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DOES EXCHANGE RATE VARIABILITY AFFECT THE CAUSATION BETWEEN FOREIGN DIRECT INVESTMENT AND ELECTRONICS EXPORTS? AN EMPIRICAL TEST USING MALAYSIAN DATA

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ABSTRACT

This paper finds that exchange rate variability does affect the causation between FDI and electronics exports using Malaysia's top five electronics exports by SITC (Standard International Trade Classification) product groups. The Granger causation runs from FDI to exports of automatic data processing equipment; and from the radio-broadcast receivers with sound recorders or reproducers exports to FDI.

Keywords: Causality; electronics exports; foreign direct investment

JEL classification codes: C22; F21

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DOES EXCHANGE RATE VARIABILITY AFFECT THE CAUSATION BETWEEN FOREIGN DIRECT INVESTMENT AND ELECTRONICS EXPORTS? AN EMPIRICAL TEST USING MALAYSIAN DATA

1. Introduction

This study examines whether exchange rate variability affects the causal relationships between foreign direct investment (FDI) and Malaysia's top five electronics exports by SITC (Standard International Trade Classification) product groups.

This study justifies: First, this study considers the potential impact of exchange rate variability on the bivariate VAR system i.e. the causation relationships between FDI and electronics exports. Excluding this variable to analyze the bivariate system may lead to misspecification and incorrect inferences. There are situations in which the exchange rate variability could have negative or positive effects on exports. The outcome of these effects depends very much on the availability of hedging mechanism (Sercu and Vanhulle, 1992), the limitations and costs of forward exchange markets (Medhora, 1990; Caporale and Doroodian, 1994), and the degree of risk aversion (De Grauwe, 1988). Besides, the increase in exchange rate variability may cause a postponement of investment plans by foreign firms in the host country in spite of favorable shift in relative costs of production (Krugman, 1989). However, empirical studies by Cushman (1985, 1988) and Goldberg and Kolstad (1995) suggest that exchange rate variability does tend to increase the FDI flows, which support the theoretical argument that in the event of fluctuating exchange rate such as a fall in currency of host country, foreign firms might take advantage of this situation to increase the share of investment activity located offshore. Second, the causality relationships between FDI and exports given that the available empirical literature on this study is limited until recent years (for examples, see Sahoo, 2004; Pacheco-López, 2005; Hsiao and Hsiao, 2006). Conceptually, the causal relationship between FDI and exports could run in either direction. With regard to export trade, foreign firms may establish a production base in the host country according to the country's comparative cost advantage (Pugel and Lindert, 2000), which suggests FDI inflows promote exports. When the multinational corporations (MNCs) become competitive and profitable in the exports markets, they will tend to grow from reinvested

internal profits and newly borrowed funds along with new technology, superior management and marketing strategies (Pacheco-López, 2005) - this implies exports stimulate FDI.

The structure of this study is as follows. Section II provides a description of the data and tests the order of integration of each variable based on unit root tests, which are a prerequisite for Granger causality analyses in Section III. Concluding remarks are presented in Section IV.

2. The data and the unit root tests

Data

The data are quarterly data from 1991:1 to 2000:4, and has been determined largely by the availability of the unpublished data of electronics exports by SITC product groups provided by the Department of Statistics, Malaysia. The Malaysia's top five electronics exports are: (1) EX776 semiconductor devices e.g. thermionic valves and tubes, photocells etc.; (2) EX752 automatic data processing equipment; (3) EX764 telecommunication equipment, parts and accessories; (4) EX763 sound recorders or reproducers, television image and sound recorders or reproducers; and (5) EX762 radio-broadcast receivers with sound recorders or reproducers. The FDI data used in this study comprises the long-term private capital (LTPC) flows from the Malaysia's balance of payments' capital account.[‡] The exchange rate variability is calculated by $EV_{t+m} = [\frac{1}{m}\sum_{i=1}^{m} (REER_{t+i-1} - REER_{t+i-2})^2]^{½}$, where REER is index of real effective exchange rate (1995=100), and m = 4, which is the order of the moving average. The electronics exports are volume of electronic export at 3-digit SITC level, while the LTPC variable is deflated by gross domestic product (GDP) deflator. All the raw data are transformed into indices at 1995 prices (i.e.1995 = 100) to ensure all variables are unit free.

