Outward FDI, merchandise and services trade: evidence from Singapore

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Abstract

This paper aims to explore the causality pattern between OFDI and major external trade components (i.e. exports and imports of merchandise as well as services) using Singapore as a case, since it is one of the largest outward investors in the Asian region, and is overtly trade-dependent. The findings reveal that there is evidence of OFDI-led trade hypothesis, particularly, merchandise exports and imports, an indication for OFDI to open up important channels for intra-firm trade activities, home country sourcing and backward integration. However, there is no evidence of causality relationships between Singapore's OFDI and services trade because the nature of services is mainly to provide market presence in the consuming country. As such, Singaporean multinationals are likely to outsource their services either from the host country services sector or their own services-supporting subsidiaries that have been relocated abroad. The present study provides implications for policy formulation on strengthening the OFDI-services trade linkages.

JEL classification codes: F21
Keywords*:* Outward FDI, multinationals, Singapore, Granger causality, merchandise and services trade

1. Introduction

With increasing globalization, the world economy has become more integrated and interdependent leading to a rapid expansion of international trade as well as foreign direct investments (FDIs). One of the salient features of the globalization process is a change in FDI pattern, that is, a rise in outward FDI (OFDI) activities by developing economies from the Southeast and East Asian regions, an indication that they have become an emerging source of the world's FDI (UNCTAD, 2008). As a consequence, this has raised an interesting empirical question pertaining to the effects of OFDI on home country trade. The empirical study of the relationship between OFDI and trade is well documented in the literature. In general, the basis of the empirical work on OFDI-trade relationships is to determine whether these two macroeconomic variables are complementary or substitutionary. Broadly speaking, the empirical evidence on such study is mixed. For instance, Horst (1972) found that OFDI is often viewed as a replacement for home exports for U.S. manufacturing firms if they were to produce for the Canadian markets. Similarly, empirical evidence supporting the proposition that OFDI are substitutes for trade can also be found in Svensson (1996), Bayoumi and Lipworth (1997) and Ma *et al.* (2000). In contrast, empirical findings by Lipsey and Weiss (1984), Helpman

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(1984), Grossman and Helpman (1989), Brainard (1993; 1997), Lin (1995), Pfaffermayr (1996), Clausing (2000) and Head and Ries (2001) advocate the complementary relationship between OFDI and trade. This was because foreign affiliates used home inputs to produce outputs in the host countries.

Moreover, as pointed out by Lim and Moon (2001), OFDI would have a positive effect on home country exports if the foreign subsidiaries were located in less developed countries, relatively new, and in a declining home industry. Furthermore, Goldberg and Klein (1999) and Bronigen (2001) showed mixed evidence in that OFDI had both the substitution and complementary effects on trade. The OFDI-trade relationship was not a clear-cut one. The outcome of the relationship depends on whether OFDI is horizontal or vertical (e.g., Markusen (1984), Markusen and Venables (1995), Helpman (1984), Helpman and Krugman (1985), Kokko, (2006)). According to Amiti *et al.* (2000), the substitutionary relationship tends to take place if horizontal OFDI occurs between countries that are similar in terms of relative endowments and size, and when trade costs are moderate to high. On the other hand, vertical OFDI is likely to dominate when countries differ in terms of relative skill endowment and size, and trade costs are low.

Another interesting empirical question pertaining to the OFDI-trade relationship is the examination of the pattern of causality between OFDI and trade (i.e. exports and imports). According to Fontagné (1999) and Kosekahyaoglu (2006), the causality between OFDI and exports as well as imports could run in the following directions: (a) OFDI may result in home exports due to foreign production by the host country's multinationals with the aim of enhancing the international competitiveness of export trade; (b) home exports may also drive OFDI when exports are serving as the first stage at an internalization process[2]; (c) OFDI may lead to imports because of backward vertical integration; and (d) imports may also drive OFDI, which is due to the relocation of domestic industries abroad in light of declining competitiveness.

