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Does FDI substitute exports of home country? A case of US FDI in select Asian economies

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Abstract. *This paper analyzes the substitution effect of outward FDI on the exports of the home country. The US is selected as the home country for its position amongst the top FDI providing countries and select Asian economies as host countries viz. China, Japan, India, Republic of Korea and Thailand. Study period covered is from 1991 to 2017. It is found that in case of Japan, US FDI in Japan had positive effect on exports of US to Japan. In case of all other economies no relation between US FDI and exports was observed. Thus the substitution effect was not observed in case of US FDI on US exports for the economies of China, Japan, India, Republic of Korea and Thailand.*

Keywords: Foreign Direct Investment, exports, Outward FDI, home country, substitution, United States, Asian economies, China, Japan, India, Republic of Korea, Thailand.

JEL Classification: A1, C0, C1, C2, E0, F0, F1, F2, F4.

I. Introduction

Foreign Direct Investment (FDI) involves investment by an entity of one country into another country. It includes setting up of operations abroad, purchase of assets in a foreign country, acquiring controlling stake in a foreign company, merger & acquisition abroad, setting up of a subsidiary in the foreign country etc. However, it does not involve such equity investments which do not acquire controlling stake as such investments are passive in nature and fall in the domain of portfolio investments.

Though there are various theories which explain the motivation of FDI, the FDI activity does have its pros and cons for both the home country and the host country. One such issue on which this paper is based upon is the effect outward FDI has on the exports of the home country. The concern of this paper is finding the possibility of a negative effect of this outward FDI on home country in the form of export substitution. Export substitution and resultant contraction of employment opportunities in home country causes balance of payment imbalances and labour market disruptions in the home country.

In this paper we study the substitution effect of outward FDI on exports of the home country. We have selected US as the home country considering its position amongst the top FDI providing countries and select Asian economies as host countries viz. China, Japan, India, Republic of Korea (Korea) and Thailand. The criteria used for selecting these Asian economies were average of GDP for F.Y. 2013 to F.Y. 2017. Though Indonesia was also one of the countries in the initial list of selected countries, the same was removed due to unavailability of US FDI data for the country. The above selected Asian nations are major emerging economies in Asia and have resultant importance and impact of their international activities on world trade and investment. The study period covered is from 1991 to 2017. This paper comprises of seven sections. Section I gives a brief introduction about the purpose of this paper. Section I provides the theoretical background of this study. It explains the various prominent theories of FDI. Section III discusses the previous empirical work on the effects of outward FDI on exports of the home country. The process of data collection and the research methodology is explained in Section IV and V respectively. The various statistical methods and test such as Correlation Analysis, Augmented Dickey-Fuller Unit Root Test, Co-integration Test, Granger Causality Test and Vector Autoregression (VAR) are explained. The process of selection of Asian economies is also described in this section. Empirical Results are presented with discussion in Section VI. The paper ends with conclusions of the study in Section VII.

II. Theoretical background

International trade and FDI in various forms have been in existence for several years. During the modern era, with the growth of international trade and the theoretical work on the subject, the concept of FDI also started to gain prominence. Various theories have been developed by the researchers which try to explain motivation for FDI. The most relevant FDI theories among them are MacDougall-Kemp Hypothesis, Industrial Organisation Theory, Location Specific Theory, Product Cycle Theory, Internalisation Approach and Eclectic Paradigm.

The MacDougall-Kemp hypothesis developed by MacDougall (1958) and Kemp (1964) postulates free movement of capital from capital abundant country to capital scarce country there by equalizing the marginal productivity of capital between the two countries. Industrial organisation theory propounded by Hymer (1976) states that an oligopolistic multinational firm with some kind of superiority looks for control in an imperfect market for maximizing its profit. Such advantages are mostly technological that helps it to produce product superior than the existing product. Location specific theory by Hood and Young (1979) emphasizes on the location specific advantages which motivates a firm to operate in another country such as low cost labour, availability of raw material etc. Product cycle theory by Vernon (1966) is based on the product life cycle due to which the product moves to various countries at different stages of its life cycle. The stages can be named sequentially as innovation, maturing, standardizing and dematuring of the product. Internalisation approach by Buckley and Casson (1976) emphasizes that the transaction costs involved in intra-firm transfer of intermediate products is almost zero whereas it is exorbitant in case of unrelated firms. This provides motivation for a firm to go international and set up a firm instead of an arms-length transaction incurring high costs. Eclectic paradigm by (Dunning 1980, 1993) is the combination of industrial organization theory, internalisation theory and location theory. It postulates that at any particular time, the stock of foreign assets owned by a MNC is determined by a combination of ownership advantages (O), location specific endowments (L) and the extent of marketing of these advantages among various units of the firm (I).

