BANK NEGARA MALAYSIA
CENTRAL BANK OF MALAYSIA

Bank Negara Malaysia Working Papers
WP9/2017

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June 2017

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Bilateral Export Trade, Outward and Inward FDI: A Dynamic Gravity Model Approach Using Sectoral Data from Malaysia

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Abstract

Malaysia is an outward-looking economy in which inward FDI has played an instrumental role in her export trade. In light of a rapid growth of outward FDI from Malaysia since 2007, this paper ascertains the possible impact of outward FDI on Malaysia's bilateral export trade at the sectoral levels, using a dynamic gravity approach. The findings reveal that both inward and outward FDI are complementary to bilateral export trade in services, mining and manufacturing. Besides, the sectoral study also suggests that the economic size of Malaysia and her trading partners is export enhancing, while the distance elasticity and the real effective exchange rate have different negative impacts on the sectors. Overall, the sectoral bilateral exports could not insulate itself against external shock such as the global financial crisis. The present study has important implications for policymakers as well as export-oriented developing economies experiencing the rising trend of outward FDI due to globalization.

JEL Classification: F21

Keywords: Outward FDI, inward FDI, bilateral exports, Malaysia, Dynamic Gravity Model. System GMM

1. Introduction

Outward foreign direct investment (OFDI) from developing countries is progressively attracting research attention due to its increasing share in world outward flows. Based on UNCTAD (2006), only six developing and transition economies reported outward stocks of more than USD5 billion in 1990. By 2005, 25 developing and transition economies have exceeded that threshold, while they contributed 17% of world outward flows. Malaysia is one of the contributors to this phenomenon. In 1980, Malaysia was ranked 11 in the top 15 developing and transition economies in terms of stocks of OFDI, and it moved up to the tenth position by 2013 (UNCTADSTAT 2014). OFDI in terms of flows surpassed inward flows after 2007 and Malaysia became a net capital exporter since then (Goh and Wong, 2011).

Data from Bank Negara Malaysia (BNM) indicates that OFDI flows from Malaysia is primarily concentrated in the services sector from 2005-2013, followed by mining and manufacturing. There is some anecdotal evidence of Malaysian banks moving out of the country in search of new markets (The Edge, 1 March 2010) while outward investments in the mining sector is led by the national oil company, Petroliam Nasional Berhad (Petronas) (Petronas Annual Report 2013; Zainal Aznam 2006). As for manufacturing, some case studies have shown that Malaysian manufacturing companies have ventured overseas to overcome labor shortages and increasing labor costs at home, thereby indicating that some manufacturing investment overseas may be resource-seeking as well (Tham 2007).

As in the case of the developed world, the impact of OFDI on home and host economies is an issue of concern for researchers and policy makers. In the case of Malaysia, the potential impact of increasing outward capital flows on exports is especially important given the continued importance of exports due to openness of the economy and the policy emphasis to increase exports in the country's Eleventh Malaysia Plan (Malaysia 2015, pp. 48). Moreover, the search for new export drivers is driven by the need to sustain the trade surplus in order to avoid the emergence of twin deficits, in view of the continued fiscal deficit in the country since the Asian Financial Crisis (AFC). Despite the importance of this issue, it has not been well explored as there is only one previous study that examined it at the macro level (Goh *et al*. 2013). This is possibly due to the scarcity of published data on this phenomenon, especially at the disaggregated level, where the different sectors' impact on trade can be investigated.

The objective of this paper is to investigate the impact of OFDI on trade in the three main sectors, namely services, mining and manufacturing, using the International Investment Position Survey (IIP) survey data from BNM. While this issue is examined with Malaysian data, it is also of interest to other developing and transition economies that have expanded their investments overseas as the nature of this impact may not be the same as that for the developed world. In addition, the empirical findings of this study can be used to guide the current public concern as to whether outward flows should be further encouraged in the current economic climate (The Malaysian Insider, 1 January 2015).

Moreover, the main contribution of this paper is the dynamic gravity modelling approach used to examine the impact of OFDI on trade at sectoral level, which is relatively limited. In the empirical literature, most authors use a static model to study bilateral trade flows, disregarding the importance of dynamics in trade. However, theoretically speaking, current bilateral trade is related to the past values of bilateral trade which is itself attributable to "habit formation". For instance, if customers have been using a specific product during the past years, they would get accustomed to the product and subsequently, the habit formation would contribute to current and future trade (Eichengreen and Irwin, 1997). Furthermore, given that a typical exporting firm tends to set up distribution and service networks in the partner country, it is cheaper for an exporting firm to continue exporting to a partner country rather than penetrating into new markets (Bun and Klaasen, 2002). Recent authors also underline that including dynamics into gravity models for trade is both econometrically and theoretically important (Harris and Mátyás, 1998; Yotov and Olivero, 2012; Campbell, 2010; Campbell, 2013).

To allow for such a dynamic effect in the gravity model, we employ a more advanced dynamic panel econometric technique, namely system Generalized Method of Moments (system GMM), developed by Arellano and Bover (1995) and Blundell and Bond (1998). The system GMM is the preferred technique since this procedure has some advantages as it allows endogeneity for some regressors as well as direct estimation of the time-invariant variables such as distance and common language in gravity model (Inmaculada et al.2009). This makes it particularly appealing for dynamic gravity model estimation. Our panel consists of data for 78 countries over the period 2005 to 2013. Our results show sectoral OFDI complements sectoral exports.

The paper is organized as follows. Section 2 provides a background on Malaysia's FDI and exports at the sectoral level. A review of the literature is presented in Section 3, followed with

the specification of the model and explanation of the methodology and data in Section 4. Section 5 reports the empirical results and provides a discussion of the findings, while the conclusion summarizes key findings from this paper and some policy suggestions.

2. Malaysia's FDI and Exports at Sectoral Level

This section provides salient features of Malaysia's FDI and exports with particular attention paid to their respective key sectors, namely, mining, services and manufacturing. The sectoral data for FDI and exports are gathered from the Joint International Investment Position (IIP) Survey conducted quarterly by Bank Negara Malaysia (BNM) and the Department of Statistics Malaysia (DOSM). Specifically, the IIP survey collects data on the external assets and liabilities of a resident company *vis-a-vis* its non-resident counterparties. Companies are required to provide details on their external exposures in terms of equity investment, portfolio investment, loans and etc.[1] The coverage of the IIP Survey includes banks, companies and domestic custodians[2] and amounts to around 3200 respondents. The FDI's sub-components are inward foreign direct investment (IFDI), which is classified by Malaysian-based subsidiary company's primary business activity, while outward foreign direct investment (OFDI) is classified by Malaysian-based parent company's primary business activity and the exports of firms are without product classification. The data from the IIP Report provides valuable input for the compilation of Malaysia's Balance of Payments (BOP) and IIP in Malaysia.