However, the literature survey shows relatively little empirical work ascertaining the causal linkages between OFDI and the components of external trade. The direction of causality between OFDI and external trade may vary not only between its external trade variables (i.e. exports and imports) but also between the type of trade (i.e. merchandise and services). The aim of this paper is to fill this gap in the empirical literature by examining the causality pattern between OFDI and the external trade components, namely, exports and imports of merchandise as well as services using Singapore as a

[2] When an imperfection in the domestic market increases transaction costs, a firm will undertake OFDI to internalize transaction costs and become more efficient overall.

case study because the city state is one of the largest outward investors in the Asian region, and is overly dependent on trade (as popularized by her successful engagement in entrepôt trade). Thus, the main contribution of this study is to provide an additional facet to the existing literature using external trade component data. Empirical analysis based on aggregated external trade data may tend to conceal the economic interactions between OFDI and the trade component variables, so to speak, and hence, the empirical findings may be misleading for policy analysis. Conversely, empirical analysis using data on external trade components can suggest useful implications for policy formulation to forge linkages between cross-border direct investment by foreign- and local-controlled firms from Singapore and both of her external trade variables and the type of trade.

The structure of this paper is organized as follows. The next section presents a profile of Singapore's OFDI and external trade with a focus on recent developments and economic performance. A sound understanding of the dynamics of the city-state's OFDI and external trade can throw some light on the linkages between them. Section 3 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. The causality results are then reported and analyzed in Section 4. Finally, concluding remarks and policy implications are discussed in Section 5.

2. Singapore's OFDI and External Trade

Singapore is renowned as a globalized city state[3] in which foreign multinational corporations (MNCs) have played a pivotal role in industrializing the economy and facilitating the country's external trade (which is dominated by merchandise exports and imports). The combined share of merchandise exports and imports in total trade in 2010 was 76.3% (see Table 1). Since 2007, merchandise exports continued to exceed merchandise imports resulting in a surplus in merchandise balance (see Table 1). The services account also displays a similar trend in services balance. Nonetheless, merchandise exports remained as an important component of Singapore's external trade vis-à-vis services exports (see Table 2). For instance, in 2010, merchandise exports were the largest foreign exchange earner, which contributed about 76.1% to total export revenue followed by services exports (23.9%)

< Insert Table 1 and Table 2 here>

The city-state's spectacular economic performance and development in the course of the implementation of its open foreign investment policy and liberalized trade regime is well documented in the literature (e.g., Chia, 1986; Pang, 1987; Rodan, 1989; Regnier, 1991; Huff 1995; Murray and

[3]Accessed at http://www.ey.com/SG/en/Newsroom/News-releases/News-release---Singapore-takes-third-spot-on-Globalization-Index-2010 (date accessed: June 1, 2011).

Pereira, 1995; Islam and Chowdhury, 1997; Blomqvist, 2001). Despite its excellent infrastructure (such as ports, air transport, telecommunications, and information technology), rising labor costs, and limited natural resources and land, coupled with its small domestic market size[4] and shrinking export markets, could act as impediments to doing business in the city-state economy for both domestic firms and Singapore-based foreign affiliates. In response to the mentioned domestic constraints as well as greater competition in costs in association with globalization, the Singaporean government initiated the so-called regionalization drive[5] to encourage domestic firms to go regional in order to take advantage of lower labor and land costs (Islam and Chowdhury, 1997; Ellingsen *et al*., 2006). The strategic relocation of lower-end production activities in the low-cost countries[6] while retaining higher-end production activities in the home country can not only possibly sustain Singapore's international competitiveness but also be instrumental in transforming the economy into a human capital- and technology-intensive country (see Lecraw 1985; Aggarwal and Agmon 1990; Ellingsen *et al*., 2006).

According to UNCTAD's (2009) report, Singapore was the fourth largest outward investor among the developing countries after China, Hong Kong and India in 2008. Outward FDI[7] (OFDI) from Singapore grew from S$13,622 million in 1990 to S$359,348 million in 2009, an increase of 2,538% growth over the 20-year period.[8] The considerable increase in OFDI by Singapore was mainly due to the adoption of regionalization strategies and the generous incentives[9] offered to cross-border direct investors by the Singaporean government, who also took the leading role to establish industrial parks regionally[10] and ventured abroad through its investment arm such as Temasek and other state-owned enterprises (UNCTAD, 2005). Table 3 reports Singapore's OFDI by activity. By and large, the financial and insurance services and manufacturing dominated the city state's total OFDI over the 2006-2009 periods. For instance, out of the total OFDI stock in 2009, financial and insurance services had the largest share of 49.5 per cent despite a slight decline from 54.4 per cent share in 2006. In the