III. Previous empirical work

Though there is a dearth of theories which study the effects of outward FDI on exports of the home country, there is some empirical literature available. We will now discuss this literature. The literature work on outward FDI is divided into two major parts. One part studies the effects on domestic exports caused by production abroad causing reduction in exports from the home country i.e. export substitution. Second part deals with contraction of employment in the home country as an aftereffect of export substitution. The understanding in this case is that employment contraction is the spillover effect caused by substitution of exports brought over by outward FDI. It considers that domestic employment is substituted by foreign employment which is caused by production in overseas facilities when firms operate abroad. As this paper is focused only on the effects of outward FDI on exports of the home country, the literature discussed also pertains to this aspect only. The employment effect is not the subject of study of this paper.

The substitution effect was first documented by Mundell (1957) is his paper where he established that there is substitution between trade and FDI. Though his analysis makes assumptions which are far from reality the same maintains the central theme of substitution intact. Svensson (1996) in his research on Swedish multinationals found that increased foreign production both replaces exports of finished goods and attracts intermediate goods from the parent. The net effect found to be negative, albeit significant only in the case of affiliate exports in the EC. Agarwal (1996) suggested that efficiency seeking FDI may cause more unemployment due to exports substitution and reimports than employment

through additional exports to host countries. Gopinath, Pick and Vasavada (1998) in their study of US Food Processing Industry found a small substitution between foreign affiliate sales and exports. Markusen and Maskus (2001) in their survey of literature observed emerging evidence that FDI production complements increased trade in intermediates but in general substitutes for trade in final goods.

However, there are various studies which also found positive or complementary relation between FDI and Exports. Lipsey and Weiss (1981) found that U.S. manufacturing investment abroad is positively related to US exports. Lecraw (1993) found that the performance of Indonesian firms that invested abroad improved dramatically after their investment in terms of management expertise, exports, quality, and costs relative to their past performance and relative to the other firms. Blomstrom and Kokko (1994) summarized some research in respect of FDI by Swedish multinationals and found the net effect of the relation between foreign investment and home country exports and employment to be complementary. Pfaffermayr (1994) in his study of Austrian economy observed possibility of a positive effect of exogenously increased foreign direct investment on exports and a negative effect of export shocks on foreign direct investment. However, significant long-run effects were not established. In another study, Pfaffermayr (1996) in respect of Austrian manufacturing found significant complementary relationship between FDI and exports in the eighties and early nineties. Long-run multipliers of exogenously increased FDI and exports were found to be positive but small in magnitude. Lin (1995) estimated the effect of Taiwan's outward FDI in four ASEAN countries viz. Indonesia, Malaysia, the Philippines and Thailand on exports to and imports from these host countries and the trade effect of inward FDI from these countries. It was observed that Taiwan's outward FDI has greatly increased trade with these host countries. Clausing (2000) using two panel data sets of operations of US multinational firms abroad and the operations of foreign multinational firms in the US found that multinational activity and trade are complimentary activities, more particularly multinational activity and intra firm trade. Head and Ries (2001) using a panel dataset containing 25 years of data on 932 Japanese manufacturing firms investigated the effect of direct investment abroad on exports. They found complementarity for the full sample of firms. Alguacil, Cuadros and Orts (2002) observed positive causal relationship from FDI to exports in Mexico during the period 1980 to 1999. Camarero and Tamarit (2004) estimated the demand for exports and imports of manufactured goods for the majority of the EU countries and the United States and Japan. The authors included both the traditional determinants of trade and also the stock of foreign direct investment (FDI) as explanatory factors. They mainly found a complementary relationship between trade and FDI. Kim and Mah (2006) analyzed the pattern of FDI flows of South Korea into China. They observed that China has become the largest destination for Korean FDI and it appeared to complement Seoul’s export to China. Martínez-Martín (2010) in the analysis of Spanish economy found positive causality relationship running from outward FDI to exports. In respect of goods it was stronger and for services it was weaker in the long run. The complementary relation was found consistent with vertical FDI strategies. In the short run, however, only exports of goods were found to be affected positively by FDIs. Chen, Hsu and Wang (2012) using data of Taiwanese manufacturing firms found that exports in Taiwan are positively associated with outward FDI by Taiwanese firms supporting the view that outward FDI complements home country exports.

