World Journal of Social Sciences
Vol. 3. No. 6. November 2013 Issue. Pp. 27 – 44

Corruption Impacts on Bilateral Trade between ASEAN Countries During 2006 to 2011: Gravity Model Approach

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This paper studies the impacts of corruption on bilateral trade flows during 2006 to 2011. The data used to form the analysis are from all ASEAN countries, which are Brunei, Cambodia, Indonesia, Laos, Malaysia, Myanmar, Philippines, Singapore, Thailand and Vietnam. The evidence from the gravity model and panel data regression has shown that the corruption perception index (CPI) of both bilateral countries has a positive relationship to bilateral trade flows. This result is consistent with many papers relate to this topic and the reasons are discussed.

JEL Codes: F14 and F17

1. Introduction

Corruption is an underlying problem in every country, especially in developing countries and undeveloped countries. Despite its immoral practice, its effect on the key determinants of trade such as GDP, export, import, trade agreement, tax and non-tax barrier is controversial. According to Dutt and Traca (2010), corruption helps stimulating the economy when tariff barriers are high. It increases the amount of trade because more transactions are generated. For instance, in the case of a country with higher tax barrier, greater amount of bilateral trade occurs because people always seek for the cheapest way to trade, which can easily be done through bribery. However, Pak (2001) and Bose (2010) have proved that corruption has decreased trade flows mainly due to low standard of infrastructure and inefficient government expenditure which are two sensitive factors to international trade. For example, an inefficient airport will make transportation become more costly. Higher transportation cost will directly increase the cost of production, the product price, and finally the amount of trade.

Since most local markets are emerging markets, ASEAN countries are moving toward a higher amount of bilateral trades through future cooperation and agreements. Moreover, ASEAN economics community (AEC), which is a national gathering of ten ASEAN countries to share economic advantage, will occur in three years. Countries included in the AEC are Brunei, Cambodia, Indonesia, Laos, Malaysia, Myanmar, Philippines, Singapore, Thailand and Vietnam. The concept of AEC is similar to that of the Euro zone which is to provide mutual economic benefits and bargaining power. The AEC will transform ASEAN into a region with freer movement of goods, services, investment, skilled labor, and freer flow of capital. For example, import and export tariffs for most goods will be eliminated between ASEAN countries. If corruption is found to play an important role in the presence of trade flows, it is interesting to highlight out its significance. Now it has come to an important question to the policymaker: “Does corruption significantly

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affects bilateral trades between ASEAN countries?" The answer to the question could lead to future structural reform and potential trade achievement.

By simply plotting CPI versus net trade flow (Figures shown in appendix section), and CPI versus export/GDP, the relationship is visually positive, so it is interesting to empirically confirm the relationship using my model by regression.

To empirically explain bilateral trade flow between certain countries and its determinants, an approach was suggested by Timbergan (1962) and Poyhonen (1963) to estimate the relation of bilateral trade in the same sense as the law of gravity proposed by Isaac Newton. This gravity of trade model is later used commonly in studies of international trade. As the popularity of the model grow, the standard gravity equation has later been augmented with many other variables. Within this study, the index representing the rate of corruption will be augmented. Formerly, empirical gravity studies used cross-sectional data to estimate the model. Recently, Dutt and Traca (2010) analyzed the impact of corruption on bilateral trade using cross-countries data with corruption augmented gravity model. However, researches nowadays are turning to panel regression in order to capture both cross-section and inter-temporal effects. With additional time-series information, the estimated result would be more accurate.

My research paper aims to highlight the significance of adding corruption perception index. The estimation of this variable can capture the effect of corruption on bilateral trade by using an update panel data set of ASEAN bilateral trade from 2006 to 2011. The results may clearly prove the belief whether corruption either stimulates trade flows or reduces trade flows.

This analysis will be beneficial for both the government and private organizations. For government, it provides a strong suggestion of governance reform for policymakers in order to reduce corruption if the corruption indexes significantly hamper trade flow of that particular country. In addition, by knowing the contribution of each estimated variables in the model, the government will be able to forecast and target the trade flows more precisely. For private organizations, this research will directly benefit those who seek for the effect of corruption on the amount of international trade flow. The topic could be their interest as their business revenues are affected by a country's overall trade flow.

The paper goes through several typical sections starting with literature review, in which existing related findings are demonstrated. Next, the theoretical model of gravity model will be explained. The following sections state the data used for the model and their summary statistics respectively. The next section is devoted for analysis and interpretation. This is where the result from the model is analyzed and explained. The final section is conclusion for the findings of the model.

2. Literature Review

Gravity model of trade is an economics model that is used to predict amount of trade flow between two countries by using the amount of GDP of both countries and the distance between them. Tinbergen (1962) was the first to use econometric model based on gravity equation. The idea of this model was adapted from Newton's law of universal gravitation. Initial gravity model equation according to Newtonian Law is

$$F_{ij} = G\frac{(Y_i Y_j)}{D_{Ij}};$$

Where *F* is a trade flow, *G* is a constant, Y_i is a GDP of country *i*, Y_j= is a GDP of country *j*, S_{ij} is the distance between country *i* and country *j*. However, more variables can be added to the equation in order generalize and enhance precision of the model. Gravity model with more variables is called "Augmented Gravity Model."