[4] For example, Estonia also initiated cross-border direct investment because of its small local market (see Ginevičius and Tvaronavičiene, 2005)
[5] Similarly, under the premiership of Dr Mahathir, the Malaysian government encouraged domestic firms to invest abroad to exploit the regional growing market opportunities and expand their market reach (Goh and Wong, 2011).
[6] In the literature, Helpman (1984) labeled FDI arising with the motive of accessing to cheap factors of production in the low-cost countries as "vertical FDI".
[7] OFDI refers to an investment in which a direct investor resident in the reporting economy owns 10 per cent or more of the ordinary shares or voting power in a non-resident direct investment enterprise. An investment by a resident enterprise with less than 10 per cent of the shares will be considered as outward portfolio investment (Singapore Department of Statistics, 2008, p. 9).
[8] Authors' calculation based on data obtained from *Singapore's Investment Abroad* (various issues).
[9] For example, tax incentives and financial support (see Okposin 1999).
[10] For instance, the Singaporean government established industrial parks in China, India, Vietnam and Indonesia (see Islam and Chowdhury, 1997; Yeung, 1999).

manufacturing activities OFDI accounted for over 20 per cent share of Singapore's total OFDI stock from 2006 to 2009.

Table 4 shows Singapore's OFDI by region from 2006 to 2009. Overall, Asia was Singapore's major OFDI destination, accounting for more than 50 per cent share in 2008 and 2009. However, Europe, Australia and New Zealand, and the U.S. became much less important destinations for Singapore's outward investors. Table 5 indicates that within the Asian region, China, Malaysia, Indonesia, Hong Kong and Thailand continued to be the major host countries for Singapore's OFDI. Excluding Hong Kong, these major Asian destinations of Singapore' OFDI turned out to be low-cost countries, a suggestion for Singaporean firms to relocate their labor-intensive activities to these locations with the intention of taking advantage of cheap production factors so as to maintain their competitive positions and also extend their market reach.

<Insert Table 3, Table 4 and Table 5 here>

In terms of Singapore's OFDI by ownership, there was a relatively high level of participation by Singapore-based foreign-controlled firms which accounted for 46 per cent share in 1999 despite its decline to 35% in 2003[11] (see Table 6). As such, OFDI can be seen as part of the MNC network where intra-firm trade is becoming increasingly important to promote Singapore's export and import trade (i.e. between the parent companies at home and their subsidiaries abroad). Also, setting up subsidiaries abroad to take advantage of lower factor costs of production could potentially enhance the cost competitiveness of the parent companies at home, which in turn could increase the home exports to the rest of the world on one hand, and increase home imports from the rest of the world in the case of backward vertical integration.[12]

<Insert Table 6 here>

Since the city state is one of the largest outward investors in the region and trade is needed as Singapore is small, this paper aims to explore the inter-linkages between OFDI from Singapore and its major external trade components (i.e. exports and imports of merchandise as well as services) by means of the Granger causality approach since the available empirical studies are limited.

[11] Singapore's Department of Statistics defines foreign-controlled companies as either wholly owned (100%) or majority-owned (at least 50% of paid-up shares). However, the publication of ownership structure of Singapore's OFDI was discontinued since 2004.

[12] Backward vertical integration refers to intermediate inputs which are produced by subsidiaries abroad, and are being imported for value added at home country.

3. Data and Methodology

3.1. Data

All the time-series data are annual data and the estimation period is from 1972 to 2009. Higher frequency data or a longer time period would be desirable but the choice of this frequency and sample period are based on the availability of OFDI data, which is retrieved from UNCTAD. The data for trade variables such as exports and imports of merchandise and services are obtained from the Department of Statistics, Singapore. All the raw data are converted into real terms using the GDP deflator before they are transformed into natural logarithms (ln).

The possible causal linkages between Singapore's OFDI and her external trade components can be determined based on the Granger causality test (Granger, 1969; 1988). The notion of the test is to distinguish whether the causality pattern between the macroeconomic variables of interest is unidirectional, bi-directional or independent. For instance, a variable X is said to Granger cause Y if information in the past and present X helps improve the forecasts of variable Y. And bi-directional is said to exist if Y also causes X, otherwise, the causality relationship is only unidirectional. If neither of them causes the other, then the two variables are statistically independent. A tri-variate VAR (vector autoregressive) model for causality analysis is written as follows:

