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Causal Links between Foreign Direct Investment and Exports: Evidence from Malaysia

Siti Hajar Samsu (Corresponding author)
School of Business and Economics, Universiti Malaysia Sabah
Locked Bag 2073, Kota Kinabalu 88999, Sabah, Malaysia
Tel: 60-88-320-000 Ext 1551 E-mail: ct_hajar_98@yahoo.com, sitihajar@ums.edu.my

Alias Mat Derus
Kulliyyah of Economics and Management Science
International Islamic University Malaysia
P.O Box 10, Kuala Lumpur 50728, Malaysia
Tel: 60-36-196 Ext 4850 E-mail: matderus@iiu.edu.my

Ai-Yee, Ooi
Labuan International School of Business and Finance
Universiti Malaysia Sabah, Labuan International Campus
Jalan Sg Pagar, W.P Labuan 87000, Malaysia
Tel: 60-87- 466-713 E-mail: ooiaiyee@yahoo.co.uk

Mohd Fahmi Ghazali
Labuan International School of Business and Finance
Universiti Malaysia Sabah, Labuan International Campus
Jalan Sg Pagar, W.P Labuan 87000, Malaysia
Tel:60-87- 466-715 E-mail: mohdfahmi_ghazali@yahoo.com

Abstract

Malaysia has encouraged foreign investment not only for its role in technology transfer but also for its contribution to Malaysian exports. Therefore, the aim of this study is to investigate empirically the causal relationship between FDI inflows and exports in Malaysia. The methodologies of stationarity of time series and the multivariate Granger concept of causality were employed to carry out the investigation. The finding that time series variables are cointegrated implies that there is a long term relationship between them. The results appear to support the effectiveness of the outward looking orientation policy deployed in this country.

Keywords: Foreign direct investment, Export, Causality, Cointegration, Malaysia

1. Introduction

The present study chooses to fill the gap by investigating the issue with annual data for the sample period of 1970-2003. This paper intends to carry out an econometric analysis to investigate interlinkages between the two variables. Although FDI has been the primary mechanism linking countries' economies, the issues of what FDI means for trade are of particular interest in the context of policies for trade and FDI. Therefore, the motivation of this current study is to empirically investigate the causal relationship between export and FDI inflows by means of the Granger causality test in the cointegration and error correction model framework for annual data from 1970 to 2003.

In the case of Malaysia, the government opted for more liberal policies favoring the private sector especially foreign direct investment participation. Responding to this swift change of policies, the domestic private sector has received an aggressive inflow of FDI to ensure the sustained expansion in output growth. Moreover, since its adoption of the policy adjustment and liberalization in the mid 1980s, Malaysia's external trade has expanded at even higher rates. Hence, Malaysia had become one of the fastest growing economies before the financial crisis of 1997. Since FDI and trade are important for growth and development, it is important to understand the interlinkages between the two.

The positive relationship between FDI inflows and exports in relation to economic performance has been broadly accepted; however, the empirical work on the relationship is relatively limited. Survey and empirical results are always uncertain, which necessitates a formal testing. Most of the existing research stresses complementarity and substitutability relationships between exports and FDI. However, many of these studies do not discuss the issue of causality between inflows of FDI and exports. The existing literature on the Malaysian position in relation to this subject matter proves to be inadequate.

The rest of the paper is organized as follows. In section two, gives a brief discussion about the data set used and outlines the methodology employed. Section three, consisted of discussion and empirical results, concluding remarks with main finding and policy implications are summarized in the last section four.

2. Data and methodology

2.1 Data

The data which used for this study is the yearly data for the period from 1970 to 2003. Our analysis is based on time series data at the national level which is on Exports, Foreign direct investment inflows, Gross Domestic product. All of the data are extracted from different published sources i.e. the International Monetary Fund (IMF) International Financial statistics, Yearbook (Various years), Department of Statistics, Yearbook of Statistics Malaysia (DOS), Malaysia International Trade and Industry (MITI) and Balance of Payment, Annual Report of Bank Negara Malaysia.