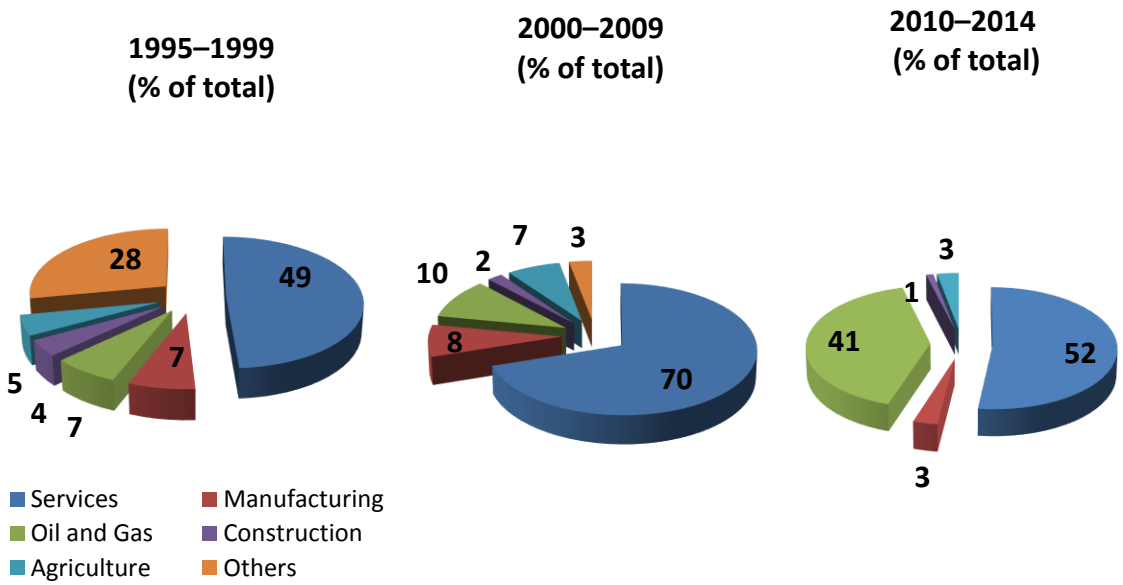
Changing Pattern of OFDI

Table 1 shows that the bulk of direct investment abroad is in the service sector, with the share increasing from 49% to 70% from the first sub-period (1995-99) to (2000-2009). In particular, while earlier investments were reported to be undertaken mainly by Petronas and government-linked plantation companies, investment in the subsequent period was reported to be undertaken by Government-linked companies (GLCs) in services such as financial services, telecommunications, utilities and private companies. In the third sub-period (2010-2014), the share of services dropped to 52% while the share of oil and gas increased to 41%.

[1] See BNM's website, http://www.bnm.gov.my/?ch=ssw_report&pg=ssw_report_iip&ac=1&tpl_id=270

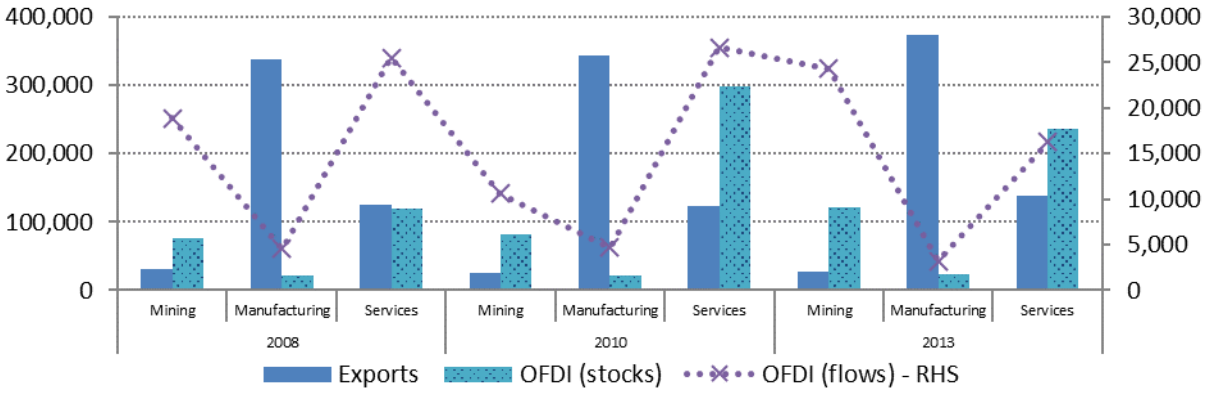
[2] A custodian maybe a nominee company, unit trust company, trustee company, security dealer or fund manager that manage resident clients' holdings of foreign securities and non-resident clients' holdings of local securities.

Table 1. Cumulative Net Direct Investment Abroad Flows by Sectors (1995–2014)



Source: BNM Annual Report 2009 & IIP Survey, BNM 2015

Figure 2.1: Overall profile of OFDI and exports by key sectors, RM mil



Source: IIP Survey, BNM 2015

Figure 2.1 shows an overall profile of OFDI and exports by key sectors. From 2008 to 2013, the services sector continues to account for the bulk of OFDI stocks from Malaysia followed by the mining and manufacturing sectors.

In the services sector, anecdotal evidence indicates the banking sector in Malaysia has increasingly moved their operations to regional markets, especially after the Global Financial Crisis in 2008, in search of new growth markets as the domestic market is getting increasingly saturated (The Edge, 1 March 2010). Maybank, CIMB Bank, Public Bank, RHB and Hong Leong Bank have reportedly established overseas operations through acquisitions of foreign banks or by establishing branch operations under their own brand name. In general, these types of investments seek to expand their activities in the region as part of their respective strategies to gain from the progressive integration of the regional market under the ASEAN Economic

Community. Hence there are both push and pull factors at work as banks diversify their activities beyond the domestic market.