Some authors could not find any relation between outward FDI and exports or had mixed results. They could not find any definitive relation. Buckley and Casson (1981) attempted to model for optimal timing of FDI. They analysed foreign market servicing decision of firms in terms of the costs of servicing the foreign market, demand conditions in that market and host market growth. It was concluded that decisions on market servicing are more complex than is sometimes assumed. Lipsey and Weiss (1984) observed that foreign production by a US firm did not substitute for exports by the firm from the US to the area in which the production takes place. Blomstrom, Lipsey and Kulchycky (1988) considering the theoretical models of direct foreign investment, which then typically treated the size of a market as exogenous and a company's share of a market as a function of its firm specific capital, opined that the decision of firms on how to serve foreign markets is a matter of choice among other methods such as to produce abroad, exporting from the home country and licensing others to produce the firm's product. Kim and Kang (1997) examined the relationship between outward FDI and exports in South Korea and Japan. In both the countries, outward FDI was not found to decrease exports nor were there any positive effects of outward FDI on exports. Blonigen (1999) found substantial evidence for both a substitution and a complementarity effect between affiliate production and exports with Japanese automobile parts for the US market. Head and Ries (2004) observed existence of substitutive relationship between FDI and exports in several papers. They also found that FDI sometimes complements exports by stimulating exports of intermediate goods for use by overseas affiliate. Africano and Magalhães (2005) found that the stock of outward FDI has no significant relation either with Portuguese exports or imports. Ellingsen, Likumahuwa and Nunnenkamp (2006) did not find that Singapore's FDI has replaced exports. Majeed and Ahmad (2007) in their study of developing countries found no evidence of a substitution relationship between FDI and exports. Goh, Wong and Tham (2012) in the study of Malaysian economy did not find any significant relation between outward foreign direct investment and trade. Bhasin and Paul (2016) analyzed the relationship of outward FDI with exports of the home country, for a group of developing/ emerging countries in Asia. They found no evidence of long-run causality from OFDI to exports and also no evidence of short-run causality between OFDI and exports in either direction.

IV. Data collection

The GDP data for selection of top Asian economies has been obtained from the World Bank Database for the years 2013 to 2017. Data on foreign direct investment of US in the shortlisted Asian economies has been obtained from the website of the United States, Bureau of Economic Analysis. Data on Exports from US to these economies has been collected from the website of United Nations, Comtrade Database. Both the FDI and exports data cover the period from financial year 1991 to 2017. Due to limited availability of data for services, the paper has only considered exports of goods and FDI in manufacturing sector. All data used is in USD millions. FDI and exports data has been transformed into natural logs for ease of analysis. The details of variables and data is presented in Table 1.