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$$\begin{bmatrix} \ln OFDI_t \\ \ln EXM_t \\ \ln IMM_t \end{bmatrix} = \begin{bmatrix} a_1 \\ a_2 \\ a_3 \end{bmatrix} + \begin{bmatrix} \theta_{11}(L)\theta_{12}(L)\theta_{13}(L) \\ \theta_{21}(L)\theta_{22}(L)\theta_{23}(L) \\ \theta_{31}(L)\theta_{32}(L)\theta_{33}(L) \end{bmatrix} \begin{bmatrix} \ln OFDI_t \\ \ln EXM_t \\ \ln IMM_t \end{bmatrix} + \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \\ \varepsilon_{3t} \end{bmatrix} \qquad (1)$$

OFDI and Services Trade

$$\begin{bmatrix} \ln OFDI_t \\ \ln EXS_t \\ \ln IMS_t \end{bmatrix} = \begin{bmatrix} b_1 \\ b_2 \\ b_3 \end{bmatrix} + \begin{bmatrix} \Phi_{11}(L)\Phi_{12}(L)\Phi_{13}(L) \\ \Phi_{21}(L)\Phi_{22}(L)\Phi_{23}(L) \\ \Phi_{31}(L)\Phi_{32}(L)\Phi_{33}(L) \end{bmatrix} \begin{bmatrix} \ln OFDI_t \\ \ln EXS_t \\ \ln IMS_t \end{bmatrix} + \begin{bmatrix} e_{1t} \\ e_{2t} \\ e_{3t} \end{bmatrix} \qquad (2)$$

where EXM_t, IMM_t, EXS_t and IMS_t denote merchandise exports, merchandise imports, services exports and services imports at time t respectively. The ε_t and e_t are the residuals with zero mean and constant variance. L is the lag operator. The idea of the multivariate Granger causality test is, for example, to test the null hypothesis of $\theta_{12}(L)$, which are jointly equal to zero. If the null hypothesis is rejected, it implies that EXM_t Granger cause $OFDI_t$, given IMM_t. The restrictions can be tested by employing the standard Wald test, which follows a χ^2 distribution. If the variables of interest are nonstationary, the

implications drawn from the usual Wald test statistics are invalid (Sim *et al*., 1990). Specifically, as pointed out by Toda and Phillips (1993), the Wald test in an integrated unrestricted VAR has nonstandard limit distributions, hence, it is important to pre-test the unit root hypothesis of all variables before the Granger causality test is performed.

We test the null hypothesis of a unit root for all variables using the Augmented Dickey-Fuller (ADF) test and the Phillips Perron (PP) test. It is widely acknowledged that ADF and PP tests are command stationary tests applied in macroeconomic studies. Both test statistics assume each series has a unit root under the null.

The regression equation for the ADF test can be written as follows:

$$\Delta X_t = \alpha_1 T + \alpha_2 X_{t-1} + \sum_{i=1}^{k} \beta_i \Delta X_{t-i} + \eta_t \qquad (3)$$

where Δ is the first difference operator; T is the time trend; k denotes the number of lags used and η is the error term; α_s are the parameters. The null hypothesis that series X_t is non-stationary can be rejected if β_0 is statistically significant with a negative sign. The optimal lag k is selected by the Akaike Information Criterion (AIC).

The PP unit root test differs from the ADF test as the former, which is based on a nonparametric method of controlling for serial correlation when testing for a unit root, is robust to general forms of heteroskedasticity in the error term.

The test regression for the PP test is:

$$\Delta X_t = \alpha_1 T + \alpha_2 X_{t-1} + \mu_t \qquad (4)$$

where the PP method estimates the Dickey Fuller equation (i.e. the ADF equation without the lagged difference terms of the dependant variable) and corrects for any serial correlation and heteroskedasticity in the errors term μ by modifying the t ratio of α_2 coefficient. The advantages of the PP test over the ADF test are that, firstly, the former is robust when the error term is heteroskedastic; secondly, the user does not have to specify a lag length for the test regression (Zivot and Wang, 2006).

4. Empirical Results

Table 7 reports the results of the ADF and PP tests. They consistently suggest that all the time series are non-stationary $I(1)$ in level terms.[13] However, both tests confirm they are $I(0)$ if they are in first differences.