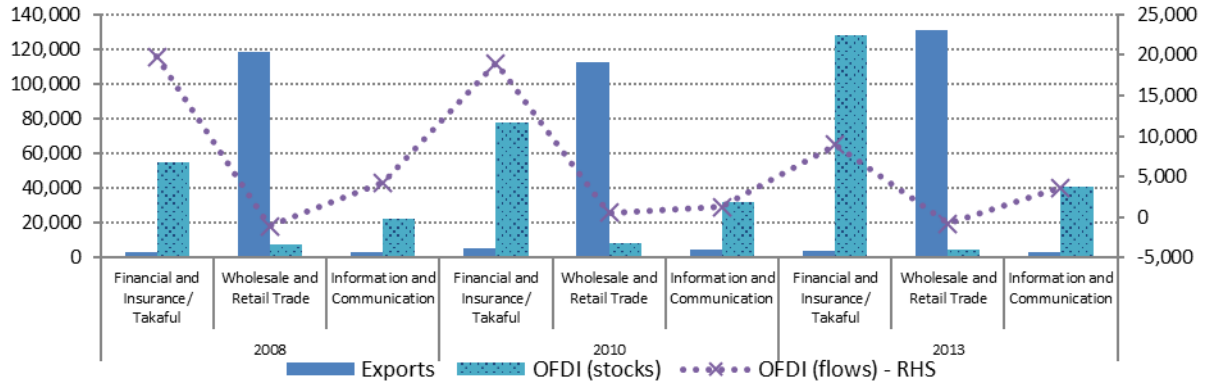
In the case of mining, Petroliam Nasional Berhad (Petronas), which is ranked 65 (by foreign assets) in the world's top 100 non-financial transnational corporations, in 2013 by UNCTAD, (UNCTAD Global Players from emerging market, 2013) has ventured overseas since the early 1990s in search of a wide range of petroleum activities, which range from upstream exploration and production of oil and gas, to downstream activities. Currently, it has over 100 affiliates and associated companies with economic interests in more than 30 countries. Their overseas operations now cover countries not only in Asia but also in Africa, Latin America and the Middle East and their activities are considered to be more resource and market-seeking (Petronas Annual Report 2013; Zainal Aznam 2006). However, Petronas also exports crude petroleum to their subsidiaries as well as third parties in countries such as Singapore, India, Japan and Korea.

For manufacturing firms, PETRONAS Lubricants International Sdn Bhd (PLI), a wholly-owned subsidiary of PETRONAS, is the lubricants manufacturing and marketing arm of PETRONAS. With a presence in more than 60 countries over five continents, PLI formulates manufactures and markets a wide range of lubricants and functional fluids. European markets accounted for almost 30% of their sales volume, followed by Asia (27%), Latin America (21%), Africa (17%) and North America (6%) (Petronas Annual Report 2013). Figure 2.1 indicates that firms that are investing abroad in manufacturing export the most, followed by firms in services for the period 2008-2013.

Services consist of a few subsectors where financial and insurance; wholesale retail trade; and information and communication, were among the major subsectors. Figure 2.2 shows an overall profile of OFDI and exports by these main services subsectors. The figure shows that OFDI stock is highest in financial sub-sector while it is lowest in wholesale and retail. Exports however show a converse picture. Almost 94% of exports from the services sector is derived from the wholesale and retail trade subsector (BNM 2015).

One of the major companies involved in retail trade is PETRONAS Trading Corporation Sdn Bhd (PETCO). This company is involved in PETRONAS downstream oil business in terms of marketing and trading of crude and petroleum products globally as they are engaged in trading of crude oil and petroleum products that are produced by affiliates and third parties. PETCO have trading operations in Dubai and London via its wholly-owned subsidiaries PETCO Trading DMCC and PETCO Trading UK Limited, respectively (Petronas Annual Report 2013).

Figure 2.2: Overall profile of OFDI and Exports by key services subsectors, RM mil



Source: IIP Survey, BNM 2015

Changing Pattern of IFDI

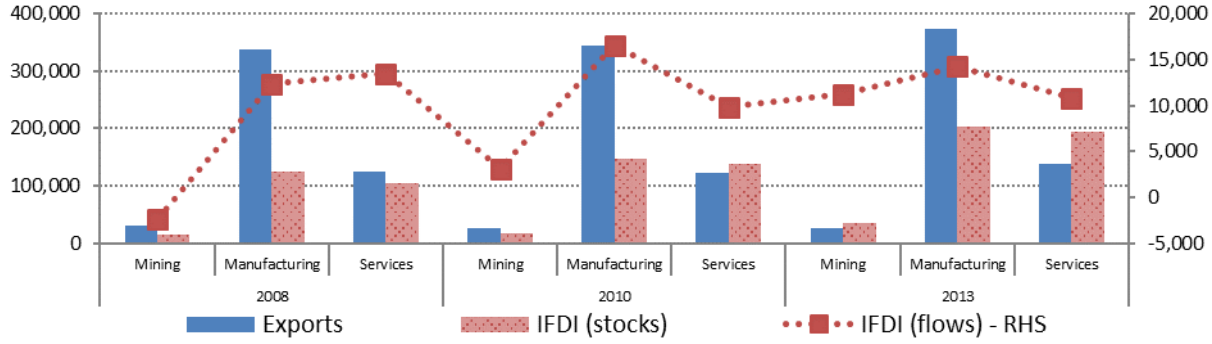
Table 2 shows a shift in inward FDI from the manufacturing sector to the service sector from 1990 to 2009. The increase in the share of FDI in services is due largely to the liberalization in financial services to promote the development of Islamic finance. BNM estimated that FDI in the financial sector, including Islamic finance, amounted to RM41.6 billion from 1999 to 2009, after the liberalization of the sector (BNM 2009). In the subsequent period, the share of inward FDI in services fell to 32 % while the share in oil and gas increased to 26%. In oil and gas for example, Murphy Oil Corporation entered Malaysia in 1999 and hold majority interests in eight separate production sharing contracts (PSCs). Murphy Sabah Oil Co., Ltd is one of the major companies that have invested in Malaysia and it is involved in production sharing contracts (PSCs) in oil and gas. They have explorations in Sabah and Sarawak (Murphy Oil Corporation, Annual Report 2014).