Table 1. *Variables used in analysis of relation between US FDI Position and US Exports in Select Partner Nations (Period F.Y. 1991 - 2017)*

Variable	Symbol	Data Source	Granularity	Transformation	Ln Symbol	Currency
US FDI in China	FDI_CHN	US - Bureau of Economic Analysis	Annual	Natural Logarithm	LFDI_CHN	USD in Millions
US FDI in Japan	FDI_JPN	US - Bureau of Economic Analysis	Annual	Natural Logarithm	LFDI_JPN	USD in Millions
US FDI in India	FDI_IND	US - Bureau of Economic Analysis	Annual	Natural Logarithm	LFDI_IND	USD in Millions
US FDI in Korea	FDI_KOR	US - Bureau of Economic Analysis	Annual	Natural Logarithm	LFDI_KOR	USD in Millions
US FDI in Thailand	FDI_THA	US - Bureau of Economic Analysis	Annual	Natural Logarithm	LFDI_THA	USD in Millions
US Exports to China	EXP_CHN	UN - Comtrade Database	Annual	Natural Logarithm	LEXP_CHN	USD in Millions
US Exports to Japan	EXP_JPN	UN - Comtrade Database	Annual	Natural Logarithm	LEXP_JPN	USD in Millions
US Exports to India	EXP_IND	UN - Comtrade Database	Annual	Natural Logarithm	LEXP_IND	USD in Millions
US Exports to Korea	EXP_KOR	UN - Comtrade Database	Annual	Natural Logarithm	LEXP_KOR	USD in Millions
US Exports to Thailand	EXP_THA	UN - Comtrade Database	Annual	Natural Logarithm	LEXP_THA	USD in Millions

Note: Due to unavailability of data on export of services and FDI in services for the entire period of F.Y. 1999 - 2017, only Manufacturing Sector is covered in the study.

V. Research methodology

1. Selection of Asian economies

We selected the Asian economies for this study on the basis of their 5 year average GDP for the period covering F.Y. 2013 to 2017. The economies with highest average GDP were to be shortlisted. Initially we found China, Japan, India, Republic of Korea (Korea) and Indonesia as the top countries. However, due to unavailability of US FDI data for Indonesia the country was replaced by Thailand the next country with highest average GDP. Thus the economies selected for study were China, Japan, India, Republic of Korea (Korea) and Thailand. The details are presented in Table 2.

Table 2. *Selection of Top 5 Asian Economies based on average of GDP for F.Y. 2013 – 2017*

(Current USD in Millions)

Economy	Rank	GDP						Selected for Study
		2013	2014	2015	2016	2017	5 Year Average	
China	1	9607224,48	10482372,11	11064666,28	11190992,55	12237700,48	10916591,18	Y
Japan	2	5155717,06	4850413,54	4394977,75	4949273,34	4872136,95	4844503,73	Y
India	3	1856722,12	2039127,45	2102390,81	2274229,71	2597491,16	2173992,25	Y
Korea	4	1305604,98	1411333,93	1382764,03	1414804,16	1530750,92	1409051,60	Y
Indonesia	5	912524,14	890814,76	860854,24	932256,50	1015539,02	922397,73	N*
Thailand	6	420333,33	407339,36	401399,42	411755,16	455220,92	419209,64	Y
Malaysia	7	323277,16	338061,96	296434,00	296535,93	314500,28	313761,87	N
Singapore	8	304454,33	311539,50	304097,76	309763,88	323907,23	310752,54	N
Hong Kong	9	275696,88	291459,36	309383,63	320881,18	341449,34	307774,08	N
Philippines	10	271836,12	284584,52	292774,10	304889,08	313595,21	293535,81	N

*** Note:** Indonesia was not selected as the FDI data of US for the country was not available.
Source: World Bank Database.

2. Analysis of time series

In order to initiate the study, we first need to understand the relationship between US FDI and exports to host countries. Only if there is any relationship among these variables we will be in a position to proceed further. For this we use few statistical methods which form part of time series analysis:

2.1. Correlation analysis

To understand the behavior of the time series of the FDI and exports among themselves, we use correlation analysis as a preliminary method. The method is used to understand the prima facie direction and strength of relationship among the variables under study.

2.2. Augmented Dickey-Fuller unit root tests

In regression analysis involving time series data, a critical assumption is that the times series under consideration is stationary. A series is said to be weakly or covariance stationary if the mean and autocovariances of the series do not depend on time. Any series that is not stationary is said to be non-stationary. It is important to check whether a series is stationary or not before using it in a regression. The formal method to test the stationarity of a time series is the unit root test. In our study we use the Augmented Dickey - Fuller Unit Root Tests to test for presence of unit root.

