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Determinants of Export: A Gravity Model Analysis of Malaysia's Electrical and Electronic Industries

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ABSTRACT

In 2019, Malaysia's export scale was USD 237.8 billion, of which E&E products accounted for the largest share, 38%. This paper utilizes the Gravity Model to analyse the determinants of Malaysia's E&E industry exports. The results show that GDP and distance are in line with the theory of gravity model. Besides, Malaysia's E&E exports are based on the H-O theory; the exports can be increased by trading with countries with different factor endowments. The appreciation of the ringgit has harmed E&E exports. The domestic inflation rate will hurt exports, but the inflation rate of partner countries is the opposite. OFDI will greatly increase E&E exports, while IFDI will reduce it. This may be because Malaysia's main exports to FTA partners are petroleum products, chemicals, liquefied natural gas, and metal products. The results also show that the FTA signed by Malaysia has no impact on E&E exports. During the global financial crisis, Malaysia's E&E exports suffered a serious setback.

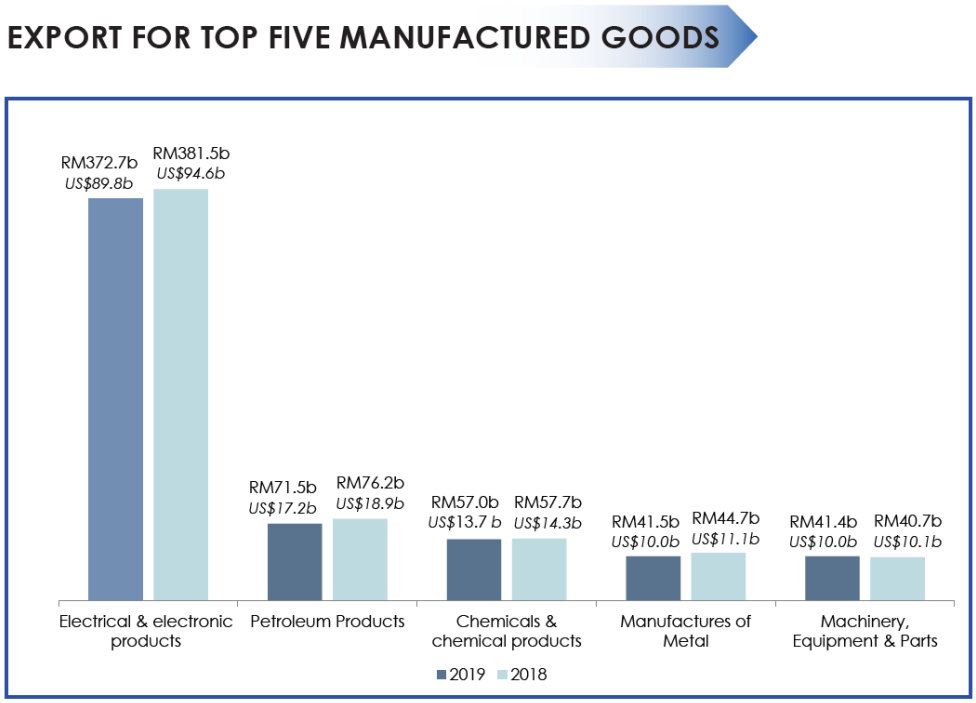
Keywords: E&E's export; E&E industry; gravity model; Malaysia

INTRODUCTION

Malaysia's economy was originally based on agriculture and resource-based industries. The Industrial Revolution originated in the agricultural sector and began during the colonial period. Until the early 1980s, low-tech and resource-based products dominated Malaysia's industrial development. The development of technology and a series of industrialization projects have made important contributions to Malaysian manufacturing's growth and development (Wong, 2008). E&E refers to Electrical and Electronics. The electrical industry applies to all manufacturers and vendors of electrical energy. Electronics is a power control technique, in which power plays a fundamental role. Electronic processing involves circuits of active electronic components such as vacuum tubes, transistors, diodes, and integrated circuits, as well as related passive electronic components and interconnect technologies. Malaysia's E&E industry dividend in to four sub- sectors: components, consumer, industrial and electrical.

Manufacturing has led economic growth in Malaysia since the 1980s, particularly in the E&E industry. According to the 2019 Trade Economic Information Handbook, exports of manufactured goods amounted to US$201.1 billion, accounting for 84.6% of total exports. In 2019, E&E products accounted for Malaysia's largest export composition share at 37.8%. Although down 2.3 percent compared to 2018, the total was $89 billion. This was due to lower exports of computer storage units, data processing equipment, and other computer units.