Table 2. Cumulative Net Foreign Direct Investment Flows by Sector (1990–2014)

Sectors	1990–1999 (% of total)	2000–2009 (% of total)	2010–2014 (% of total)
Manufacturing	63	41	39
Oil & Gas	17	17	26
Services	15	37	32
Others	5	5	3

Source: BNM Annual Report 2009 & IIP Survey, BNM 2015

Figure 2.3: Overall profile of IFDI and exports by key sectors, RM mil

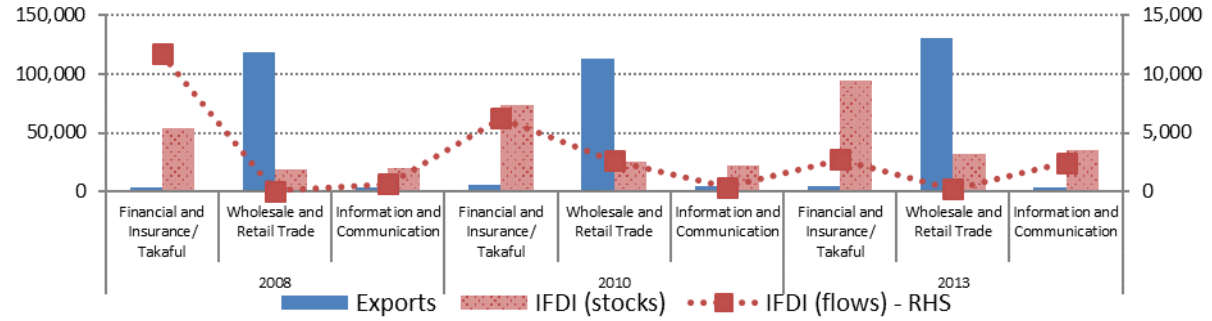


Source: IIP Survey, BNM 2015

With the shift towards services, the manufacturing and services sector have almost the same amount of IFDI stock from 2008 to 2013, as shown in Figure 2.3.

In terms of exports, the average exports from manufacturing, services and mining from firms investing in Malaysia, for the period of study, amount to RM351 billion, RM129 billion and RM28 billion, respectively (BNM 2015). Figure 2.3 above indicates that manufacturing exports continue to dominate for firms investing in Malaysia due to the nature of MNC production in the region, where host economies are used as export platforms for trade in intermediate goods (BNM 2011).

Figure 2.4: Overall profile of IFDI and Exports by main services subsectors, RM mil



Source: IIP Survey, BNM 2015

As shown in Figure 2.4, most of the exports from firms investing in Malaysia's service sector are contributed by the wholesale and retail sub-sector. To illustrate, MNCs such as IBM Malaysia and UMW Toyota are exporting goods and services abroad from their investment in Malaysia. Since the 1960s, IBM has been actively developing local capabilities through alliances and business partners to build an ICT eco-system. Global Technology Services Delivery Centre in Cyberjaya, which opened for business in March 2012, is a key component of IBM's global services delivery network and assists IBM in delivering information technology services capabilities to its clients around the world. Malaysia also plays a key role

in IBM's globally integrated enterprise strategy, and it is home to 21 Centres of Excellence/shared services operations that support the global and regional operations of IBM and its clients (IBM, 2013). UMW Toyota Motor has established an extensive network of over 97 sales and after-sales outlets, including Lexus and dealers throughout the nation. As highlighted in its annual report, its export of goods and services with Toyota Motor Corporation, Japan and its subsidiaries remain significant. In 2014, the total amount of export of goods and services with Toyota Motor Corporation, Japan amount to RM825million (UNW, 2014).

3. Review of the Literature

In the literature on FDI and trade, one key concern raised is the impact of firms' investment abroad on the home country's trade flows. Theoretically, Mundell (1957) postulates OFDI and exports are substitutes. In particular, horizontally integrated firms[3] tend to duplicate their parents' production activities in the host economies when their parents' exports are impeded by an increase in trade costs (e.g. transportation costs and trade barriers) and a decrease in production scale economies, resulting in a substitution effect on their parent companies' exports (Markusen, 1984; Stevens and Lipsey, 1992; Markusen and Venables, 1995; Svensson, 1996). On the other hand, firms investing abroad may have a complementary effect on trade owing to their participation in international production fragmentation process. These vertically integrated firms[4] may relocate core or supporting activities to other locations that offer the best cost advantages, thereby promoting intra-firm activities and leading to higher trade flows between home and host economies (Helpman, 1984; Helpman and Krugman, 1985; Desai *et al*., 2005; Hanson *et al*., 2005).

Empirical work, in the main, provides four different approaches for investigating the relationship between OFDI and trade, namely, studies undertaken at country level (i.e., based on bilateral trade data e.g., Grubert and Mutti, 1991; Clausing, 2000; Goh *et al*., 2013), industry level (i.e., based on cross-section data by industry e.g., Lipsey and Weiss, 1981; Brainard, 1997; Kawai and Urata, 1998), firm level (i.e., based on U.S. MNEs e.g., Lipsey and Weiss, 1984) and product level (i.e., based on disaggregated export data e.g., Blonigen, 2001). In general, the empirical evidence on the effects of OFDI on trade is mixed. Some studies support

[3] Firms expand their business by setting up subsidiaries abroad that operate at the same level in the production chain.

[4] Firms expand their business by setting up subsidiaries abroad that operate in the upstream or downstream segments of the production chain.

the proposition that OFDI substitutes trade (Host, 1972; Grubert and Mutti, 1991; Svensson, 1996; Bayoumi and Lipworth, 1997; Ma *et al.*, 2000). But there is also evidence that suggests a complementary relationship between OFDI and trade (Lipsey and Weiss, 1981 and 1984; Helpman, 1984; Blomström *et al*., 1988; Grossman and Helpman, 1989; Brainard, 1993 and 1997; Lin, 1995; Graham, 1996; Pfaffermayr, 1996; Clausing, 2000; Head and Ries, 2001; Hejazi and Safarian, 2001). Wong and Goh (2013) provide further evidence on the OFDI-led trade hypothesis for Singapore, particularly with regard to merchandise exports and imports, which therefore indicates OFDI opens important channels for intra-firm trade activities, home country sourcing and backward integration. Goh *et al*. (2013), however, find that OFDI and trade linkages are not significant for Malaysia while inward FDI (IFDI) is found to be complementary to trade. As indicated by Amiti *et al*. (2000), the substitutionary relationship is a distinguishing feature of horizontal FDI, especially when both the sources and destinations of FDI are similar in terms of relative endowments and size, and when trade costs are moderate to high. Vertical OFDI can be inferred when intra-firm trade between multinational enterprises (MNEs) and their affiliates dominates, leading to a complementary trade and investment relationship. In addition, Lim and Moon (2001) notes that a complementary relationship between OFDI and home exports may also arise from foreign subsidiaries that are located in less developed countries, or if they were relatively new, and in a declining home industry. On the other hand, empirical findings by Goldberg and Klein (1999) and Blonigen (2001) show mixed evidence in that OFDI can have both a substitutionary and complementary effect on trade. The former uses data on OFDI from the U.S. in eight Lain American countries in both of their manufacturing and non-manufacturing exports sectors, while the latter uses data on Japanese production in the U.S. and exports to the U.S. for automobile parts and consumer goods.