2.3. Co-integration test

There is always a possibility that time series of macroeconomic variables may contain a unit root. If we regress a non-stationary time series on another non-stationary time series we may get a spurious relationship. Engle and Granger (1987) pointed out that a linear combination of two or more non-stationary series may be stationary. If such a stationary linear combination exists, the non-stationary time series are said to be cointegrated. The stationary linear combination is called the cointegrating equation and may be interpreted as a long-run equilibrium relationship among the variables. However, when more than three variables are involved we have to use Johansen Co-integration Test which is more advanced than Engle-Granger Co-integration Test.

2.4. Granger causality test

If it is found that two time series under study are cointegrated it indicates a long term equilibrium relationship between them. When such a relationship is found it becomes apt to study the causality between such time series which can help for forecasting purpose. The concept of causality rests on the understanding that future events cannot cause past events but past event can affect the future outcomes. One time series can cause an effect on another time series and vice versa. It is this forecasting possibility of one time series based on the other time series which is of interest to this study. In this paper we propose to use the Granger Causality Test developed by Granger (1969). In a bivariate scenario the Granger Causality Test involves estimating a pair of equations. As this paper is concerned with the causality of FDI on exports we use the following equation:

$$lEXP_t = \sum_{i=1}^{m} \alpha_i lEXP_{t-i} + \sum_{j=1}^{m} \beta_2 lFDI_{t-j} + \lambda_1 t + u_t \qquad \text{Eq. No. 1}$$

Where t is the trend variable. $lEXP$ is natural log of EXP i.e. exports and $lFDI$ is natural log of FDI i.e. foreign direct investment. u_t is the white noise error term.

A critical assumption under this test is that the variables under study are stationary. However, in case of non-stationary variables it is still possible that the variables are cointegrated. In such case the use of error correction mechanism (ECM) is required.

Granger Causality Test with ECM can be performed with the following equation:

$$\Delta lEXP_t = \alpha_1 + \alpha_2 \Delta lEXP_{t-1} + \cdots + \alpha_p \Delta lEXP_{t-p} + \beta_1 \Delta lFDI_{t-1} + \cdots +$$
$$+ \beta_q \Delta lFDI_{t-q} + \lambda e_{t-1} + v_t \qquad \text{Eq. No. 2}$$

Where Δ is the first difference operator and e_{t-1} is the lagged residual term from the cointegrating regression also termed as error correction (EC) term.

2.5. Vector Auto Regression (VAR)

The concept of Vector Auto Regression was introduced by Sims (1980). It was introduced to address the problem of identification in the equations. It was observed that often arbitrary restrictions were imposed by excluding some variables from an equation which may be present in other equations in the system. Sims argued that if there are m endogenous variables, they should all be treated on an equal footing and there should not be any distinction between endogenous and exogenous variables. Therefore, the VAR system was introduced.

A bivariate VAR can be specified with the following equations:

$$lEXP_t = A_1 + \sum_{j=1}^{j=p} B_j lEXP_{t-j} + \sum_{j=1}^{j=p} C_j lFDI_{t-j} + u_{1t} \qquad \text{Eq. No. 3}$$

$$lFDI_t = A_2 + \sum_{j=1}^{j=p} D_j lEXP_{t-j} + \sum_{j=1}^{j=p} E_j lFDI_{t-j} + u_{1t} \qquad \text{Eq. No. 4}$$

Where *us* are white noise error terms.

A critical requirement of VAR is that the time series under consideration are stationary. If both series are individually I(0) i.e. stationary, each equation can be estimated by OLS. If both series are I(1) then we can take first difference of the two series and use OLS thereafter. However, if both the I(1) series are cointegrated then error correction mechanism (ECM) has to be used. This method is called Vector Error Correction Model (VECM). In VECM, we first estimate the cointegrating relation between the two time series. Then the residuals of the regression are tested for stationarity. This residual is the error correction (EC) term. Then the short run dynamics are tied to long run relations via the EC terms as given in the following equations:

$$\Delta lEXP_t = \alpha_1 + \alpha_2 e_{t-1} + v_{1t} \quad \text{Eq. No. 5}$$

$$\Delta lFDI_t = \alpha_3 + \alpha_4 e_{t-1} + v_{2t} \quad \text{Eq. No. 6}$$

We propose to use VAR / VECM only if causality is observed so that the direction of the coefficients could be determined.