<Insert Table 7 here>

Since the Granger-causality test is very sensitive to the number of lags included in the regression, we adopted a set of statistical selection information criteria viz. Likelihood Ratio (LR), Final Prediction Error (FPE), Akaike Information Criterion (AIC), Schwarz Criterion (SC) and Hannan-Quinn Information Criterion (HQ) to determine the optimal lag length. Table 8 provides the calculated values of the loss functions based on the proposed information criteria. All the information criteria choose lag 1 as optimal lag for the tri-variate VAR using the merchandise trade data (see the first panel of Table 8). The same lag-length selection results also apply to the tri-variate VAR using the services trade data with the exception for SC, which favors lag 0. Hence, the tri-variate VAR in first differences with 1 lag is estimated for equations (1) and (2).

<Insert Table 8 here>

Table 9 presents the causality test results. There is a strong evidence of a unidirectional causality that runs from Singapore's OFDI to home merchandise exports, suggesting that cross-border direct investments by both local- and foreign- controlled firms have the propensity of enhancing the country's international competitiveness of export trade and consequently, encouraging merchandise exports. The positive sign of the estimated coefficient confirms the complementary effect of $\Delta \ln OFDI$ on $\Delta \ln EXM$. This finding is consistent with the view that OFDI tends to open up an important channel for firms based in Singapore to engage in cross-border intra-firm trade in value-adding activities that could lead to more efficiency in doing business within firms to promote merchandise exports. However, there is no evidence supporting the reverse causality from home merchandise exports to Singapore's OFDI.

The tri-variate Granger causality test results also indicate the existence of a unidirectional causality from Singapore's OFDI to home merchandise imports. The positive sign of the estimated coefficient implies the complementary effect of the former on the latter. Such evidence would be consistent with backward vertical integration, which involves importing intermediate outputs from the host

[13] We take note that one can infer Granger causality if the non-stationary variables are cointegrated. However, there are no theories to justify that there is a long-run relationship exist among OFDI, merchandise exports and imports as well as services exports and imports.

economies where foreign affiliates undertake their production activities for value added in the home country by their parent firms. This finding is also consistent with Singapore's regionalization drive, which is a long-term strategy to encourage and offer incentives to Singaporean firms to invest abroad so that they can exploit the lower factor costs of production in the host economies especially in Asia, while retaining the more human capital-and technology-intensive stages of production in the home country (see Yeung (2001) and Ellingsen *et al*. (2006)).

<Insert Table 9 here>

Furthermore, the causality test results also indicate a bi-directional causality between merchandise exports and merchandise imports. The causation that runs from merchandise exports to merchandise imports supports the high import content of merchandise exports, which advocates the notion of entrepôt trade and multinational trade and investment activity that involves backward and forward linkages. The reverse causation that runs from merchandise imports to merchandise exports suggests a supply-side view that merchandise imports especially those as inputs for exports production have the propensity to encourage merchandise exports. The evidence of bi-direction causality between these two variables further supports the sustainability of trade balances as pointed out by Tang (2003).

Nonetheless, Table 9 shows there is no evidence of any causal linkages between Singapore's OFDI and services trade (exports and imports) in that OFDI is not able to draw on the services trade in as much as trade in services is not capable of encouraging OFDI. The plausible explanations for this set of Granger causality test results are as follows:

a. The foreign subsidiaries of Singapore-based firms tend to outsource their supporting services either from the host countries or their own services-supporting subsidiaries that have been relocated abroad[14] since the nature of services is mainly to provide market presence in the consuming country, and hence, there is no evidence of causation that runs from Singapore' OFDI to services exports,
b. The multinationals from Singapore are similarly not involved in the imports of intermediate services from abroad for value-adding in the home country because their value chain activities in services might not fit into the core activities of their parent companies (e.g., research and development, IT services, product design, marketing, delivery, and provision of after-sale services). Instead, Singapore is highly dependent on foreign expertise to make it the regional

[14] For instance, Table 3 shows that a significant range of services activities from Singapore have been operating overseas, which can also potentially complement the foreign production undertaken by Singaporean multinationals.

and international hubs for business, financial and knowledge-based services. Therefore, it continues to attract foreign investments into business and financial services rather than encouraging OFDIs. That is the reason why the Granger causality test results do not show any evidence of interactions between OFDI and import trade in services.