FIGURE 1. MY's EX for Top Five Manufactured Good in 2019 and 2018



This study aims to identify the factors affecting the export of E&E products in Malaysia. This study applies a gravity model to regress exports of E&E products. Therefore, in the addition to the fundamental factors of the gravity model, exchange rates, FDI, inflation, FTA, and the global financial crisis are also studied. The motivation of this study is to promote Malaysia's E&E exports to increase the country's trade revenue. Second, it fills the knowledge gap in the E&E industry in Malaysia, thus enabling the application of international trade literature. Third, the findings of this study will also be useful to policymakers as the E&E industry seeks to expand its export base to stimulate economic growth. The results of this paper will provide evidence of factors that increase or hinder export growth in the E&E industry and build a stronger economy based on E&E exports.

The study used data on exports of E&E products between Malaysia and 29 partner countries from 2001 to 2019 to examine the impact of exports of E&E products. The structure of this paper is outlined below. Section 2 is the literature review and Section 3 is the methods and data. Section 4 is the findings, and Section 5 is the discussion. Conclusions are in Section 6 at the end of this paper.

LITERATURE REVIEW

Gravity models are widely used to analyze the determinants of national trade flows. GDP is the most commonly used variable in the gravity equation and is often used to measure the size of an economy. GDP refers to the national income and the country's population. Dascal et al. (2002), Bounedi (2013), and Zainal et al. (2013) believe that a larger GDP is more likely to achieve economies of scale and increase export supply based on comparative advantages. Furthermore, GDP per capita growth positively affects exports, and the tradable share of total income may increase as income rises (Dascal et al., 2002).

Some scholars use the gravity model to analyze the difference in per capita income between local and foreign countries and the difference in trade end factors and trade preference between

countries. When two countries have similar income levels and characteristics, usually refers to "demand structure" and "preferences", they are attracted to each other to conduct more trade to expand consumer choices, known as the Linder hypothesis (Linder, 1961; Frankel, 1997). However, the Heckscher-Ohlin hypothesis mentioned in Rasoulinezhad and Gil (2016) explains the comparative advantage caused by the difference in the relative factor endowments of the two countries.

In international trade, the exchange rate cannot be ignored and is an indicator of the global competitiveness of domestic goods (Rahman, 2003; Dinh et al., 2013; Rasoulinezhad and Gil, 2016; Zainal et al., 2016; Rahman et al., 2019). A rise in the exchange rate, also known as depreciation, means less foreign exchange is required to buy one unit of the domestic currency and vice versa. This makes domestic products relatively cheap, and as foreign demand increases, exports increase, and vice versa.

Inflation rates significantly impact a country's currency value and exchange rate. Some authors use the inflation rate to examine the exchange rate's effect on bilateral trade exports (Rahman, 2003; Zainal Abidin et al., 2016; Sultan and Munir, 2015). The authors point out that domestic inflation has a negative impact on exports. However, the partner's inflation rate positively impacts domestic exports.

FDI is an investment in which an investor operating in another country acquires a durable management interest in a local business. The subcomponents of FDI are inflow foreign direct investment and outward foreign direct investment. Outward FDI will increase the country's exports, while inward FDI will reduce export flows (Tham et al., 2017).

In the gravity model, distance is important in explaining international trade. Krugman et al. (2012) show that when countries are close to each other, trade between them tends to be intense; vice versa, when trading partners are further apart, trade gains are reduced, hindering trade.

Free trade agreements (FTA) are agreements between countries to reduce or eliminate trade barriers and achieve closer economic integration. FTA offers low or zero import and export duties. This would make products more competitive, and the agreement facilitates trade (Rahman, 2003; Hellyer, 2019; Rahman et al., 2019).

For South Asian countries, 2008 and 2009 were economic and trade downturns. The 2008/2009 financial crisis witnessed a "trade crash". According to Broll and Jauer (2014) analysis, the financial crisis has a large negative impact on export commodities. This argument is also supported by a study by Tham et al. (2017).

EMPIRICAL LITERATURE OF THE ELECTRICAL AND ELECTRONIC (E&E) SECTOR IN MALAYSIA

According to Wong and Tang (2007), international production and prices are important determinants of long-term and short-term export demand for all five electronics products. In addition, exchange rate fluctuations have affected Malaysia's electricity exports.