2.2 Tests for Stationarity

In any econometric studies, the first step in our methodology is to check the stationarity of the variables used as regressors in the model to be estimated. The variables used in the specified model required the test for the existence of unit root. The unit root test is used for individual variables of time series data with the purpose of ensuring the variables are integrated. In fact, non stationary series could result in spurious regression.

The ADF test is based on the regression equation with the inclusion of a constant and a trend of the form:

$$\Delta X_t = \beta_0 + \mu_t + \delta X_{t-1} + \sum_{i=1}^{k} \alpha_i \Delta X_{t-i} + \varepsilon_t \tag{1}$$

Where X_t = Variables of interest in the logarithm forms at time trend *t*, ΔX_{t-i} expresses the first differences with *k* lags, ε is the white noise residual of zero mean and constant variance. The coefficients $\{\beta_0, \delta, \mu_t, \alpha_1, \ldots\ldots, \alpha_k\}$ are parameters being estimated. The null and the alternative hypothesis for the existence of unit root in variable X_t is;

$H_0 : \delta = 0$ (X_t is non stationary or contains a unit root)

$H_1 : \delta < 0$ (X_t is stationary or non unit root)

The null hypothesis of the unit root test is that the series are non stationary. Then, if the value AIC (Akaike Information Criterion) is greater than t-statistic, the probability (p-value) is less than the level of significance; we can reject the null hypothesis. In other words, if the estimated value for δ is significantly less than zero i.e. rejects the null hypothesis δ = 0, then the series is stationary. Conversely, if we cannot reject the null hypothesis, this means that the time series have a unit root process. However, usually it is likely to be stationary in the first differences as asserted in studies such as Hakim and Rashidian (2002) and Adjaoud and Abdul Rahman (1996).

2.3 Tests for Cointegration

After having completed examination of the stationary of each time series, the next step is to figure out the level of cointegration between the examined variables. For simplicity, this step investigates whether the stochastic trends in the examined variable, which is supposed to contain unit roots, have a long term relationship.

For the cointegration test, the most common used methods are the Engle and Granger (1987) and the Johansen (1988) and Johansen and Juselius (1990) method. The Johansen and Juselius test is a method of cointegration testing based on the maximum likelihood estimation of the VAR model to determine the number of cointegrating vectors in the analysis. In this technique, two test statistics are involved in identifying the number *(r)* of cointegrating vectors, namely the trace test statistics and the maximum eigenvalue test statistics. The trace statistics hypothesize the null hypothesis that there are at most *r* cointegrating vectors against the alternative of *r* or more cointegrating vectors. Meanwhile, the maximal eigenvalue statistics tests are for *r* cointegrating vectors against the alternative of *r*+1 cointegrating vectors. It is widely accepted that the Johansen and Juselius approach is more powerful than the Engle and Granger tests, hence we decided to use the Johansen and Juselius method to test for the long run relationship at integrated variables.

In this study, we employ the Johansen and Juselius method to test for the long run relationship between variables in a multivariate model using Johansen's full information maximum likelihood procedure. The analysis is based on the following equations:

$$y_t = \mathrm{A}_1 y_{t-1} + \mathrm{A}_2 y_{t-1} + ... + \mathrm{A}_\rho y_{t-\rho} + \varepsilon_{t-p} \quad (2)$$

Where y_t is a k- vector of non stationary 1(1) variables, A with i=1,…, ρ is a lag operator and ε_t is a the white noise residual of zero mean and constant variance. The lag order ρ must be determined using Akaike's Information Criterion (AIC).