To extent the gravity model, Steven Yamarik and Sucharita Ghosh (2005) have identified many strong variables that are linked with trade. They looked into 47 variables to find strong variables to extend their gravity model. They have used a variant of Leamer's extreme-bounds analysis to check the importance of variables. Out of 47 variables, there are only 20 strong variables that link to trade. The list includes measuring level of development, trade policy, linguistic and colonial ties, geographic factors, relative population density, common currency, and membership in the Central American Common Market (CACM), Caribbean Community (Caricom), Mercado Comúndel Sur (Mercosur), Australia-New Zealand Closer Economic Relations Trade Agreement (ANZCERTA), and Asian Pacific Economic Cooperation (APEC).

In addition, Süleyman Ok has offered more significant factors, which are flexibility of income, competitiveness effect, and alternative and consistent to measure the remoteness, to expand the gravity model. Carlo Filippini and Vasco Molini (2003) use the modified version of the gravity model, which includes time dummies, export dummies and technological distance, to see whether these augmented variables significantly affect the amount of trade flow. They also found that the bigger the technological gap between countries, the less each country is willing to trade.

The effect of corruption can also be an interesting analysis, since corruption apparently underlies every important economic factor related to gravity model. Lambsdorff (1999) academically determined the causes and consequences of corruption by concentrating on cross-country analysis. He reviewed an amount of studies on the impact of corruption on GDP, institutional quality, international flow of capital goods, and aids. He also emphasized the absence of competition, policy distortion political system, and public salary as causes of corruption. Swaleheen and Stansel (2007) explained the relationship between corruption and economic growth by using an improved econometric model with the economic freedom variables. They found that, corruption in countries with high economic freedom leads to an increase economic growth. They also suggested that corruption can decrease output as it reduces competition and increases market rigidity. The consistent relationship and theoretical links between corruption and output which is the key to gravity of trade are to be found in this study.

Dutt and Traca (2007) found that corruption will extort trade tariff when the level of protection is low, however, corruption will cause more evasion of tariff payment when the level of protection is high. Pierre Méon and Sekkat (2007) state that the impact of governance on FDI inflows is found but still in a weak relation.

Although many researchers augmented the model with many intricate variables, most research utilized data in the global scale, thus putting the limitation to the result, which can only present global corruption effects but cannot present a similar effect for a specific region in the world. As a result, the effect of corruption specifically on ASEAN's countries trade flow, which is the objective of this paper, has not been analyzed.

As an alternative to the gravity model, Heckscher-Ohlin (H-O) model is one the model that uses predict the trade pattern according to the factor abundance of countries. A country with abundant of one factor is expected to produce more goods that requires intensive use of that factor. For example, a country that is more labor abundant would produce and trade more goods that require relatively higher labor intensity. H-O model is an alternative model utilized to predict trade flow.

3. Theoretical Model

The double-logged OLS regression on gravity model is the eligible estimation method for estimating the corruption perception index (CPI) on bilateral export volumes between ASEAN members.

Initial Gravity Model Equation according to Newtonian Law is expressed as shown:

$$F_{ij} = G\left(\frac{Y_i\, Y_j}{D_{ij}}\right);$$

Where *F* is the amount of trade flow, *G* is the constant, Y_i is the GDP of country *i*, Y_j is the GDP of country *j*, andD_{ij} is the distance between country *i* and country *j*.

Theoretically, the gravity of bilateral trade function form can be derived from simple bilateral trade model of general equilibrium (Anderson and Van Wincoop (2003)). First, the value of export from an original country (country *i*) take part in the total expenditure of importing country (country *j*).

$$P_{ij}x_{ij} = S_{ij}E_j \ , \qquad (1)$$

Where P_{ij} is the price of good from country *i* export to country *j*,x_{ij} is the amount of good from country *i* export to country *j*, S_{ij} is the fraction of expenditure spent on good from country *i* by country *j*, andE_j is the total expenditure on foreign products by country *j*. However, S_{ij} is the function of relative prices between import price and domestic price. Equation (1) also represents the partial market equilibrium for the country *i*'s export to country *j.*

With CES demand functional form:

$$S_{ij} = f\left(\frac{P_{ij}}{P_j}\right) = \left(\frac{P_{ij}}{P_j}\right)^{1-\sigma}, \text{with } \sigma > 1. \qquad (2)$$

Assume that all goods are traded:

$$P_j = \left[\sum_{k=1}^{R} n_k \left({P_{kj}}^{1-\sigma}\right)\right]^{\frac{1}{1-\sigma}} \ , \qquad (3)$$