5. Conclusions

Singapore is a city-state economy with very limited land and is virtually without natural resources. Despite its strategic location in the region, the availability of skilled workforce and sophisticated infrastructure, the Singaporean government is encouraging domestic firms to invest in the region in view of rising labor costs, small domestic market size and declining export markets. Cross-border direct investment has become a long–term strategy for Singapore not only to sustain international competitiveness but also to lead the country towards high-technology industrialization. Ascertaining the causal linkages between OFDI from Singapore and its external trade components (i.e. both exports and imports of merchandise as well as services) can provide an economic assessment on the viability of the internationalization of firms based in Singapore to forge trade linkages with the export and import sectors with regard to merchandise and services in the era of globalization.

The findings suggest that cross-border direct investments by local and Singapore-based foreign-controlled firms are instrumental in promoting merchandise trade, particularly, exports as well as imports thereby supporting the OFDI-led trade hypothesis. For instance, the causality test results suggest that Singapore's OFDI activities have a tendency to enhance the international competitiveness of the city state's merchandise exports by means of intra-firm trade activities and home sourcing, which potentially open up an important channel to boost merchandise export trade. As a result, the regionalization drive initiated by the city-state government is not only able to take advantage of regional growing business opportunities but also could foster a trade linkage with its merchandise exports. Moreover, the production activities of Singapore's foreign subsidiaries could also establish backward vertical integration that encourages merchandise imports for value added in the home country and thereby complements the home country's exports. However, the present study does not show any evidence of causal interaction between Singapore's OFDI and services trade (i.e. exports and imports) because the Singaporean multinationals are likely to outsource their services either from the host country services sector, where ongoing contact with the former is important (such as accounting, banking, finance and related services), or from their own services-supporting subsidiaries that have been relocated abroad. The city state is well-known for its strategic location as an operational headquarters, international procurement centre and regional distribution centre. Therefore, the linkages between Singapore's OFDI and the home services sector can be strengthened in order to

promote cross-border direct investment and services trade. To facilitate OFDI-services trade linkages, the city state government could create a platform with incentives to encourage domestic support services that can complement the global operations undertaken by the Singaporean multinationals.

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Tables

Table 1. Singapore's external trade components (% share of total trade), 2007-2010

External Trade Component	2007	2008	2009	2010
Merchandise Exports	42.2	40.6	39.6	40.8
Merchandise Imports	35.6	37.3	35.4	35.5
Services Exports	11.8	11.8	13.6	12.8
Services Imports	10.4	10.4	11.5	11.0

Source: Authors' calculation based on data from Singapore Department of Statistics

Table 2. Singapore's export components (% share of total exports), 2007-2010

Export Trade	2007	2008	2009	2010
Merchandise Exports	78.1	77.5	74.5	76.1
Services Exports	21.9	22.5	25.5	23.9

Source: Authors' calculation based on data from Singapore Department of Statistics

Table3. Singapore's OFDI by activity (% share), 2006-2009

Activity	2006	2007	2008	2009
Financial & Insurance Services	54.38	56.23	49.21	49.51
Manufacturing	22.20	21.77	24.34	23.39
Real Estate Activities	4.07	3.83	5.48	5.62
Wholesale & Retail Trade	5.33	4.69	5.47	5.46
Administrative and Support Services	1.99	2.53	3.81	5.08
Information & Communication	5.28	4.89	4.64	4.74
Transport & Storage	3.37	3.18	3.48	2.66
Professional, Scientific & Technical	2.10	1.83	2.21	2.06

Accommodation, Food & Beverages	0.94	0.83	0.80	0.75
Construction	0.34	0.21	0.56	0.73

Source: Authors' calculation based on data from *Singapore's Investment Abroad* (various issues)

Table 4. Singapore's OFDI by region (% share), 2006-2009

Region	2006	2007	2008	2009
Asia	48.91	46.68	54.54	52.81
Europe	13.71	14.63	14.35	16.48
Australia & New Zealand	4.92	5.85	5.98	5.43
U.S.	3.47	4.38	3.70	3.35
Other countries	7.17	10.74	4.80	5.43

Source: Authors' calculation based on data from *Singapore's Investment Abroad* (various issues)

Table 5. Singapore's OFDI within Asia (% share), 2006-2009

Asia	2006	2007	2008	2009
China	27.78	28.17	31.16	30.62
Malaysia	15.69	15.39	14.47	15.12
Indonesia	13.87	13.6	12.92	13.84
Hong Kong	12.91	13.46	11.59	11.35
Thailand	10.84	11.43	11.10	10.25
Japan	2.09	1.66	2.82	2.62
Taiwan	4.33	3.46	3.43	3.03
Philippines	2.77	2.76	2.48	2.30

Source: Authors' calculation based on data from *Singapore's Investment Abroad* (various issues)

Table 6. Ownership structure of Singapore's OFDI, 1999-2003

Ownership	1999	2000	2001	2002	2003
Foreign-controlled firms	46.06	41.58	41.86	36.92	35.36
Local-controlled firms	53.94	58.42	58.14	63.08	64.64

Source: Authors' calculation based on data from *Singapore's Investment Abroad* (various issues)
Note: Singapore's OFDI by ownership data is only made available by *Singapore's Investment Abroad* until 2003.