2.4 Test for Granger (temporal) Causality with VECM

The next step involved is testing for Granger causality among the variables. We thus proceed with our causality test using the first difference version of the variables under study. The cointegration between two or more variables is sufficient to demonstrate the presence of causality in at least in one direction (Granger, 1988). Although cointegration indicates the presence or absence of Granger causality, it does not indicate the direction of causality between the variables. Thus, the causality test helps us to verify whether change in any series can be explained by the other two series. The concept of causality is initially introduced by Granger (1969). Hakim and Rashidian (2002) briefly explain about the causality test. In addition, all series need to be stationary in order to avoid spurious causality. Much of the previous literatures demonstrated the use of non stationary macroeconomic variables in regression would produce spurious results and lead to misleading conclusions (Gujarati, 2003). This view is also supported by Granger (1988), which stated that standard tests for causality are valid only if there exists cointegration between the examined variables. Thus, we can conclude that the prerequisite of causality testing is to check the cointegrating properties of the variables.

We employed the vector autoregression (VAR) technique and regressed on its own lags and the lag of other variables. To examine the causal linkages among these variables, we specify and estimate a vector error correction model (VECM) which can be expressed as follows:

$$\begin{aligned}\Delta \ln EXP &= \delta_0 + \delta_1 \sum_{i=1}^{p} \delta_{1i} \Delta \ln EXP_{t-1} + \delta_2 \sum_{i=1}^{p} \delta_{2i} \Delta \ln FDI_{t-1} + \delta_3 \sum_{i=1}^{p} \delta_{3i} \Delta \ln GDP_{t-1} + \\ &+ \delta_4 ect_{t-1} + \mu_t\end{aligned} \quad (3)$$

$$\begin{aligned}\Delta \ln FDI &= \delta_0 + \delta_1 \sum_{i=1}^{p} \delta_{1i} \Delta \ln FDI_{t-1} + \delta_2 \sum_{i=1}^{p} \delta_{2i} \Delta \ln GDP_{t-1} + \delta_3 \sum_{i=1}^{p} \delta_{3i} \Delta \ln EXP_{t-1} \\ &+ \delta_4 ect_{t-1} + \mu_t\end{aligned} \quad (4)$$

$$\begin{aligned}\Delta \ln GDP &= \delta_0 + \delta_1 \sum_{i=1}^{p} \delta_{1i} \Delta \ln GDP_{t-1} + \delta_2 \sum_{i=1}^{p} \delta_{2i} \Delta \ln EXP_{t-1} + \delta_3 \sum_{i=1}^{p} \delta_{3i} \Delta \ln FDI \\ &+ \delta_{46} ect_{t-1} + \mu_t\end{aligned} \quad (5)$$

Where ect_{t-1} is the error correction term generated from the cointegrated regression from the Johansen multivariable process, μ_t are disturbance terms, Δ denote first differences required to induce stationary for corresponding variables and the estimated coefficient of $\delta_1, \delta_2 ……\delta_3$ indicates the 'short run' causal effects, shown by the F-test of the explanatory variables whereas the coefficient of ect_{t-1} measures the 'long run' causal relationship implied through the significance of the t-statistics. The relevant error correction term must be included to avoid misspecification and omission of important constraints. The lag structure is determined by using Akaike's minimum Final Prediction Error (FPE) Criterion.

3. Estimations results

3.1 Time Series properties of the Data

As it is well known, the unit root test objective is to test whether the potential macro variables in estimation are stationary. The unit root test results both with and without time trend are reported in Table 3.1. The table reports the results of the Augmented Dickey Fuller (ADF) and Philips Perron (PP) tests on these variables. The Akaike Information Criteria was used to select the optimum lag lengths required in each case.

The testing results from panel A propose that all the variables considered have unit roots. The estimated ADF t-statistics less than the corresponding critical values reveals that the null hypothesis of the unit root (non stationary) cannot be rejected for most of the variables at the 10% level of significance. This implies that most of the variables are stochastic at all levels, then it will be further confirmed that the variables are integration of order 1. From Panel B, the null hypothesis could be rejected for the differences of the series. In other words, the time series data are first difference stationary. One advantage of the PP test over the ADF test is that the PP tests are robust to general forms of heteroskedasticity in the error term μ_t (Philips and Perron, 1988). Taking this view for the results of stationarity collectively, greater reliance is placed on the PP results.