Where $P_j$is a CES domestic price index, *R* is the number of countries that sells goods to country j including country j itself,n_k is the number of good varieties sold by country *k* to *j* and, σ is the elasticity of substitution constant. The price of goods sold by country *k* to country *j* (P_{kj}) can be defined as the product of producer price in country *i* and the

product of producer price in country *i*. The profit mark up with transportation cost was considered.

$$P_{ij} = P_i \mu_i T_{ij} C_i C_j \ , \quad (4)$$

Where P_i is the producer price,μ_i is the mark-up rate which, for simplicity, is assigned to be equal to 1, $T_{ij}$is the transportation cost, C_i is the mark up rate caused by corruption of exporting country's officers, and C_j is the mark up rate caused by corruption of importing country's officers. In this study C_i and C_j are meant to include bribery for faster administration, evasion of strict inspection and other cost-imposing factors to sellers and buyers. With the equation (2), the total value (TV) of bilateral trade from country *i* is

$$TV_{ij} = (S_{ij})E_j = \left(\frac{P_{ij}}{P_j}\right)^{1-\sigma} E_j. \quad (5)$$

From now on, let TV_{ij}represents the total value of bilateral trade from country. Substitute values of P_{ij} from equation (4) into (5)

$$TV_{ij} = \left(\frac{P_i T_{ij} C_i C_j}{P_j}\right)^{1-\sigma} E_j = (P_i C_i)^{1-\sigma} \left(\frac{T_{ij} C_j}{P_j}\right)^{1-\sigma} E_j. \quad (6)$$

Summing the total value of goods produced by country *i* that are exported to its every customer countries and its own consumption must equal to country *i*'s GDP.

$$Y_i = \sum_{\forall j} TV_{ij} \quad (7)$$

Together with equation (6) and (7)

$$Y_i = \sum_{\forall j} (P_i C_i)^{1-\sigma} \left(\frac{T_{ij} C_j}{P_j}\right)^{1-\sigma} E_j = (P_i C_i)^{1-\sigma} \sum_{\forall j} \left(\frac{T_{ij} C_j}{P_j}\right)^{1-\sigma} E_j. \quad (8)$$

Rearranging yields

$$(P_i C_i)^{1-\sigma} = \frac{Y_i}{\sum_{\forall j} \left(\frac{T_{ij} C_j}{P_j}\right)^{1-\sigma} E_j}. \quad (9)$$

Then, substitute equation (9) into (6)

$$TV_{ij} = \frac{Y_i}{\sum_{\forall j} \left(\frac{T_{ij} C_j}{P_j}\right)^{1-\sigma} E_j} \left(\frac{T_{ij} C_j}{P_j}\right)^{1-\sigma} E_j = Y_i \left(\frac{{C_j}^{1-\sigma}}{\sum_{\forall j} \left(\frac{T_{ij} C_j}{P_j}\right)^{1-\sigma} E_j}\right) {T_{ij}}^{1-\sigma} \left(\frac{E_j}{{P_j}^{1-\sigma}}\right) \quad (10)$$

If we let

$$\sum_{\forall j} \frac{\left(\frac{T_{ij} C_j}{P_j}\right)^{1-\sigma} E_j}{{C_j}^{1-\sigma}} = \frac{1}{G} \quad (11)$$

By putting together into equation (10) and (11), we have

$$TV_{ij} = Y_i(G){T_{ij}}^{1-\sigma}\left(\frac{E_j}{{P_j}^{1-\sigma}}\right). \quad (12)$$

If we view ${E_j P_j}^{1-\sigma}$ as country *j* income (Y_i), then we will get

$$TV_{ij} = \frac{G Y_i Y_j}{{T_{ij}}^{\sigma-1}}$$

If we use distance between countries *i* and *j* as a proxy of ${T_{ij}}^{\sigma-1}$, we will get the gravity equation of trade model. Since G consists of corruption mark-up rate of importing country.

$$G = \frac{1}{\sum_{\forall j}\left(\frac{T_{ij}C_j}{{P_j}^{1-\sigma}}E_j\right)}. \quad (13)$$

Eaton and Kortum (2002) proved that trade among countries should be larger than the observed volumes according to economic theory and suggested that trade can be made larger by reducing the frictions. One important friction of trade is the lack of competitiveness in the sellers and buyers' purchasing powers. Corruption is one cause of imperfect competition and budget cuts. It causes prices to increase, which can be view as a hidden tax or a barrier.

The reductions in trade are subjected to two effects of price increase, which are substitution effects and real income effect. For substitution effect, when imported prices are corrupted, relative prices are changed and domestic prices are preferred. Thus the amount of import volume decreases. If exported prices are corrupted, exporting country is more likely to do worse in international market competition which causes the reduction in the country's export volume. For real income effect, the real budgets of countries with corruption are cut, resulting in the reduction in the potential import volume. These two effects of corruption obviously discourage bilateral trade between countries.