The FDI-augmented gravity model,[5] where inward and outward FDI are added as further determinants of bilateral trade, can be used to ascertain whether the relationship between trade and FDI is substitutionary or complementary (Ahn *et al*. undated; Hejazi and Safarian, 2001; Goh *et al*., 2013). A simple gravity model[6] is commonly used to examine how bilateral trade between two countries is influenced by key determinants such as the GDP of and the distance between the two countries (see Anderson, 1979). The simple gravity model is subsequently

[5] Bayoumi and Eichengreen (1997, pp.2) note that "the gravity equation has long been the work-horse for empirical studies on the pattern of trade".

[6] The gravity model was developed by Tinbergen (1962) and Poyhonen (1963) and has become an essential tool in the simulations on international trade flows.

extended to test other important economic drivers of bilateral trade such as a common language, per capita income differential between partner countries, bilateral real exchange rates, market access indicators, trade arrangements, historical and cultural ties, to name a few (see Bergstrand, 1990; Egger, 2000 and 2002; Baltagi *et al*., 2003). Besides, it has also been extensively used in the trade literature to examine several trade issues such as ascertaining, for example, the impact of trade liberalization; a currency union; or FDI on trade flows (Frankel, 1997; Rose, 2000). Applying extended gravity model, both the OFDI and IFDI can be incorporated into the FDI-augmented model to examine whether trade and FDI are substitutes or complements after controlling for the influence comparative advantage on trade (Hejazi and Safarian, 2001; Ellingsens *et al.*, 2006).

4. Model Specification, Methodology and Data

Model Specification

Taking into consideration of the change in FDI landscape in Malaysia[7] along with her economic growth is export-led, the econometric specification of the gravity model for Malaysia's bilateral export trade can be written as:

$$\ln X_{ij} = \beta_0 + \beta_1 \ln [Y_i.Y_j] + \beta_2 \ln [y_i - y_j]^2 + \beta_3 \ln dist_{ij} + \beta_4 \ln ofdi_{ij} + \beta_5 \ln ifdi_{ij} + \beta_6 \ln language_{ijt} + \beta_7 \ln REER_{ijt} + \varepsilon_{ij} \quad (1)$$

where X_{ij} denotes the volume of exports from country *i* (i.e. Malaysia) to countries *j* (i.e. Malaysia's export destinations); $Y_i.Y_j$ is the product of GDP of country *i* and country *j*; $[y_i - y_j]^2$ represents the squared difference in per capita income between countries *i* and *j*; *dist* denotes the bilateral distance between country *i* and country *j*; *ofdi* and *ifdi* are outward and inward FDI respectively; *language* is a dummy variable that takes the value 1 if countries *i* and *j* share the same language, otherwise, they take value 0; and REER stands for the real effective exchange rate.

It is expected that ln X_{ij} is a positive function of $Y_i.Y_j$, which corresponds to the economic size of countries *i* and *j*. $[y_i - y_j]^2$ is intended to test the impact of differential per capita income

[7] Regionally speaking, although Malaysia used to be one of the major destinations of FDI, it has of late become the second largest source of FDI after Singapore.

between two countries on the degree of trade intensity. According to the Linder (1961) hypothesis, countries with similar income levels tend to trade more intensively between each other as consumers with similar income are likely to have similar taste that leads to the production and trade in similar but differentiated products. Therefore, the lesser the difference between two countries' per capita income (i.e. the sign of the coefficient is negative), the higher the share of the bilateral intra-industry trade would occur between them and *vice versa* (see Kabir and Salim, 2010; Tronignon, 2010). Accordingly, the expected sign of the estimated coefficient of $[y_i - y_j]^2$ is negative. The distance variable, which is a proxy for transport costs[8], is negatively related to bilateral export trade. Other things being equal, the longer the distance between two countries, the higher is the transport costs, which could in turn be an impediment to trade. In this study, we can use the absolute geographical distance variable (i.e. the distance between capitals of countries) as a proxy for the economic centre for a country to measure distance.[9] In general, the effects of OFDI and IFDI variables on bilateral exports can be either positive or negative.[10] For instance, with horizontal OFDI (or IFDI) i.e., domestic production have been entirely relocated abroad (or home economy) to serve a protected host (home) market in order to save trade costs, then OFDI (or IFDI) substitutes bilateral export trade. On the other hand, vertical OFDI (or IFDI) tends to complement bilateral export trade when the foreign affiliates of the home (or foreign) parent multinationals set up their production bases across different countries according to comparative cost and locational advantages.[11] The *language* variable is expected to enhance bilateral export trade because countries sharing the same language not only tend to have lower transaction cost to trade but also are instrumental in establishing trade ties between them (see Bussiers, 2006). Lastly, REER, which measures Malaysia's relative international competitiveness against its trading partners, is inversely related to bilateral exports. For example, an increase in REER indicates an appreciation of the ringgit exchange rate against a basket of her trading partners' currencies that causes its export price competitiveness to deteriorate, and hence, resulting in a decrease in Malaysia's exports.

[8] Other transport costs can comprise insurance premiums, unloading and custom clearance.
[9] Melitz (2007) pointed out that the distance between capitals excludes internal distances such as mountain ranges, which might also serve as a barrier to bilateral trade.
[10] There are a number of papers which used both OFDI and IFDI simultaneously in a gravity model, for example, Brenton *et al*. (1999), Hejazi and Safarian (2001), Ellingsens *et al.*(2006), Goh *et al*. (2013).
[11] Examples of locational advantages are availability of cheaper resources, proximity to market and favorable policy regimes etc.