3.2 Cointegration and Johansen Test

If all variables have unit root and they have the same order of integration, then the likelihood ratio test is used to find out the number of cointegrating vectors. Therefore, if there is one or more than one cointegrating vector, then the long run combination among the variables can be found, even though they may drift apart in the short run. The possibility of cointegration between the variables included in the model is examined by estimating the cointegrating regression described in equation (2).

Table 3.2 represents the Johansen cointegration test results for the cointegration rank *r*. The null hypothesis is rejected, thus suggesting that there is certainly at least one cointegrating vector in each sample to show the stable long run relations between these variables. Evidence from the table shows that the null hypothesis of r = 0 or there is no cointegration is rejected at 5% and 1% level of significance by trace statistics and maxi Eigenvalue tests. Evidence from Table 3.2 confirms that the number of statistically significant cointegration vectors is equal to two for trace statistics and one cointegrating vector for maximal eigenvalue. This implies that there exists a significant cointegrating relationship connecting three variables and we can conclude that there is a long run relationship among the variables under study.

Our result is supported by Dritsaki, Adamopoulus (2004) who assert that there exists a long term relationship between LEXP, LGDP, and LFDI which long run estimated elasticities relative to exports suggest that foreign direct investments are inelastic to exports.

The export cointegration equation suggests that the FDI and GDP influence Malaysian exports in the long run. The long run estimated elasticities relative to exports suggests that foreign direct investment is inelastic to exports, while output growth is elastic to export. The study result seems to support our study expectations of the linkages between FDI and exports growth in the long run. It is likely to show that an increase in FDI inflows may boost or enhance movements in Malaysian exports.

Co-integration Equation

InEXP= 0.765039 + 2.752742

(0.02643) (0.03958)

Causality Analysis with VECM

A.M.M. Masih and R. Masih (1996) stress that the vector error correction modeling is used to observe an additional channel for causal linkage among cointegrated variables. He added that the VECM approach allows us to distinguish between short term and long term Granger causality. Hakim and Rashidian (2002) further explain that by using the VECM two sources of causality are detected. First, the traditional channel of causality through the F-statistics of the lagged explanatory variables which demonstrates short term causal effects, whereas the second additional channel is implied through the significance of the lagged error correction term which represents long run causality.

The evidence of the co-integration presented in Table 3.2 indicates that we should proceed with the error correction model (ECM) in order to combine both the long run information and short run dynamic in the model. The results of the multivariate causality from the VECM are presented in Table 3.3. From the results we can see the existence of a long term equilibrium relationship between foreign direct investment and exports. The empirical result of the estimated error correction models indicates the significance of the error correction term (ECT) which confirms the long run relationship between exports and its regressors.

The direction of causality is in line with our prior expectations for the current study. From the causality result, it appears that causality flows from foreign direct investment to exports in the long run. Specifically, this reflects an exports growth in manufactured goods which is through foreign involvement in the manufacturing sector which is parallel with the trends in Malaysia whereby 40% to 60% of FDI inflows are directed towards the manufacturing sector compared with other sectors i.e. oil and gas, and services. The findings match up with the analysis of Zhang et al., (2001) who examine the relationship between inward direct foreign investment and Chinese exports which found that FDI leads exports for China as a whole.

4. Conclusion

The main result of this study was that the FDI inflows and exports are cointegrated in the period of analysis. The finding that the time series variables were cointegrated implies that there was a long term relationship between them. Even though the empirical results from the VECM showed there was no causality effect in the short run between FDI inflows and exports, it still supported the validity that FDI inflows have a positive effect on exports in the long run. The causal linkages suggest the direction running from FDI inflows to exports. It is clear that expansion of exports can results from FDI, if there are relatively large differences in resource endowments between the home countries and host country (Liu et al., 2001). The positive association between these two variables is an evidence of a beneficial impact of FDI on exports. These results provide further insight into the role played by FDI in the effectiveness of the export oriented policy deployed in this country. Its seems that the findings of this study support the hypothesis made by Dollar (1992) and Jun and Singh (1995) which acknowledge that outward oriented economies particularly those exploiting their export potential attract more foreign direct investment. Phang (1998) whose study was about foreign direct investment at Malaysia's balance of payments position, found that FDI is attracted to countries with high trade potential and the export.