The gravity model of trade,

$$F_{ij} = G\left(\frac{{Y_i}^{\beta_1}\,{Y_j}^{\beta_2}}{{D_{ij}}^{\beta_3}}\right), \quad (14)$$

Can be log-linearized to

$$\ln(F) = G + \beta_1 \ln(Y_i) + \beta_2 \ln(Y_j) + \beta_3 \ln(D_{ij}). \quad (15)$$

With CPI, as a proxy of corruption rate, the augmented log-linearized equation is

$$\ln(F) = G + \beta_1 \ln(Y_i) + \beta_2 \ln(Y_j) + \beta_3 \ln(D_{ij}) + \beta_4 \ln(CPI_j); \quad (16)$$

Where *F* is the amount of trade flow, *G* is the constant, Y_i is the GDP of country *i*, Y_j is the GDP of country *j*, D_{ij} is the distance between country *i* and country *j*, and CPI_j is the corruption perception index of country *j*.

The regression model further improved by including other variables that affect the amount of export. These variables are the coefficient of variation of exchange rate, total population, GDP deflator and unemployment rate. With these variables, the augmented log-linearized equation is

$$\begin{aligned}\ln(F) \quad = \quad & G + \beta_1 \ln(Y_i) + \beta_2 \ln(Y_j) + \beta_3 \ln(D_{ij}) + \beta_4 \ln(CPI_j) + \beta_5 \ln(CV_i) + \\ & \beta_6 \ln(CV_j) + \beta_7 \ln(POP_i) + \beta_8 \ln(POP_j) + \beta_9 \ln(GDP\_D_i) + \\ & \beta_{10} \ln(GDP\_D_j) + \beta_{10} \ln(UR_i) + \beta_{11} \ln(UR_j); \qquad (17)\end{aligned}$$

Where *CV* is a coefficient of variation of exchange rate, *POP* is total population, *GDP_D* stand for a GDP deflator, which represents the inflation level, and *UR* is the unemployment rate.

From the estimation, coefficients of each determinants of trade can be obtained, and the prediction of potential bilateral trade flows under corruption-captured situation can be obtained.

Variables used in the model are presented below with expected sign. Export Value ($\ln(F)$)

Export value is a part of a country GDP. It measures the value of goods and services that are transferred outside a country.

Distance between two capital cities ($ln(D_{ij})$)
As proved by Berthelon and Freund (2008), Brun et al. (2005), and Leamer and Levinsohn (1995), distance variable has a negative effect on export value due to transportation costs, which are positively related to this distance variable.

GDP of exporting country ($ln(Y_i)$)
Gross domestic product (GDP) is a measure of all final goods and services produced in a country. It is one of the most important indicators for an economy. GDP can indicate the size of the economy; the bigger the GDP the larger the size of that economy. According to Tinbergen (1962) and Poyhonen (1963), GDP should have a positive relationship with export value. A brief explanation is that a country with a larger economy size (higher GDP) should be able to produce and export more.

GDP of importing country ($ln(Y_j)$)
An increasing in GDP indicates that there is an increase in economic activities, jobs and income for individuals. People with higher income tend to spend more on both domestic products and foreign products in order to increase their own standard of living (Linnemann, 1966).

Corruption perception index (CPI) ($(ln(C_i)\ and\ (ln(C_j))$
CPI is one of the indexes that reflect the perception of the respondents towards corruption in the public sector. The index score ranges from 0 to 10. The greater

numbers of CPI reflects lower appearance of corruption. Most developed countries have a high rate of CPI; on the other hand, most of undeveloped countries have a low rate of CPI (2-4). According to Helble et al (2007) and Groot et al (2003), this corruption should have a negative impact on export since a higher rate of corruption (lower CPI) a country has the smaller export volume would occur.

Coefficient of variation of exchange rate $(ln(CV_i)\ and\ ln(CV_j))$
The higher coefficient of variation of exchange rate reflects the higher risk of trading with different currency. Since there is more risk, the amount of export should be less. Therefore, the sign of this variable should be negative.

Total population $((ln(POP_i)\ and\ ln(POP_j))$
Total population of country *j* represents the total demand of country *j* which should be positively correlated to the export volume. However, the relationship of the population of country *i* could be positive or negative depending on the consumption and production structure of the exporting country. For export-oriented country, higher population should lead to higher export volume, but for countries with higher domestic demand, a bigger population should lead to lower export volume.

GDP deflator $(ln(GDP\_D_i)\ and\ ln(GDP\_D_j))$
GDP deflator represents inflation. Higher inflation should lead to higher price level. However, if there is a higher inflation in exporting country *i*, the exporting price will be relatively higher. Thus, the amount of export should decrease. When prices in importing country *j* rise, the imported goods seem cheaper, hence the amount of export from *i* to *j* should increase.

Unemployment rate $(ln(UR_i)\ and\ ln(UR_j))$
Due to Okun's law, the relationship between decreases in unemployment and increases in GDP should hold. Therefore, the sign of unemployment rate coefficient should be opposite that of the GDP.