Methodology: System GMM

This paper applied the system Generalized Method of Moment (GMM) panel estimator proposed by Arellano and Bover (1995) and Blundell and Bond (1998). There are advantages in employing the GMM estimator to ascertain the economic relationship as stated in equation (1). Firstly, the GMM is able to deal with the simultaneity bias, which could possibly be caused by the endogeneity problem of explanatory variables (Mairesse and Hall, 1996; Beck and Levine, 2004). For instance, Azman *et al*. (2010) found that GDP, which was one of the key determinants of trade, was likely to be endogenous, as higher output might attract more market seeking FDIs. Secondly, this estimator is designed for data with 'small T, large N' panels, meaning small time series periods but a large number of individuals or countries (see Roodman, 2009). Lastly, this estimator is able to control time-invariant country specific effects, which cannot be managed using country-specific dummies due to the dynamic structure of the regression equation (Bond *et al*. 2001). Moreover, system GMM offers dramatic improvements in both efficiency and consistency compared to earlier GMM estimators such as Arellano-Bond estimation.

Consider the following regression equation:

$$y_{i,t} - y_{i,t-1} = (\alpha - 1) y_{i,t-1} + \beta' X_{i,t} + \eta_i + \varepsilon_{i,t} \quad (2)$$

where *y* is the logarithm of real exports, *x* represents the set of explanatory variables (other than lagged real exports), η is an unobserved country-specific effect, ε is the error term, and the subscripts *i* and *t* represent country and time period, respectively.

Rewrite equation (2) as

$$y_{i,t} = \alpha y_{i,t-1} + \beta' X_{i,t} + \eta_i + \varepsilon_{i,t} \quad (3)$$

In order to eliminate the time-invariant country-specific effects, equation (3) is transformed into first differences (Arellano and Bond, 1991), which takes the following form:

$$y_{i,t} - y_{i,t-1} = \alpha (y_{i,t-1} - y_{i,t-2}) + \beta '(X_{i,t} - X_{i,t-1}) + (\varepsilon_{i,t} - \varepsilon_{i,t-1})$$

(4)

Equation (4) is prone to simultaneity bias of explanatory variables and the correlation between $(y_{i,t-1} - y_{i,t-2})$ and $(\varepsilon_{i,t} - \varepsilon_{i,t-1})$, which could be addressed using the lagged levels of the regressors as instruments (Arellano and Bond, 1991), assuming that (i) the error terms are serially uncorrelated, and (ii) the lag of the explanatory variables are weakly exogenous.

However, the so-called first-differenced GMM estimator is still likely to perform poorly due to the following reasons: (i) the differencing process removing the cross country effects tends to eliminate the information on the cross-country variation in levels (Blundell and Bond, 1998), and (ii) lagged levels are often rather poor instruments for first-differenced variables, if the variables are close to a random walk, which may lead to biased parameter estimates in small samples and larger variance (Arellano and Bover, 1995). To overcome the shortcomings of the first-differenced GMM estimator, Arellano and Bover (1995) and Blundell and Bond (1998) proposed the system GMM estimator, which combines standard set of moment conditions in difference equation (4) with lagged levels as instruments, with additional set of moment conditions derived from the level equation (3).[12] Thus, the additional set of moment conditions consist of lagged differences of the dependent variable that are orthogonal to levels of the disturbances and they assume that panel-level effect is unrelated to the first observable first-difference of the dependent variable (Drukker, 2008). Moreover, there are two specification tests that can be used to examine the consistency of the GMM estimator. The first is the Sargan test of over-identifying restrictions, which tests the overall validity of the instruments. The second test examines the hypothesis of no second-order serial correlation in the error term of the difference equation. Failure to reject the null of both tests provides support for correct specification of the estimated model.

[12] In this case, the system GMM estimator uses the level equation to obtain a system of two equations i.e., one in first differences and the other in levels. By adding a second equation, additional instruments can be obtained. Thus, the variables in levels in the second equation are instrumented with their own first differences, which could enhance efficiency.

Data

The system GMM model is estimated using a panel dataset, which consists of annual observations spanning from 2005 to 2013 for three sub-sectors, namely manufacturing, services and mining. The sample of countries is different in each of these sub-sectors as it depends on the data available over the specified sample period. Nevertheless, these sample countries represent the core partners of Malaysia's in regional production and distribution networks.[13] The series for OFDI and IFDI by sector (i.e. manufacturing, services and mining) is a set of primary data prepared by Bank Negara Malaysia (BNM) based on International Investment Position (IIP) Survey, which is the official data source for Malaysia's Balance of Payments (BOP) accounts. Correspondingly, the data on bilateral trade (i.e. exports and imports) by sector (i.e. manufacturing, services and mining) are also from IIP Survey[14] due to similar set of reporting entities that are reported for OFDI and IFDI. The main benefit of using this set of primary data is that it allows the empirical study to take advantage of data accessible at a disaggregated level for analysing Malaysia's bilateral trade relationship by key sectors. The data source for GDP and population measuring the economic size (i.e. the product of GDP of country *i* and country *j*) as well as the degree of inter- (intra-) industry trade (i.e. the squared difference in per capita income between countries *i* and *j*) is from the World Bank's *World Development Indicators* (WDI). The data on distance and common language can be found from the Centre d'Etudes Prospectives et d'Informations Internationales (CEPII) database. Moreover, language similarity can be handled by a dummy variable. For instance, it takes the values of 1 if partner countries share the same language (i.e. Malay, English and Chinese) or 0 if they do not. The data for REER is obtained from the International Monetary fund's (IMF) *International Financial Statistics* (IFS). All the raw data (except for bilateral distance between countries *i* and *j*, and language) are converted into real terms before they are transformed into natural logarithms. The source and the description of the data can be found in Appendix A.

[13] Due to space constraint, the sample countries for each sub-sector can be made available upon request from the authors.

[14] In general, IIP Survey covers about 95% of trade data published by the Department of Statistics Malaysia (DOSM).

5. Empirical Results

Table 3 provides the estimations results of the gravity equations for exports of manufacturing, services and mining from 2005 to 2013. In addition, the diagnostic test statistics for each equation are also reported. The regression results suggest that all models are appropriately specified. For instance, the Sargan test statistic in each estimated equation suggests that we do not reject the null hypothesis of valid over-identifying restrictions. The AR(1) and AR(2) test statistics for first- and second-order serial correlations were applied to these regressions. The AR(1) test results show that the null hypothesis of white noise of error terms against the alternative of a first-order serial correlation is rejected while the AR(2) test results indicate all the regressions do not exhibit second-order serial correlation. Moreover, the lagged dependent variable is statistically significant, implying that the dynamic GMM is an appropriate estimator for statistical inference and policy analysis.