Unit root tests and Granger causality test

If unit roots are present in each time-series variable, spurious correlation may arise if we regress levels of these time-series variables that contain trend components via OLS (ordinary

[‡] Prior to 2001, all the FDI data was classified as LTPC flows but from 2001 onwards, LTPC flows was named as FDI flows in Malaysia's balance of payments' capital account (see Goh, 2005).

least squared) estimator. Hence, before implementing the Granger causality test by VAR (Vector Autoregressive) framework, it is essential to test each individual series for unit roots such as augmented Dickey-Fuller (ADF), which allows for serial correlation in residual and still tests for unit roots. In addition, the Kwiatkowski-Phillips-Schmidt-Shin (KPSS, 1992) test will also be used, which differs from ADF test described earlier in that the series is assumed to be (trend-) stationary under the null.

Table 1. Testing for Stationarity

	ADF (H_o: a unit root)	KPSS (H_o: trend stationary)
*Ln*FDI	-6.127 (1)*** ~ *I*(0)	0.0539 ~ *I*(0)
*Ln*EX752	-1.3996 (4) ~ *I*(1)	0.2181*** ~ *I*(1)
*Ln*EX762	-2.7398 (5) ~ *I*(1)	0.1302* ~ *I*(1)
*Ln*EX763	-2.1744 (0) ~ *I*(1)	0.1787** ~ *I*(1)
*Ln*EX764[#]	-3.5403 (10)** ~ *I*(0)	0.1710** ~ *I*(1)
*Ln*EX776	-4.8790 (0)*** ~ *I*(0)	0.0724 ~ *I*(0)
EV	0.0536 (1) ~ *I*(1)	0.1503** ~ *I*(1)
Critical values		
1%***	-3.96	0.216
5%**	-3.41	0.146
10%*	-3.13	0.119

Notes: The data are in levels. A time trend is included in these tests. (.) denotes the optimum lag length suggested by AIC (Akaike's information criterion). # the lag is set up to 8 manually since the system fails to compute the test statistic for 12 lags as suggested by SIC; and the Phillips-Perron test does not reject the null of a unit root in levels, which the p-value of the test statistics is 0.2714 suggesting *I*(1). [.] is the suggested break date. The critical values for the ADF test are from Davidson and MacKinnon (1993, page 708, Table 20.1). While the critical values for KPSS test is from Kwiatkowski, *et al*. (1992). A four-quarter lags are included for KPSS test.

As in Table 1, it is clear from ADF and KPSS test statistics that a unit root is unlikely for the FDI variable i.e. it is stationary in levels, *I*(0). On the other hand, the evidence seems firmly in favor of the hypothesis of *I*(1) for EX752, EX766, EX763, and EV. The test result is inconclusive for EX764, e.g. it is only *I*(1) as assessed by KPSS test at 5% level of significance but we reject the null hypothesis of a unit root at 5% level of significance as indicated by ADF tests, while we are strongly against the hypothesis of *I*(1) both according to KPSS and Phillips-Perron tests. The EX776 series is stationary in levels, *I*(0).

Based on the unit root tests, we have found the FDI variable is *I*(0) and the electronics exports variables are either *I*(0) or *I*(1), and the exchange rate variability is *I*(1). This suggests that it would be infeasible to consider a cointegration analysis, which implies a long-run relationship

does not exist between FDI inflows and anyone of the five electronics exports. Thus, standard Granger-causality approach (Granger, 1969 and 1988), which is based on a Wald test of VAR framework, is applied, in which the variables are ensured to be stationary by first differencing are EX752, EX762, EX763, EX764, and EV.

3. Empirical Results

The causation between FDI and electronics exports has been initially tested by a bivaraite VAR which is without exchange rate variability. For completeness, the *F* statistics for Granger causation with lags 4, 8 and 12, are reported in Table 2. The results of some cases are found to be sensitive to the predetermined lag length. Consequently, the results with lag length of 12, which are suggested by AIC, are preferred. The test statistics show that there is an evidence of unidirectional Granger causality which runs from electronics exports (EX752, EX762, and EX764) to and FDI in the short run.