4. Data

This study analyzes the data from ten ASEAN countries throughout 2006 to 2011. For gravity equation, there are 90 bilateral trade flow observations. All ASEAN countries are included in the model, which includes Brunei Darussalam, Cambodia, Indonesia, Lao DPR, Malaysia, Myanmar, Philippines, Singapore, Thailand, and Vietnam. The independent variables used in this study are distance, GDP, corruption perception index (CPI), coefficient of variation of exchange rate, total population, GDP deflator and unemployment rate (percentage of labor force).GDPs, total population figures, GDP deflators and unemployment rates are obtained from official websites, namely the World Trade Organization (WTO) and the International Monetary Fund (IMF). The CPI is obtained from International Transparency Organization. Values for bilateral exports are collected from the International Trade Center. All variables in this paper are measured in terms of US dollar.

5. Summary Statistics of All Variables

Data used includes 540 observations with 90 cross section units and 6 time periods. Missing values generated 219 skipped observations.

Table 1: Basic statistic summary of all of the variables in the regression model

Variable	Mean	Median	Minimum	Maximum	Std. Dev.
Export_i_j	2838.26	376.10	0.00	49988.30	6633.51
Dij	1606.82	1632.63	312.42	3018.45	705.28
Y_i	156535	123086	3453	846832	174642
Y_j	156535	123086	3453	846832	174642
CPI_i	3.5667	2.6000	1.3000	9.3000	2.2101
CPI_j	3.5667	2.6000	1.3000	9.3000	2.2101
CV_i	0.0230	0.0211	0.0003	0.0843	0.0165
CV_j	0.0230	0.0211	0.0003	0.0843	0.0165
POP_i	58.1515	37.7322	0.3703	242.3260	67.5448
POP_j	58.1515	37.7322	0.3703	242.3260	67.5448
GDP_D_i	0.0660	0.0540	-0.2210	0.2364	0.0693
GDP_D_j	0.0660	0.0540	-0.2210	0.2364	0.0693
UR_i	0.0412	0.0370	0.0068	0.1028	0.0224
UR_j	0.0412	0.0370	0.0068	0.1028	0.0224

Note: Export_i_j, Y_i and Y_j are measured in million US dollar. POP_i and POP_j are measured in million people.

The table represents basic statistic summaries of variables that will be used in the Gravity Model. The standard statistics includes mean, median, minimum, maximum and Standard Deviation for each variable. Since all present variables the ten countries was represented for both country *i* and country *j,* the basic statistics for each equivalent variable, for example UR_i and UR_j, were the same.

6. Analysis and Interpretation

Table 2: Summary of OLS regression results with studied variables

Variable	Pooled OLS	Pooled OLS with significant variable	Pooled OLS with uncorrelated coefficient variable	Pooled OLS with significant uncorrelated coefficient variable
Constant	-6737500000*** (-5.6659)	-6399080000*** (-5.6912)	-6561650000*** (-5.5078)	-5665020000*** (-5.2564)
Dij	-4921630*** (-11.3287)	-4894600*** (-11.5367)	-4869050*** (-11.1625)	-4812360*** (-11.4062)
Y_i	0.0111*** (2.9427)	0.0091*** (5.8282)	0.0094*** (5.6247)	0.0089*** (5.9563)
Y_j	0.0200*** (5.1114)	0.0200*** (5.2346)	0.0119*** (6.9952)	0.0127*** (8.1115)
CPI_i	1557200000*** (9.2793)	1560860000*** (13.5204)	1624360000*** (12.8356)	1516070000*** (13.2469)
CPI_j	752366000*** (4.3054)	774238000*** (4.6552)	1023130000*** (7.8273)	929826000*** (7.900)
CV_i	-6220790000 (-0.3746)	-	-7032010000 (-0.4246)	-
CV_j	7484600000 (0.4441)	-	2844400000 (0.1629)	-
POP_i	-8.7321 (-0.6443)	-	-	-
POP_j	-32.8956** (-2.3435)	-31.4048** (-2.3048)	-	-
GDP_D_i	5120360000 (1.2436)	-	4806160000 (1.2173)	-
GDP_D_j	7469350000* (1.9048)	7882760000** (2.0664)	4679710000 (1.2498)	-
UR_i	57005200000*** (2.7256)	46438000000*** (3.4140)	43307400000*** (3.0817)	44902100000*** (3.3539)
UR_j	93221800000*** (4.4059)	91459400000*** (4.4364)	55355200000*** (3.9134)	55075700000*** (4.0826)
Adjusted R-squared	0.5782	0.5773	0.5737	0.5587
#Observation	381	388	381	400

Note: *** represents 99% confidence interval, ** represents 95% confidence interval and * represents 90% confidence interval. Numbers in bracket are t-statistic values.