Nik Muhammad and Yaacob (2008) showed Malaysia's E&E exports were competitive with other countries in the first stage, according to the findings of CMS. After 1994, Malaysia's export growth was due to increased world imports. The results of the RCA show that Malaysian E&E products are doing well in the US market. Malaysia's export potential is higher than that of the US, Singapore, Japan, and Hong Kong.

Wong (2008) showed a specific long-term relationship between the export market of electronic products and the relative price of electronic products and foreign income. In addition to semiconductor exports, price is important in explaining export production.

Al-Mamun et al. (2015) research show that the export value of all countries except Japan, Thailand, and the United States increases with the growth of the experiential market. In

addition, Malaysia's export to Singapore has the highest growth rate, while Cambodia's growth rate is relatively low.

METHODOLOGY AND DATA

VARIABLE DESCRIPTION

Data on exports between Malaysia and 29 trading partners and factors affecting bilateral export trade in the E&E industry are provided in panel data from 2001 to 2019 (19 years). All observations are based on yearly data, and the data used are in real terms.

This entire variable comes from:

Variable	Description	Unit
Bilateral E&E export	The dependent variable is the annual total export of Malaysia and partners in the E&E industry.	USA Million
GDP	GDP is the market value of a country's production of goods and services to GDP; it may also be referred to as national income and the mass of the country. This variable will be calculated by the formula: $(\text{Yit} * \text{Yjt}) = \text{GDPit} \times \text{GDPjt}$	USD Million
GDP per capita	This variable used to measure income per capital for the Malaysia and partners. The calculation method is: $(\text{YPit} * \text{YPjt}) = \frac{GDP_{it}}{Total\ Population_{it}} \times \frac{GDP_{jt}}{Total\ Population_{jt}}$	Person Million and USD Million
Different of per capita income	Differences in per capita income between countries not only reflect the difference between the trade factor endowments but also the difference between the trade preferences constitutes a significant trade barrier between countries. The formula of this variable as following: $\text{DYPijt} = \text{YPit} - \text{YPjt}$	USD Million
Exchange rate	The exchange rate measures the international competitiveness of domestically produced goods. The exchange rate is included in the model as an explanatory variable and calculated by the formula: $EX_{ijt} = \frac{Annual\ average\ of\ the\ curency\ of\ Malaysia\ per\ US\ dollar}{Annual\ average\ of\ the\ curency\ of\ partner\ per\ US\ dollar}$	National Currency per USD
Inflation rate	The inflation rate is used to test the exchange rate impact on bilateral trade export. Zainal Abidin et al. (2013), the author indicated that Malaysia's inflation rate has a negative impact on Malaysia's export. However, the inflation rate on partners has a positive impact on Malaysia's export.	%
Outflow FDI	Foreign direct investment is when an investor in another country acquires a durable management interest (10 percent or more voting shares) in a local business (Bounedi, 2013). The subcomponents of Malaysia's OFDI are inward foreign direct investment (IFDI) and outward direct investment (OFDI).	USD Million
Inflow FDI		USD Million
Distance	Distance is the geographical distance between Malaysia's economic centre (capital) and its trading partners. Straight-line distances are in kilometres.	Kilometre (km)
Free Trade Agreement	FTA is referred to the dummy variable of a free trade agreement. If Malaysia has signed a free trade agreement with a partner, it is equal to 1; otherwise, it is equal to 0.	1 OR 0

Global Financial Crisis Year	This variable refers to virtual variables during the global financial crisis on 2008 and 2009. If Malaysia and its partners are in year 2008 and 2009 of the financial crisis, it is equal to 1, otherwise, it is equal to 0.	1 OR 0

MODEL SPECIFICATION

The earliest gravity model was constructed by Tinbergen (1962) :

$$lnExport_{ij} = \beta_0 + \beta_1 lnY_i + \beta_2 lnY_j + \beta_3 lnDIS_{ij} + \varepsilon_{ij} \qquad Eq.\ 1$$

Where,

$lnExport_{ij}$	=	The export from country i to j
lnY_i	=	The GDP for country i
lnY_j	=	The GDP for country j
$lnDIS_{ij}$	=	The distance between both countries