The policy implications are straightforward. For rapid expansion of exports, trade liberalization policies have to promote on sectors that will trigger FDI inflows to Malaysia. Specifically, sectors which are able exploit exporting capabilities built on local suppliers. This approach must take into account a way to defeat poor linkages between foreign firms and local industry; as past study reveals that technology transfers remain poor in host country. Thus, Asian countries have been facing a low value added and poor record of technology transfer. However, for effective policy analysis studies may be undertaken using data at the disaggregate level. Economically speaking, this means that host government should promote activities as a potential exports which make use of our comparative advantage. In addition, FDI should be seen as a supplement, not as a substitute for local capital resources.

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Table 3.1 Augmented Dickey Fuller (ADF) and Philips Perron (PP) tests for unit roots

Panel A	**Test for I (0) Levels**			
	Tμ(Without trend)		**Tτ (With trend)**	
Variables	**ADF**	**PP**	**ADF**	**PP**
InEXP	-0.108700	0.216468	-1.823779	-2.107035
InFDI	-1.878789	-2.126401	-1.861765	-2.364900
InGDP	-1.196921	-2.747645	-1.54823	-5.594169***

Panel B	**Test for I (1) First difference**			
	Tμ(Without trend)		**Tτ (With trend)**	
Variables	**ADF**	**PP**	**ADF**	**PP**
InEXP	-4.436118***	-5.236766***	-4.220030	-5.109199***
InFDI	-3.610565**	-5.540936***	-3.640772**	-5.559412***
InGDP	-3.644645**	-9.344744***	-3.743587**	-9.079127***

Notes: Number in the table are the t-statistics for testing the null hypothesis that the variables non stationary or has a unit root.

*, **, *** indicate the significance level of 10%, 5%, and 1% respectively.

The optimum lags lengths for each case determined by the Akaike Info Criterion.

Table 3.2 Johansen's test for multivariable cointegrating vector VAR with 6 lags

Vector			**Critical value**			**Critical value**		**Results**
H_0	**H_1**	**Trace Statistics**	**5 %**	**1 %**	**Maxi Eigenvalue**	**5 %**	**1 %**	TTest & Maxi Eigen indicate two cointegrating equations at the 5% & 1% level
InE XP	**InFDI**	**InGDP**						
r = 0	**r > 0**	107.34***	29.68	35.65	79.0709**	20.97	25.52	
r ≤ 1	**r > 1**	28.277***	15.41	20.04	27.4444	14.07	15.63	
r ≤ 2	**r > 2**	0.832735	3.76	35.65	0.8327	3.76	6.65	

Notes: r indicates the number of cointegrating vectors.

Critical values are taken from Johansen & Juselius 1990

** (*) denotes rejection of the hypothesis at 5% (1%) significance level.

Table 3.3 Dynamic MultivariateCausality Analysis through Vector error correction modeling (VECM) VAR with 2 lags

Dependent Variable	**Independent variables**			
	F-Statistics			**T-Statistics**
	ΔlnEXP	**ΔlnFDI**	**ΔlnGDP**	**For ECT_{t-1}**
(1)ΔlnEXP	**-**	1.396702	8.165046***	2.66836***
(2)ΔlnFDI	0.1904	-	0.950317	-0.27559
(3)ΔlnGDP	2.028217	5.94809**	-	3.88316***

Notes: *, **, *** denote significance at 10%, 5% and 1% respectively. Statistics on lagged EC terms are t-ratio and measure long run causality, while statistics on lagged independent variables are F-statistics and evaluate short run causality.