From table 2, the coefficient of main variables, which were the distance between the two capital cities, GDP of exporting and importing countries, and the corruption perception index (CPI) of both countries, were as expected. Putting it all together with the augmented variables, the estimation of pooled OLS shows that the coefficient variation of exchange rate for both countries, total population, and GDP deflator of exporting country were not significant. At the same time, we also found that the GDP deflator of importing countries and unemployment rate for both countries have a positive relationship with the export volume. However, the effect of total population of importing country was found to be negative with the value of -31.4048.The relationship between GDP deflator and total population of importing country, and unemployment rate for both countries were believed to be incorrect. After dropping all insignificant variables, the relationship of all significant variables remained the same.

When the problem of multicolinerity was eliminated by dropping out highly correlated variables[1], total population of both countries which seemed to be linear with GDP, the result showed that all variables were significant except from coefficient variation and GDP deflator of both countries, which had a lower adjusted R-squared value of 0.5737 when compared to the pooled OLS and pooled OLS with significant variable model. By dropping all insignificant variables from the last model, the result remained the same but with the lowest adjusted R-squared of 0.5587.

The incorrect signs of coefficient of the total population of importing country and unemployment rate of both countries may be caused by the omitted effect from lag variables.

Table 3: Summarize of OLS regression results with studied variables in *log* form (except for UR_i and UR_j)

Variable	Pooled OLS	Pooled OLS with significant variable	Pooled OLS with uncorrelated coefficient variable	Pooled OLS with significant uncorrelated coefficient variable
Constant	-36.6581*** (-12.0385)	-38.5615*** (-16.2932)	-41.9761*** (-12.1044)	-41.0572*** (-18.6223)
l_Dij	-1.54448*** (-8.1139)	-1.82128*** (-11.2902)	-1.8182*** (-8.3492)	-2.2744*** (-14.7043)
l_Y_i	0.774213*** (3.7765)	0.956848*** (5.1769)	1.7560*** (19.6009)	1.7123*** (28.289)
l_Y_j	-0.192716 (-0.9614)	-	1.0998*** (12.2191)	1.2452*** (20.6066)
l_CPI_i	3.87387*** (7.1277)	3.22671*** (6.8867)	1.4738*** (5.5603)	1.3540*** (7.6061)
l_CPI_j	4.00144*** (7.6662)	3.72212*** (19.0153)	0.8300*** (3.1002)	0.6289*** (3.5220)
l_CV_i	-0.065768 (-0.6361)	-	-0.1460 (-1.2518)	-
l_CV_j	0.0805752 (0.9032)	-	0.0200 (0.1982)	-
l_POP_i	1.10818*** (5.3718)	0.882967*** (5.0210)	-	-
l_POP_j	1.43318*** (7.1307)	1.34779***	-	-
l_GDP_D_i	0.138153 (1.0810)	-	0.2258 (1.5794)	-
l_GDP_D_j	-0.231941* (-1.7596)	-0.28019**	-0.0368 (-0.2536)	-
UR_i	-9.29706* (-1.9420)	-7.96758*	-2.6306 (0.4846)	-
UR_j	-4.17543 (-0.8683)	-	1.2535 (0.2298)	-
Adjusted R-squared	0.8267	0.8174	0.7684	0.7803
#Observation	321	376	321	439

Note: *** represents 99% confidence interval, ** represents 95% confidence interval and * represents 90% confidence interval. Numbers in bracket are t-statistic.

From table 3, all data were estimated in *log* form except from the unemployment rate since it is already measured in percentage. By doing the pooled OLS regression, the significant coefficients were distance, GDP of exporting country, CPI, total population of both countries, GDP deflator of importing country, and unemployment rate of exporting country. After dropping the insignificant variables, the result remained the same, but the adjusted R-squared reduced slightly from 0.8267to 0.8174. All variable signs are as expected except from GDP deflator.

The sign of the effect of GDP deflator on trade volume were different from our expectation could be explained by three underlying reasons. First, we assumed that the exchange rate between the two countries are constant, therefore the increase in the price in one country would directly affect the terms of trade. However, this is not the case in the real life situation where the exchange rate is adjusted so that inflation does not affect the term of trade. Second, an economic cycle could be the third-party factor that affects both inflation and trade at the same time. For instance, when an economy is growing faster than its natural speed, the central bank of a particular country might bring up a measure to slow down the economy which in turn negatively affects the country's export. Finally, the GDP deflator may affect export volume in two ways, through substitution effect and income effect. For substitution effect, a higher GDP deflator in country *j* makes the price in country *j* relatively higher than that of country *i*, which causes country *i*'s product to become more preferable. Therefore, the coefficient should be positive. Nevertheless, most prices are made in the form of contact, therefore the substitution effect tenor to be none. For income effect, the purchasing power turns out to be lower as price become higher. This consequently leads to the negative result for the GDP deflator coefficient.

By cutting out the variables that have a multilinearity problem[2], only core variables, which were distance, GDP and CPI of both countries were significant. The coefficients of all core variables had positive relationship except for distance. However, this estimation yielded the lowest adjusted R-square. By dropping all insignificant variables from the last model, the result still remained the same.