Over the years, many scholars have developed the above basic forms by using other real or pseudo-variables. For example, Frankel (1992) expanded the basic form to include the factor of income (GDP per capita). In this study, the researchers used a gravity model developed by Rasoulinezhad and Gil (2016), Zainal Abidin el at (2016) and Tham et al. (2017) for modelling bilateral export trade in E&E industries. In this case, the model can be written as follows:

$$InExpe\&e_{ijt} = \beta_0 + \beta_1 ln(Y_{it} * Y_{jt}) + \beta_2 ln(YP_{it} * YP_{jt}) + \beta_3 lnDYP_{ijt} + \beta_4 lnEX_{ijt} + \beta_5 lnINF_{it} + \beta_6 lnINF_{jt} + \beta_7 lnOFDI_{it} + \beta_8 lnIFDI_{it} + \beta_9 lnDist_{ij} + \beta_{10} FTA_{ij} + \beta_{11} FC_{ij} + \varepsilon_{ijt} \qquad Eq.\ 2$$

Where,

lnExpe&e$_{ijt}$	=	The export volume of E&E product between Malaysia (i) and partner (j) at specific time.
ln(Y$_{it}$ * Y$_{jt}$)	=	The economy size (GDP) of Malaysia and partner at time t.
ln(YP$_{it}$ * YP$_{jt}$)	=	The income (income per capita) for Malaysia and partner at time t.
ln(DYP$_{ijt}$)	=	The income difference between and partners at time t.
lnEX$_{ijt}$	=	The bilateral exchange rate at time t.
LnINF$_{it}$	=	The inflation rate of Malaysia at time t.
lnINF$_{jt}$	=	The inflation rate of partner at time t.
lnOFDI$_{it}$	=	The outflow FDI of Malaysia at time t.
lnIFDI$_{it}$	=	The inflow FDI of Malaysia at time t.
lnDist$_{ij}$	=	The distance between Malaysia's capital and partners' capital.
FTA$_{ij}$	=	A dummy variable for Free Trade Agreement 0: Agreement not signed 1: Agreement signed
FC$_{ij}$	=	A dummy variable for 2008/2009 Global Financial Crisis Year 0: There is not the global financial crisis year 1: There is the global financial crisis year

Rasoulinezhad and Gil (2016) believe that the *Eq. 2* model will have multicollinearity problems. Therefore, in order to avoid the problem of multicollinearity, it is better to decompose the above *Eq. 3, Eq. 4, and Eq. 5*, gravity model into three models, and consider the GDP and income variables separately. According to Rasoulinezhad and Gil (2016), the following three gravity models will be used in this study:

Model I ：

$$InExpe\&e_{ijt} = \beta_0 + \beta_1 ln(Y_{it} * Y_{jt}) + \beta_2 lnEX_{ijt} + \beta_3 lnINF_{it} + \beta_4 lnINF_{jt} + \beta_5 lnOFDI_{it} + \beta_6 lnIFDI_{it} + \beta_7 lnDist_{ij} + \beta_8 FTA_{ij} + \beta_9 FC_{ij} + \varepsilon_{ijt} \quad Eq.\ 3$$

Model II:

$$InExpe\&e_{ijt} = \beta_0 + \beta_1 ln(YP_{it} * YP_{jt}) + \beta_2 lnDYP_{ijt} + \beta_3 lnEX_{ijt} + \beta_4 lnINF_{it} + \beta_5 lnINF_{jt} + \beta_6 lnOFDI_{it} + \beta_7 lnIFDI_{it} + \beta_8 lnDist_{ij} + \beta_9 FTA_{ij} + \beta_{10} FC_{ij} + \varepsilon_{ijt} \quad Eq.\ 4$$

Model III:

$$InExpe\&e_{ijt} = \beta_0 + \beta_1 lnDYP_{ijt} + \beta_2 lnEX_{ijt} + \beta_3 lnINF_{it} + \beta_4 lnINF_{jt} + \beta_5 lnOFDI_{it} + \beta_6 lnIFDI_{it} + \beta_7 lnDist_{ij} + \beta_8 FTA_{ij} + \beta_9 FC_{ij} + \varepsilon_{ijt} \quad Eq.\ 5$$

In the model, *ln* stands for logarithmic form, and ε_{ijt} is the error term.

In contrast to the FE model, the random effects model (RE) has the advantage of cancelling the effects of time-invariant variables in FE estimation. However, the use of RE may introduce the possibility of heterogeneous effects. In other words, the random component is independent of the regression term on the right and some error terms (Shepherd, 2013).