Table 7. Unit root test results

Series	**Type of test**	**ADF**		**PP**	
		In Levels	**In first differences**	**In levels**	**In first differences**
lnOFDI	intercept	-1.7103	-10.5780***	-1.6053	-11.7181***
lnEXM	Trend & intercept	-3.1363	-4.8270***	-3.1456	-4.7080***
lnEXS	Trend & intercept	-1.7495	-3.1188**	-2.0005	-3.3515**
lnIMM	Trend & intercept	-2.0949	-4.9375***	-2.1229	-4.8327***
lnIMS	Trend & intercept	-2.1797	-4.1364***	-2.1979	-4.0574***

Note: * denotes significant at 10%, ** denotes significant at 5%, *** denotes significant at 1%.

Table 8. Lag length selection

Lag	LogL	LR	FPE	AIC	SC	HQ
Tri-variate VAR(1): Δln*OFDI*, Δln*EXM* and Δln*IMM*						
0	15.6148	NA	7.61e-05	-0.9703	-0.8252	-0.9285
1	29.7713	23.9571*	5.15e-05*	-1.3670*	-0.7863*	-1.1998*
2	36.0813	9.2222	6.55e-05	-1.1601	-0.1439	-0.8674
3	42.6261	8.0551	8.61e-05	-0.9712	0.4804	-0.5532
Tri-variate VAR (1): Δln*OFDI*, Δln*EXS* and Δln*IMS*						
0	51.7095	NA	1.14e-05	-2.8652	-2.7305*	-2.8193
1	66.6663	26.3943*	8.08e-06*	-3.2156*	-2.6769	-3.0319*
2	73.9969	11.6246	9.05e-06	-3.1174	-2.1747	-2.7959
3	81.7283	10.9150	1.01e-05	-3.0428	-1.6960	-2.5835

Note: * indicates the order of lag length selected by the information criteria

Table 9. Causality tests for OFDI, exports and imports

Tri-variate VAR(1): Δln*OFDI*, Δln*EXM* and Δln*IMM*		
Null hypothesis	**χ^2 (p-value)**	**Complementary (+) / Substitutionary (-)**
Δ*ln*EXM =/=> Δ*ln*OFDI	0.253 (0.6143)	(+)#
Δ*ln*OFDI =/=> Δ*ln*EXM	2.969 (0.0849)*	(+)
Δ*ln*IMM =/=> Δ*ln*OFDI	0.055 (0.8131)	(+)
Δ*ln*OFDI =/=> Δ*ln*IMM	4.692 (0.0303)**	(+)
Δ*ln*IMM =/=> Δ*ln*EXM	3.8695 (0.0492)**	(+)
Δ*ln*EXM =/=> Δ*ln*IMM	5.167 (0.0230)**	(+)
Tri-variate VAR (1): Δln*OFDI*, Δln*EXS* and Δln*IMS*		
Null hypothesis	**χ^2 (p-value)**	**Complementary / Substitutionary**
Δ*ln*EXS =/=> Δ*ln*OFDI	0.068 (0.7934)	(-)
Δ*ln*OFDI =/=> Δ*ln*EXS	0.004 (0.9495)	(+)
Δ*ln*IMS =/=> Δ*ln*OFDI	1.269 (0.2599)	(+)
Δ*ln*OFDI =/=> Δ*ln*IMS	0.009 (0.9 29)	(+)
Δ*ln*IMS =/=> Δ*ln*EXS	0.011 (0.9156)	(+)
Δ*ln*EXS =/=> Δ*ln*IMS	1.348 (0.2455)	(+)

Note: Δ denotes first differences

the sign of the estimated VAR coefficient

* significant at 10% level, ** significant at 5% level

A short biographical note about contributors

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