The results from the *log* form seemed to be better due to the theoretical model of gravity. The functional form of gravity equation should be in the form of exponential; therefore applying double-logged to variables should yield a better result.

7. Conclusion

This paper analyzes impacts of corruption on bilateral trade flows between ASEAN countries using data from 2006 to 2011. The data were used to form the analysis consisting of all ASEAN countries which are Brunei, Cambodia, Indonesia, Laos, Malaysia, Myanmar, Philippines, Singapore, Thailand and Vietnam. An OLS regression was used to estimate the effect of all variables.

As the result has shown, we can conclude that CPI, along with other variables including total population, GDP deflator and unemployment rate has an effect on the trade volume. The regression has been done with normal form and with double logarithmic form. However, not all aforementioned variables were significant in both forms. Nevertheless, the result from the study has shown to correlate to that of Swaleheen and Stansel (2007), and Dutt and Daniel Traca (2010).

Nevertheless, the CPI or the corruption perception index itself has shown to have positive effect on trade volume in both models. It is therefore safe to state that corruption contributes negatively to the volume of trade. For further research, we could improve the model by adding other corruption indication variables such as the control of corruption index, which is a combination of indicators that measure how government exercises its power.

Endnotes

1. According to Table 4, the correlation between Y_i and POP_i, and,Y_j and POP_j are 0.8044, which mean they are highly correlated.
2. According to Table 5, the correlation between l_Y_i and l_POP_i, and,l_Y_j and l_POP_j are 0.6314, which mean they are correlated.

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Appendix

Figure 1: Relationship between net trade flow and corruption perception index (CPI) in 2009

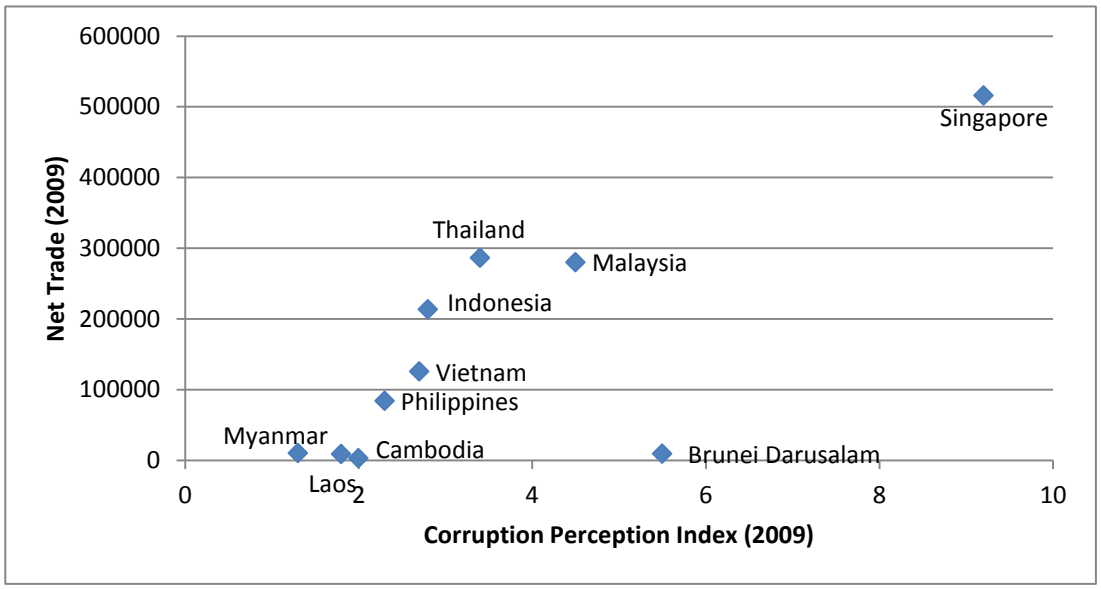

Figure 2: Relationship between export/GDP and corruption perception index in 2009