This study also used the Poisson pseudo-maximum likelihood model (PPML) proposed by Santos Silva and Tenreyro (2006). Santos Silva and Tenreyro (2006) showed that, under weak assumptions, only the gravity model contains the correct set of explanatory variables and that PPML can provide consistent estimates for the original nonlinear model. Furthermore, a recent study by Alvarez et al. (2018) successfully applied the PPML model to the estimation and analysis of the gravity equation and also considered PPML the most appropriate econometric method because it is methodologically consistent and unbiased. Because PPML models can be used to solve multicollinearity, heteroscedasticity, and autocorrelation problems (Shepherd, 2013).

Because the cointegration estimates of the expert group do not have similar views, this study uses three estimators to estimate and compare the results.

FINDINGS

PANEL CROSS-SECTION DEPENDENCE TEST

TABLE 1. Panel Cross-Section Dependence Test

Variables	Pesaran's CD Test	Prob.
***ln*Expe&e$_{ijt}$**	19.83	0.0000

$ln(Y_{it} * Y_{jt})$	86.20	0.0000
$ln(YP_{it} * YP_{jt})$	85.24	0.0000
$ln(DYP_{ijt})$	48.63	0.0000
$lnEX_{ijt}$	22.43	0.0000
$nINF_{it}$	87.83	0.0000
$lnINF_{jt}$	22.39	0.0000
$lnOFDI_{it}$	87.83	0.0000
$lnIFDI_{it}$	87.83	0.0000
Model I FE	2.72	0.0065
Model I RE	4.94	0.0000
Model II FE	2.78	0.0055
Model II RE	2.71	0.0067
Model III FE	6.15	0.0000
Model III RE	5.44	0.0000

The probability values of all variables are found to be below the critical value and the null hypothesis can be rejected at the 5% level. This means that all series have strong evidence that cross-sectional correlation and the cross-sectional augmented ADF is the most appropriate unit root test (Pesaran, 2004).

TABLE 2. ADF Panel Unit Root Test

Variables	Pesaran's CADF Test	Prob.	Stationary
$lnExpe\&e_{ijt}$	101.80	0.0003	Yes
$D(lnExpe\&e_{ijt})$	336.91	0.0000	Yes
$ln(Y_{it} * Y_{jt})$	107.30	0.0001	Yes
$D(ln(Y_{it} * Y_{jt}))$	208.07	0.0000	Yes
$ln(YP_{it} * YP_{jt})$	97.58	0.0009	Yes
$D(ln(YP_{it} * YP_{jt}))$	216.61	0.0000	Yes
ln(DYPijt)	115.49	0.0000	Yes
D(ln(DYPijt))	199.83	0.0000	Yes
$lnEX_{ijt}$	76.52	0.0521	No
$D(lnEX_{ijt})$	178.97	0.0000	Yes
$LnINF_{it}$	268.44	0.0000	Yes
$D(LnINF_{it})$	343.34	0.0000	Yes
$lnINF_{jt}$	172.39	0.0000	Yes
$D(lnINF_{jt})$	377.63	0.0000	Yes
$lnOFDI_{it}$	310.64	0.0000	Yes
$D(lnOFDI_{it})$	440.54	0.0000	Yes
$lnIFDI_{it}$	301.85	0.0000	Yes
$D(lnIFDI_{it})$	343.77	0.0000	Yes

Based on the result, the probability values of all variables are found to be below the critical value and the null hypothesis was strongly rejected at the 5% level, except the lnEX. This means that the entire time series variable is stationary at their level (Pesaran, 2007).

TABLE 3. Perdroni Panel Cointegration Test

Model		Statistic	Prob.	Weighted Statistic	Prob.
Model I	Panel v-Statistic	-2.60	1.00	-5.16	1.00
	Panel rho-Statistic	3.80	1.00	5.21	1.00
	Panel PP-Statistic	-8.32	0.00	-3.77	0.00
	Panel ADF-Statistic	-9.22	0.00	-5.23	0.00
	Group rho-Statistic	6.80	1.00	-	-
	Group PP-Statistic	-8.35	0.00	-	-
	Group ADF-Statistic	-6.34	0.00	-	-
Model II	Panel v-Statistic	-2.38	0.99	-4.65	1.00
	Panel rho-Statistic	3.85	1.00	5.18	1.00
	Panel PP-Statistic	-8.24	0.00	-4.36	0.00
	Panel ADF-Statistic	-4.42	0.00	-4.80	0.00
	Group rho-Statistic	6.77	1.00	-	-
	Group PP-Statistic	-8.42	0.00	-	-
	Group ADF-Statistic	-5.39	0.00	-	-
Model III	Panel v-Statistic	-2.57	0.99	-3.56	1.00
	Panel rho-Statistic	3.86	1.00	4.81	1.00
	Panel PP-Statistic	-7.43	0.00	-3.33	0.00
	Panel ADF-Statistic	-4.88	0.00	-4.55	0.00
	Group rho-Statistic	6.69	1.00	-	-
	Group PP-Statistic	-5.95	0.00	-	-
	Group ADF-Statistic	-4.71	0.00	-	-

