particular trend of movement to avoid absurd estimations. Levin-Lin-Chu (LLC) unit root test was chosen which carry a hypothesis of; (1) $H_0$: Panels contain unit roots and (2) $H_a$: Panels are stationary. LLC test results on natural log variables show that only four variables are stationary and the rest contain unit root. To treat this problem of non-stationary, first order difference is conducted on all variables and LLC test was re-estimate where the results is presented in Table 3 below.
Table 3 shows the descriptive statistics of overall data consisting 102 observations. LLC test conducted shows that the probability values are all less than 0.01 which means we fail to reject null hypothesis. This concludes that the data is stationary at first order difference compare to raw data and natural log data. After that, Breusch - Pagan Lagrangian multiplier was conducted and the test results shows probability value is more than 0.05 thus indicating we fail to reject null hypothesis. Null hypothesis stated that pooled ordinary least square need to be conducted to avoid wrong estimation procedure.

Not just that, since the distance data is in static form for all period of time, we need to conduct two stage regression where Individual Effect are extracted from first regression before re-estimate it with distance as independent variable as reported by Rahman (2003); Batra (2006); and Zainal et. al. (2015). The equation and model specification are explained in the next subsection.

3.2 Model Specification

The first stage pooled ordinary least square regression is explained in the following equation:

\[
d_{11} = \beta_0 + \beta_1 \ln(GDP_{it}) + \beta_2 \ln(GPDPC_{it}) + \beta_3 \ln(GDP_{jt}) + \beta_4 \ln(GPDPC_{jt}) + \beta_5 \ln(EXP_{it}) + \beta_6 \ln(GDP_{ij}) + \beta_7 \ln(GPDPC_{ij}) + \beta_8 \ln(INF_{it}) + \beta_9 \ln(UENE_{it}) + \beta_{10} \ln(TRA_{it}) + \beta_{11} \ln(TRA_{jt}) + \beta_{12} \ln(POP_{it}) + \beta_{13} \ln(POP_{jt}) + \beta_{14} \ln(EXR_{it}) + \epsilon_{it}
\]

Where the variables are explained as follow:

- \(d_{11}\) = First Order Difference
- \(\ln\) = Natural Logarithm Form
- \(i\) = Home Country (Malaysia)
- \(j\) = Destination Country (Top 6 Malaysia Trading Partners)
- \(\epsilon\) = Error Term
- \(EXP\) = Export value of Home Country (Malaysia) to Top 6 Destinations
- \(GDP\) = Gross Domestic Product (current USD)
- \(GDP\) = Gross Domestic Product Per Capita (current USD)
- \(INF\) = Inflation Rate (annual percentage)
- \(UNE\) = Unemployment Rate (percentage of total labor force)
- \(TRA\) = Trade Openness (percentage of GDP)
- \(POP\) = Total Population
- \(EXR\) = Exchange Rate of 1 Ringgit to Destination Country Currency

The second stage regression involves the implementation of gravity model in our estimation. We are unable to include the distance variable in the first regression because the data on distance between capital cities of trading countries are static over time and unable to be process together with unbalanced data as mentioned by Rahman (2003) in his study. Thus, the linear equation of second stage regression is as follow:

\[
IE_{ij} = \beta_0 + \beta_1 \ln(DIST_{ij}) + \epsilon_{ij}
\]

Where the variables are explained as below:

- \(IE\) = Individual Effect (Home Country and Destination Country)
- \(DIST\) = Distance between Capital City of Home Country and Capital City of Destination Country (in Kilometers)

3.3 Data Source
The data used in this study are obtained from multiple sources consists of international data storage covering the time period of 18 years starting from the year 1995 until 2012. The data of GDP, GDPPC, INF, UNE, TRA and POP are obtained from the World Development Indicators (WDI) database of the World Bank. All the values of GDP and GDPPC are originally in the form of USD whereas INF, UNE and TRA are in percentage. As for the exchange rate data, it was taken from United States foreign exchange website at www.usforex.com and the data are in yearly average of 1 Ringgit Malaysia against export destination currency. Moreover, the data of exports between Malaysia as home country to top six destinations are acquired from the Observatory of Economic Complexity at atlas.media.mit.edu in the measurement of USD. Finally, the distance data are obtained from an Indonesian tourism website at www.indo.com/distance and the value are all in the unit of kilometers.

4. Analysis and Findings

The pooled OLS regression results are reported in Table 4.