Table 2. Testing for Causality (*F*-statistic) – without Exchange Rate Variability, EV

Null hypothesis	Lags: 4	8	12 (AIC)
*Ln*FDI =/=> *dLn*EX752	0.29307 (0.87978)	0.75073 (0.64906)	3.26572 (0.25818)
*dLn*EX752 =/=> *Ln*FDI	1.1759 (0.34442)	1.75814 (0.16998)	9.62182 (0.09791)*
*Ln*FDI =/=>*dLn*EX762	0.82758 (0.51972)	0.88449 (0.5527)	0.21715 (0.96721)
*dLn*EX762 =/=> *Ln*FDI	2.68376 (0.05367)*	2.2729 (0.08561)*	106.58 (0.0093)***
*Ln*FDI =/=>*dLn*EX763	0.73814 (0.57449)	0.3975 (0.90388)	0.07026 (0.99432)
*dLn*EX763 =/=> *Ln*FDI	0.63839 (0.6398)	0.78618 (0.6228)	3.28896 (0.25665)
*Ln*FDI =/=>*dLn*EX764	0.10321 (0.98037)	0.58207 (0.77682)	1.13873 (0.55937)
*dLn*EX764 =/=> *Ln*FDI	1.30806 (0.29305)	1.61014 (0.20815)	13.3356 (0.07181)*
*Ln*FDI =/=>*Ln*EX776	0.68761 (0.60682)	1.81584 (0.15202)	1.78917 (0.34784)
*Ln*EX776 =/=>*Ln*FDI	6.51239 (0.00084)***	3.94496 (0.01067)***	2.79246 (0.21569)

Note: =/=> denotes 'do not Granger-cause'. (.) is p-value. *d* is first different operator. *, **, and *** denote significant at 10%, 5%, and 1%, respectively.

Table 3 reports the results of Granger causation between electronics exports and FDI with an inclusion of exchange rate variability variable in bivariate VAR equations. There are insufficient observations to compute the VAR system equations for a lag length of 12; thus only a lag length of 4 and 8 are used. The results with lag length of 8, which are suggested by AIC, are preferred showing that the Granger causation only runs from FDI

to EX752; and from EX762 to FDI. This evidence corroborates the theory and is consistent with previous studies by Alguacil *et al*. (2002) and Pacheco-López (2005). This implies that FDI inflows to Malaysia can promote the exports of automatic data processing equipment (EX752). And also if the exports radio-broadcast receivers with sound recorders or reproducers (EX762) are competitive and profitable, they can also stimulate more FDI inflows to the country. Hence, the exchange rate variability does affect the causation between electronics exports and FDI for Malaysia.

Table 3. Testing for Causality (*F*-statistic) – with Exchange Rate Variability, EV

Null hypothesis	Lags: 4	8 (AIC)
*Ln*FDI =/=> *dLn*EX752	0.315016 (0.8648)	15.46968 (0.0018)***
*dLn*EX752 =/=> *Ln*FDI	1.290264 (0.3042)	1.031589 (0.4991)
*Ln*FDI =/=>*dLn*EX762	0.905726 (0.4777)	0.821705 (0.6126)
*dLn*EX762 =/=> *Ln*FDI	2.345503 (0.0862)*	3.317507 (0.0806)*
*Ln*FDI =/=>*dLn*EX763	0.541663 (0.7068)	0.420629 (0.8722)
*dLn*EX763 =/=> *Ln*FDI	0.587938 (0.6748)	1.294686 (0.3871)
*Ln*FDI =/=>*dLn*EX764	0.119597 (0.9741)	0.55027 (0.7872)
*dLn*EX764 =/=> *Ln*FDI	1.684765 (0.1893)	1.344485 (0.3693)
*Ln*FDI =/=>*Ln*EX776	0.814262 (0.5297)	0.962503 (0.534)
*Ln*EX776 =/=>*Ln*FDI	7.2859 (0.0007)***	1.84999 (0.2346)

Note: =/=> denotes 'do not Granger-cause'. (.) is p-value *d* is first different operator. *, **, and *** denote significant at 10%, 5%, and 1%, respectively.

4. Conclusions

This paper provides new empirical evidence on the causality between FDI inflows and exports using Malaysia's top five electronics exports by SITC product groups as a case. In addition, we also examine whether exchange rate variability has any impact on the causality in the bivariate VAR system. The findings show that the FDI variable is *I*(0) while the electronics export variables are inconclusive either *I*(0) or *I*(1). These findings do suggest that there is no long-run relationship between FDI and anyone of the top five electronics exports. Moreover, the exchange rate variability does affect the causation between FDI and electronics exports, viz. the Granger causation runs from FDI to exports of automatic data processing equipment; and from the exports of the radio-broadcast receivers with sound recorders or reproducers to FDI.

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