Table 3: System GMM estimation results, 2005-2013; dependent variable is log of real export.

	Manufacturing Sector	Services Sector	Mining Sector	Manufacturing Sector (with slope dummies)	Services Sector (with slope dummies)	Mining Sector (with slope dummies)
Constant	-1.42*** (0.21)	0.81*** (0.27)	1.01 (1.05)	3.05 (2.17)	-0.53 (0.42)	7.64* (3.88)
$lrexport_{it-1}$	0.62*** (0.00)	0.62*** (0.00)	0.42*** (0.02)	0.69*** (0.03)	0.60*** (0.01)	0.43*** (0.35)
$lpgdp_{it}$	0.01*** (0.00)	0.01*** (0.00)	0.01*** (0.00)	0.01*** (0.00)	0.01*** (0.00)	0.14*** (0.00)
$ldrgdppop_{it}$	0.01*** (0.00)	0.11*** (0.01)	0.30*** (0.09)	0.01 (0.02)	0.11*** (0.01)	0.03 (0.16)
$lorfdi_{it}$	0.49*** (0.02)	0.12*** (0.01)	0.04*** (0.00)	0.14*** (0.04)	0.05*** (0.01)	0.04** (0.01)
$lifdi_{it}$	-0.07*** (0.02)	0.18*** (0.00)	-0.23*** (0.06)	0.09*** (0.02)	0.11*** (0.03)	0.11* (0.06)
$ldist_{it}$	-0.15*** (0.01)	-0.30*** (0.02)	-0.44*** (0.07)	-0.19 (0.12)	-0.29*** (0.03)	-0.37*** (0.09)
$lreerm_{it}$	-0.67*** (0.05)	-0.94*** (0.02)	-0.69*** (0.10)	-0.81** (0.40)	0.20 (0.14)	-5.48** (2.72)
$language_{it}$	0.49*** (0.03)	-0.06 (0.04)	0.13* (0.07)	-0.23 (0.40)	-0.00 (0.07)	0.25 (0.20)
Crisis year 2007	0.18*** (0.01)	-0.02*** (0.00)	-0.11*** (0.01)			
Crisis year 2008	-0.03*** (0.00)	0.17*** (0.00)		-1.19*** (0.29)	-0.86*** (0.19)	0.60** (0.26)
Crisis year 2009				-0.13*** (0.01)		

lrofdi*2007				1.73*** (0.36)	-0.75*** (0.06)	
lrofdi*2008				0.47*** (0.10)	0.30*** (0.03)	
lrifdi*2007				-1.61*** (0.33)	0.44*** (0.04)	
lrofdi*2010					-0.15*** (0.02)	-0.13** (0.06)
lrofdi*2012						-0.08* (0.04)
lrifdi*2005						-0.09** (0.04)
lrifdi*2008					0.21*** (0.07)	
lrifdi*2010					0.14*** (0.01)	
Sargan test (p-value)	74.47 (0.46)	71.38 (0.59)	26.10 (0.89)	42.24 (0.10)	64.8 (0.7915)	16.82 (0.99)
Autocorrelation of order 1(p-value)	-2.96 (0.00)	-3.77(0.00)	-2.73(0.00)	-3.22(0.00)	-4.19(0.00)	-2.72(0.00)
Autocorrelation of order 2(p-value)	0.72 (0.47)	-1.02(0.30)	1.13(0.25)	0.59 (0.55)	-1.43(0.15)	1.13(0.25)
N x T	78 x 9	78 x 9	34 x 9	78 x 9	78 x 9	34 x 9

Notes: Figures in parentheses are probability values. ***, **, and * denote 1%, 5% and 10 % level of significance respectively.

Source: Authors' calculation

Columns 2-4 in Table 3 show the estimated coefficient of $lpgdp_{it}$ (i.e. the product of GDP) is positive and inelastic (i.e. less than one) and is significant at 1% level, suggesting the product of home and host market size is an important determinant of bilateral exports relating to manufacturing, services and mining. Likewise, the estimated coefficient of $ldrgdppop_{it}$ (i.e. the difference in per capita GDP between two countries) is also positive and significant, which rejects the *Linder* hypothesis, implying that the bilateral exports for the three sectors are inter-industrial in nature. The elasticity of bilateral export with respect to the difference in per capita GDP ranges between 0.01 and 0.3, suggesting a one per cent increase in the income gap between the host and home countries would increase the volume of Malaysia's bilateral exports less than proportionately, *ceteris paribus*. Both the $lreerm_{it}$ (i.e. the real effect exchange rate) and $ldist_{it}$ (i.e. the distance between countries *i* and *j*) are negative and inelastic, and both are significant at 1 percent level. The former indicates that an increase in the distance between Malaysia and her trading partners would decrease her bilateral exports for manufacturing, services and mining less than proportionately, while the latter is consistent with the economic argument that an appreciation of the ringgit exchange rate against a basket of her trading partners' currencies would cause a decrease in bilateral export trade less than proportionately

for her three export sectors. The estimated coefficient for $language_{it}$ (i.e. language similarity between countries *i* and *j*) has expected sign and is significant at 1 and 10 per cent levels for manufacturing and mining sectors respectively. The system GMM estimation results in Table 3 also show that Malaysia's bilateral exports experienced a significant setback during the global financial crisis of 2007-2008, which is not unexpected.

With reference to the estimated $lorfdi_{it}$ (i.e. the OFDI variable), it is positive and inelastic and, is significant at the 1% level for the three export sectors, indicating that the effect on Malaysia's bilateral exports by OFDI is complementary. Whereas the estimated coefficient of $lifdi_{it}$ (i.e. the IFDI variable) is negative for bilateral exports from the manufacturing and mining sectors (see Columns 2 and 4 of Table 3), which does not corroborate with the existing evidence that IFDI is complementary to trade especially in relation to Malaysia's manufacturing exports. The distortionary opposite sign for the IFDI estimates might be attributed to some outliers that occurred during the global financial crisis (GFC) from 2007 onwards.[15] That is to say GFC can be seen as a possible channel through which IFDI might have a negative effect on bilateral exports. Therefore we model the interaction effect (i.e. between FDI and a financial crisis dummy variable), that is specifically, the marginal effect of IFDI (and OFDI) on bilateral exports of manufacturing, services and mining depends on whether it is during the financial crisis period (i.e. the dummy variable takes a value of one) or non-financial crisis period (i.e. the dummy variable takes a value of zero).