Referring to table 4, out of 14 variables, two was omitted due to collinearity problem which are GDP of home country and destination country. GDP per capita of destinations country bear a positive coefficient indicating that an increase of 1% of destination country GDP per capita, the export will increase 1.1371%. Next, the differential GDP per capita between home country and destination country bear a negative coefficient which means that the export value will decrease by 0.2253% if the difference in GDP per capita increase by 1%.

Inflation rate of home country proven to be significant at 1% confident level where it carry a negative coefficient as expected. This shows that an increase of inflation rate of Malaysia by 1% will reduce the export value by 0.0653%. Apart from that, trade openness of destination country also show a significant level at 1% confident interval. It bears a positive sign as expected means that the more lenient the trade barriers are, the higher the value of export towards the destination country.

Furthermore, population of home country result show a positive relationship where an increase in population of Malaysia by 1% will results in the increase of export by 11.6657%. Finally, exchange rate which is one of the popular determinants of export shows a 10% confident interval with negative coefficient. This explains that as the home country currency devaluate, in this case Ringgit Malaysia, the volume of exports will decrease by 0.1919.

On the other hand, it is quite surprising that six of the variables show insignificant probability values which made up of GDPPC of home country, INF of destination countries, UNE of both home and destination country, TRA of home country and lastly POP of destination countries.

By considering the full pooled OLS regression results, the overall model suggest that the result tends to reject the null hypothesis at 1% level indicating the model overall goodness of fit. Following that, R^2 proved that the independent variables can explain the dependent variable at 62% whereas the remaining 38% is due to omission of other important independent variables.

To achieve the second objective of determining H-O or Linder, we need to take a look at the coefficient sign of GDPPC differential which is obviously negative and significant at 1% interval. Quoting from literature, this is a sign of Malaysia are actually obeying the Linder hypothesis stating...
Table 5: Results on Second Stage Individual Effect and Distance Estimation

| Independent Variable | Coefficient | Standard Error | t    | P>|t|   | R²  | F-stats |
|----------------------|-------------|----------------|------|-------|-----|---------|
| Indist               | 0.0079      | 0.01499        | 0.528806 | 0.6249 | 0.063341 | 0.279636 |

Interestingly, the most surprising aspect of this regression is in second stage estimation results where the coefficient of distance against export value supposes to be negative as proven by numerous studies. However in this case, it bears a positive sign which means even the distance increase by 1%, the export value still increase by 0.0079%. Fortuitously, the probability value is exceeding rule of thumb of 0.05 confident levels which is not significant and independent variable is not able to explain dependent variable.

A diagnostic testing on econometrics’ problems has been conducted to test the existence of multicollinearity, heterokedasticity and serial correlation. According to Montgomery (2001), Variance Inflation Factor (VIF) values should be less than 5 or 10 to prove that the regression coefficient does not suffer from multicollinearity problem where the mean VIF value for above regression stands at 2.7 which are below 5. Next test conducted on the regression is Cook Weisberg (1983) heteroskedasticity test which carry a null hypothesis of there is no heteroskedasticity problem and vice versa for alternative hypothesis. The results of Cook Weisberg test on the regression shows a probability value of 0.6574 which is higher than 0.05 thus fail to reject null hypothesis. To complete the econometrics unbiased test, Woolridge (2002) test is conducted to test on serial correlation problem with null and alternative hypothesis are as follow; (1) Ho: There is no first order autocorrelation and (2) Ha: There is first order autocorrelation. The results of probability value stands at 0.5146 which is higher than 0.05 indicating that we are fail to reject null hypothesis thus showing the regression are free from serial correlation problem.

Thus, the diagnostic results indicates that our regression comply with the Best Linear Unbiased Estimation (BLUE) theorem by Gauss-Markov theorem as proven by previous econometrics’ problems testing.

5. Conclusion and Recommendation
The present study was designed to see the gravity effect of export towards the top six destination countries as well as proving the theory Malaysia implementing whether it is H-O theory or Linder theory. We have used 102 observations comprising of 14 independent variables of home and destinations country in the pooled ordinary least square analysis due to violating against the panel data assumption.

Estimated results reveal that Malaysia tend to trade the most with the closest, largest and sharing similarity to us which is why our neighbor country (Singapore) are standing first the list of top six export destinations. The results also reveal that we are trading with the countries who share similar taste of product consumption to us as explained by Linder theory of trade. However, this does not mean we are not implementing H-O theory at all, it is just proving that Linder theory is more superior in explaining Malaysia trade partners rather than H-O theory.

References