Source: Author's Calculation by EViews 10

Most series are stationary at their level. Thus, the Pedroni panel cointegration test can be applied to a set of variables where all series are before the different levels to check whether there is a long-term equilibrium relationship between series (Ramires, 2006).

From the results, the p-values of most of the statistics were less than 0.05 after combining all the panels, groups and weighted statistics. Therefore, most statistical tests can significantly reject the null hypothesis. In conclusion, there are cointegration and long-term relationships among variables in the three models.

MODEL ESTIMATION

After finding long-term relationships between all series, the authors used three-panel data estimation methods, namely FE, RF, and PPML, to explore the coefficients of all variables.

TABLE 2. *Gravity Model Estimation of FE, RE and PPML*

Model	Variables	FE	P-Value	RE	P-Value	PPML	P-Value
Model I	Constant	-3.912	0.0001	-2.063	0.5058	-1.095	0.0000
	ln(Y_{it} * Y_{jt})	0.346	0.0000	0.507	0.0000	0.238	0.0000
	lnEX_{ijt}	-0.164	0.0011	-0.037	0.3813	0.004	0.3690
	lnINF_{jt}	0.102	0.0005	0.106	0.0004	-0.008	0.3982
	InINF_{it}	-0.009	0.8577	0.037	0.4801	0.064	0.0007
	ln$OFDI_{it}$	0.028	0.4976	-0.062	0.2040	-0.135	0.0000
	ln$IFDI_{it}$	-0.019	0.5156	-0.036	0.3501	-0.016	0.2826
	In$Dist_{iJt}$	-	-	-0.599	0.0787	-0.226	0.0000
	FTA	-	-	-0.425	0.4933	-0.083	0.0177
	FC	-	-	0.023	0.8107	0.095	0.0147
Model II	Constant	-3.414	0.0003	-4.906	0.4850	0.794	0.0432
	ln(YP_{it} * YP_{jt})	0.437	0.0000	0.454	0.0000	0.161	0.0000
	ln(DYP_{ijt})	0.031	0.6773	0.018	0.8138	-0.128	0.0000
	lnEX_{ijt}	-0.147	0.0036	-0.118	0.0152	0.011	0.1635
	*ln*INFjt	0.098	0.0007	0.098	0.0009	-0.034	0.0293
	*In*INFit	-0.021	0.6872	-0.016	0.7616	0.010	0.7771
	ln$OFDI_{it}$	0.009	0.8326	0.012	0.8048	0.017	0.5459
	ln$IFDI_{it}$	-0.015	0.6174	-0.021	0.5720	0.001	0.9609
	In$Dist_{iJt}$	-	-	0.103	0.8903	-0.156	0.0000
	FTA	-	-	0.580	0.6746	0.012	0.8445
	FC	-	-	-0.023	0.8080	0.046	0.4865
Model III	Constant	1.222	0.0791	-0.890	0.9023	1.944	0.0000
	ln(DYP_{ijt})	0.180	0.0169	0.182	0.0143	-0.024	0.1410
	lnEX_{ijt}	-0.231	0.0000	-0.188	0.0002	0.041	0.0000
	*ln*INFjt	0.062	0.0362	0.068	0.0261	-0.060	0.0001
	*In*INFit	-0.117	0.0242	-0.103	0.0533	-0.016	0.6852
	ln$OFDI_{it}$	0.187	0.0000	0.224	0.0000	0.072	0.0112
	ln$IFDI_{it}$	0.037	0.2147	0.002	0.9624	0.018	0.5097
	In$Dist_{iJt}$	-	-	0.238	0.7593	-0.121	0.0028
	FTA	-	-	-0.111	0.9380	0.019	0.7877
	FC	-	-	-0.137	0.1654	0.009	0.8954