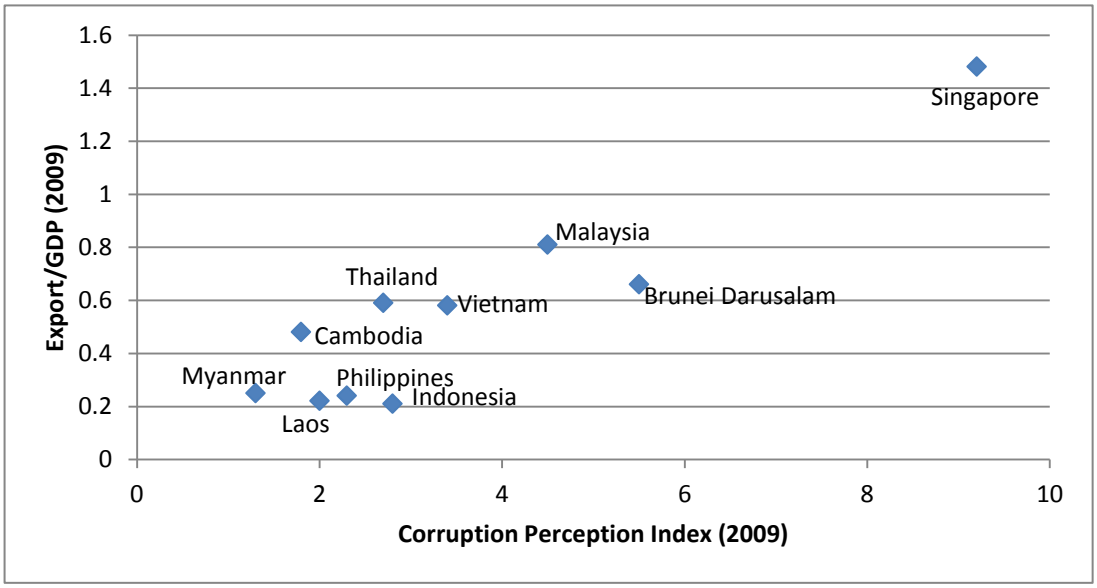

Table 4: Descriptive statistics and correlation matrix for studied variables

	Distance	Y_i	Y_j	CPI_i	CPI_j	CV_i	CV_j	POP_i	POP_j	GDP_D_i	GDP_D_j	UR_i	UR_j
Distance	1												
Y_i	0.2007	1											
Y_j	0.2007	-0.0666	1										
CPI_i	-0.0705	0.1128	-0.0100	1									
CPI_j	-0.0705	-0.0100	0.1128	-0.1161	1								
CV_i	0.1383	0.4191	-0.0428	0.2277	-0.0397	1							
CV_j	0.1383	-0.0428	0.4191	-0.0397	0.2277	0.1188	1						
POP_i	0.3027	0.8044***	-0.0858	-0.3253	0.0365	0.3375	-0.0368	1					
POP_j	0.3027	-0.0858	0.8044***	0.0365	-0.3253	-0.0368	0.3375	-0.1108	1				
GDP_D_i	0.0820	0.0665	-0.0188	-0.3811	0.0404	-0.0168	0.0300	0.3229	-0.0389	1			
GDP_D_j	0.0820	-0.0188	0.0665	0.0404	-0.3811	0.0300	-0.0168	-0.0389	0.3229	0.1026	1		
UR_i	0.3995	0.3985	-0.0664	-0.3036	0.0366	0.2364	-0.0679	0.7468*	-0.0856	0.2774	-0.0427	1	
UR_j	0.3995	-0.0664	0.3985	0.0366	-0.3036	-0.0679	0.2364	-0.0856	0.7468*	-0.0427	0.2774	-0.0975	1

Note: The sample sizes across values in correlation matrix were 540. Missing values were skipped.*** Highly correlated

Table 5: Descriptive statistics and correlation matrix for studied variables in *log* form

	l_Distance	l_Y_i	l_Y_j	l_CPI_i	l_CPI_j	l_CV_i	l_CV_j	l_POP_i	l_POP_j	l_GDP_D_i	l_GDP_D_j	UR_i	UR_j
l_Distance	1												
l_Y_i	0.1456	1											
l_Y_j	0.1456	-0.0879	1										
l_CPI_i	-0.0477	0.3629	-0.0397	1									
l_CPI_j	-0.0477	-0.0397	0.3629	-0.1124	1								
l_CV_i	0.0521	0.3494	-0.0295	0.5255	-0.0748	1							
l_CV_j	0.0521	-0.0295	0.3494	-0.0748	0.5255	-0.0318	1						
l_POP_i	0.1005	0.6314*	-0.068	-0.4526	0.0436	-0.0798	0.0095	1					
l_POP_j	0.1005	-0.068	0.6314*	0.0436	-0.4526	0.0095	-0.0798	-0.1109	1				
l_GDP_D_i	0.0777	-0.1303	0.0010	-0.4088	0.03	-0.2101	0.0915	0.2128	-0.0242	1			
l_GDP_D_j	0.0777	0.001	-0.1303	0.0300	-0.4088	0.0915	-0.2101	-0.0242	0.2128	0.0699	1		
UR_i	0.3650	0.3665	-0.0555	-0.2751	0.0354	0.0775	-0.0363	0.4755	-0.055	0.2849	-0.0525	1	
UR_j	0.3650	-0.0555	0.3665	0.0354	-0.2751	-0.0363	0.0775	-0.055	0.4755	-0.0525	0.2849	-0.0975	1

Note: The sample sizes across values in correlation matrix were 540. Missing values were skipped.* Correlated

Table 4 and Table 5 show the degree of relationship between two variables. Result values that are close to 1 or -1 indicate that the variable pairs are highly correlated. Result values that are close to 0 indicate that the variable pairs are weakly correlated.