The System GMM model with slope dummies on IFDI and OFDI are then estimated and the estimation results for the final parsimonious models are presented in Columns 5 to 7 of Table 3. The diagnostic test statistics suggest that all the estimated equations are correctly specified. The lagged dependent variable $lrexport_{it-1}$ in each equation is significant at one per cent level, implying the dynamic GMM is an appropriate estimator and the estimations are robust. When the slope dummies on IFDI and OFDI are included in the System GMM models, both the estimated OFDI and IFDI are positively significant in the bilateral export equations. OFDI and IFDI are both significant at one per cent level for export of manufacturing as well as services, whereas OFDI is significant at five percent and IFDI is significant at ten per cent level respectively for exports of mining. These findings support IFDI- and OFDI-led sectoral export hypotheses. The findings that OFDI and IFDI are both positive and significant for services

[15] During the GFC, IFDI have dropped sharply while exports expanded because of the depreciation of the ringgit, thereby creating an inverse relation during these years of the crisis.

sector suggests that wholesale and retail trade in services sector as explained in Section 2, play a significant role in mobilizing export trade in Malaysia.

As expected, the estimated coefficients on the product of GDP (for all the three export sectors), the distance between countries *i* and *j* (except for the exports of manufacturing) and the real effective exchange rate (except for the exports of services) are significant and all have correct sign. In contrast, using the slope dummies, the common language effect for the all the three export sectors turn out to be insignificant. The sign of the intercept dummies (i.e. Crisis year 2008 in Columns 5 to 7 of Table 2) for the three export sectors, which capture the GFC, is significantly negative, suggesting the worsening of the financial crisis could undermine Malaysia's bilateral export trade. The high estimate of the slope dummies for lrifdi*2007 for exports of manufacturing (i.e. the interaction term on IFDI and the year 2007 in Column 5 of Table 3) is found to be very negatively significant, which explains why we obtained a negative estimate for the manufacturing exports in Column 2, row 6 of Table 3.

5. Conclusion

Foreign multinationals in Malaysia have been instrumental in not only industrializing the economy but also promoting export trade. Hence, IFDI is an important driver of the country's economic development and growth. Although Malaysia has an open foreign investment policy, there is a change in the FDI landscape indicating that domestic firms have a growing interest in spreading their operations abroad so as to gain competitive/cost advantage and expand markets. Given that the bulk of OFDI comprises sectors from services, mining and manufacturing, the aim of this paper is to use the FDI-augmented gravity model to ascertain the possible effects of both sectoral IFDI and OFDI on Malaysia's bilateral sectoral exports using the System GMM approach. The key findings suggest that economic size of both home and host countries has a positive influence on bilateral export trade for all the three sectors, namely, services, mining and manufacturing. On the other hand, both the distance elasticity and the real effective exchange rate are found to have negative effect on bilateral export trade (especially pertaining to the services and mining export sectors for the former variable, and the mining and manufacturing export sectors for the latter variable). In particular, exports from the mining sector is very responsive to movements in the real effective exchange rate compared to manufacturing, which is consistent with the findings in Bank Negara Malaysia (2010) where the appreciation of the ringgit is shown to have impacted various sectors differently. For instance, the mining sector, which has a relatively much smaller share of imported input tends

to lead to some counteracting effect when the ringgit appreciated, whereas the manufacturing sector that imported a larger share of raw and processed materials is seen to serve as a natural hedge that limited the impact of the ringgit exchange rate movement. The complementary effects of IFDI and OFDI on bilateral exports for all sectors become more evident when the slope dummies are incorporated into the System GMM model, revealing that Malaysia's sectoral IFDI and OFDI support the complementary relationship between investments and exports. However, the bilateral sector exports could not insulate itself against external shock such as the global financial crisis.

The empirical evidence has important implications for policymakers as well as export-oriented developing economies, especially those that are experiencing the rising trend of OFDI due to globalization. For instance, it is evident that Malaysia's OFDI in manufacturing could lead to higher bilateral sectoral exports relative to OFDI in services although the latter dominates the country's total OFDI. As we know, many manufacturing firms (such as Globetronics, Press Metal and Top Glove etc.) from Malaysia invested in low-cost countries with the intention to improve their efficiency (ASEAN Investment Report 2012). As such, efficiency-seeking OFDI in manufacturing can be viewed as part of the regional production network in which intra-firm trade is becoming increasingly important in Malaysia's export trade (i.e. between the parent companies at home and their subsidiaries abroad). Hence, the Malaysian government should encourage vertical OFDI in manufacturing to reinforce the OFDI-export trade linkages at the sectoral level. On the other hand, Malaysia's OFDI in services, to a larger extent, is market-seeking type, of which Malaysian firms set up subsidiaries or joint ventures in new markets abroad to provide services to the locals. Malaysian firms with significant market-seeking OFDI include Axiata, CIMB, Maybank, GHL Sytems, and Hong Leong, to name a few (ASEAN Investment Report 2012). To enhance greater export linkages with OFDI in services, Malaysian multinationals should consider outsourcing their supporting activities (e.g. procurement of inputs, technology and human resources like management and finance) as some of these supporting activities can be executed more efficiently by their respective parent companies and suppliers located elsewhere, which could potentially lead to higher cross-border transaction flows of intermediate goods and services.

The swings in the ringgit exchange rates can have a dramatic effect on an exporter's international price competitiveness and hence its profitability. From a policy perspective, one policy option is for policy-makers to continue to ensure that the country's exchange rate reflects

the underlying fundamentals of the economy and to mitigate excessive volatility of exchange rate. For the case at hand, Malaysian exporters could possibly consider undertaking business strategies to cover their exposure for import and or export contracts that are denominated in foreign currencies by for example using forward exchange markets, switching sources of demand and supply, or having exports sales in the same foreign currency as import contracts.[16]

[16] It is probable that many small local firms lack in-house expertise in foreign exchange management.

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Appendix A: Sources and description of the data

Variable	Source	Unit of measurement	Type of data
Export of goods & services	BNM, IIP Survey	US$, million	Primary
OFDI by sectors			
IFDI by sectors			
GDP	World Bank	US$, million	Secondary
Population	UNCTAD	million	
Real Effective Exchange Rate	IMF	index	
Distance	CEPII	kms	
Language	CEPII	dummy	