Source: Author's Calculation by EViews 10

$$InExpe\&e_{ijt} = -0.86 + 0.36\ ln(Y_{it} * Y_{jt}) + 0.35\ ln(YP_{it} * YP_{jt}) + 0.08\ lnDYP_{ijt} - 0.13\ lnEX_{ijt} + 0.06\ lnINF_{jt} - 0.02\ lnINF_{it} + 0.10\ lnOFDI_{it} - 0.09\ lnIFDI_{it} - 0.39\ lnDist_{ij} - 0.26\ FC_{ij} + \varepsilon_{ijt} \quad \textit{Eq. 6}$$

The results show that if GDP increases by 1%, the export of E&E products will increase by about 0.36%. Per capita income has a positive impact on exports of E&E products. The results show that exports between these countries will increase by about 0.35%, and income will increase by 1%. The difference in income (DYP) is consistent with the H-O theory, which states that countries export more if their factors differ.

The results of the three models all prove that the exchange rate has a severe negative impact on E&E exports. The ringgit appreciated 1% against the US dollar, while exports of E&E products fell by an average of 0.13%. From these models, it can be found that inflation in partner countries positively impacts E&E product exports. A 1% rise in partner country inflation would lead to a 0.07% rise in exports; conversely, if the domestic inflation rate increases by 1%, exports of E&E products will decrease by an average of 0.02%.

Regarding the estimated outflow FDI, as it increases by 1%, E&E exports will increase by 0.10% on average. However, if inflow FDI increases by 1%, E&E exports will decrease by 0.09% on average. In this study, a 1% increase in trade distance reduces E&E exports by 0.35%. During the financial crisis, the export of E&E products will drop by 0.29%, indicating that the financial crisis negatively correlates with E&E exports. The positive effect of FTA has been reflected in many studies, but its impact is negligible in this study. This suggests that FTA did not significantly support E&E exports during the study period.

DISCUSSION

This study demonstrates that Malaysia's GDP and income strongly correlate with E&E exports. In addition, the income differential results find that E&E exports strongly follow the H-O assumption. This is because the model demonstrates a strong positive effect on different per capita incomes. This means that trade with countries of different economic levels will increase exports of E&E products. (Gil, 2016; Linder, 1961; Frankel, 1997).

From an exchange rate perspective, the appreciation of the ringgit against the currencies of the model countries will reduce the export of E&E. (Rahman, 2003; Dinh et al., 2013; Rasoulinezhad and Gil, 2016; Zainal et al., 2016; Rahman et al., 2019). The inflation rate estimates are consistent with those of Rahman (2003), Zainal Abidin et al. (2016) and Sultan & Munir (2015). Domestic inflation will hurt Malaysia's E&E exports. However, rising inflation in partner countries will positively impact Malaysia's E&E exports.

According to this study, the results of FDI are consistent with those of Tham et al. (2017). Outflow FDI will greatly increase Malaysia's E&E exports, while inflow FDI will reduce its exports. In this study, the authors also proved the contention of Tham et al. (2017) Malaysian FDI inflows and outflows are complementary to bilateral export trade.

Furthermore, in this study, distance was used as a proxy for transportation costs, a result supported by Krugman et al. (2012), as transportation costs can increase the price of a product, thereby weakening its competitiveness and trade income.

Many empirical studies have found that FTAs can promote trade. However, in this study, the FTA variable does not support Malaysia's EEE exports. This may because Malaysia's main exports to FTA partners are petroleum products, chemicals, liquefied natural gas and metal products (MITI Malaysia, 2017). Malaysia suffered a severe setback during the global financial crisis. Consequently, the financial crisis negatively impacted exports of E&E products (Broll & Jauer, 2014; Tham et al., 2017).

CONCLUSION

In conclusion, exporting E&E products brings huge benefits to the industry and improves national income and investor confidence. For example, Malaysia provides an affordable platform for investors looking to develop offshore operations to manufacture advanced E&E products and services. In addition, the rapidly developing Industry 4.0, robotics and automation technology, and smart homes all reflect the importance of the E&E industry.

This study provides empirical evidence on the determinants of Malaysia's E&E exports. However, this study encountered some limitations during the data collection phase. In the future, the E&E industry in Malaysia should study large-scale data and more factors such as political stability, corruption levels, and labour wages. This article also hopes Malaysia's E&E industry can develop rapidly under national unity and cooperation. Thereby enhancing the internal and external competitiveness of the Malaysian E&E industry.

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