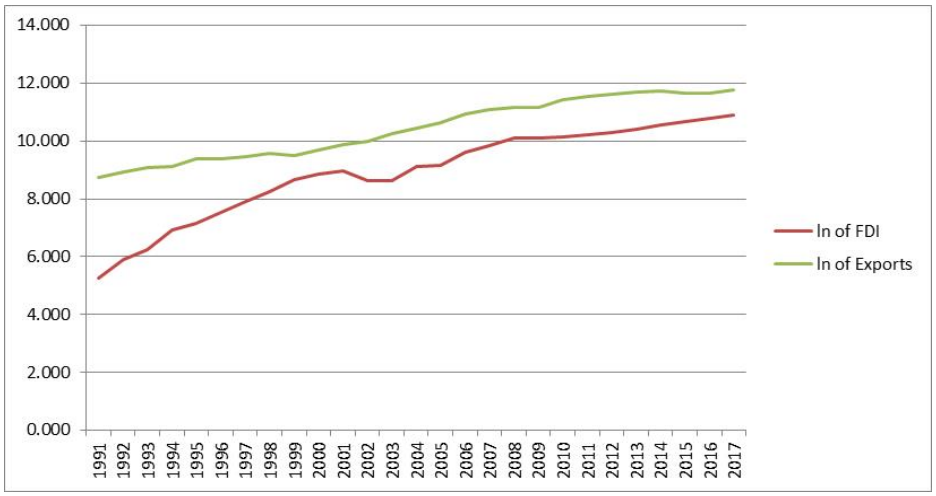
VI. Empirical results

1. Trend analysis

We now perform the graphical trend analysis of the US FDI position and US exports in the selected Asian economies. The FDI and exports data for each economy is annexed to this paper for detailed reference.

a. China

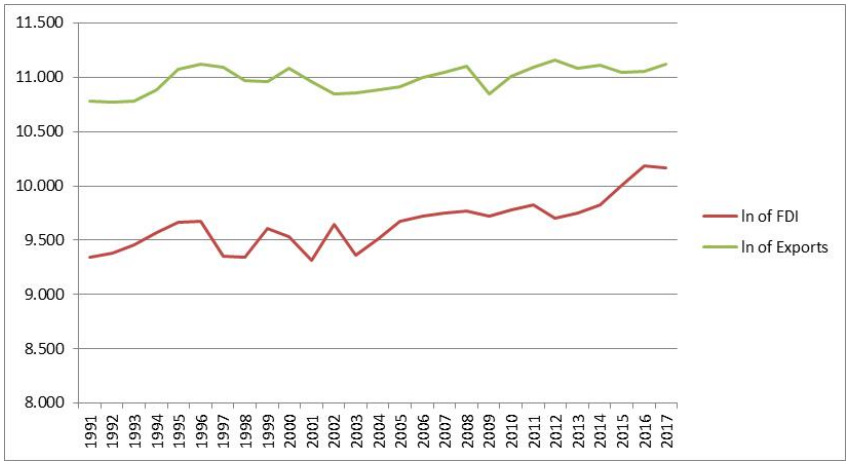
Graph 1. *Trend of US FDI Position and Exports to China from 1991 to 2017*



It can be observed from Graph No. 1 that in case of China both FDI and exports are increasing consistently with the exception that FDI has failed to maintain pace with exports briefly from 2000 to 2004. In 1991 there was a wide gap in the FDI and exports which started narrowing down and getting much closer during 1999 to 2001. Thereafter the variables moved little apart and maintained consistent distance. Visually there appears to be high correlation among both the time series.

b. Japan

Graph 2. *Trend of US FDI Position and Exports to Japan from 1991 to 2017*

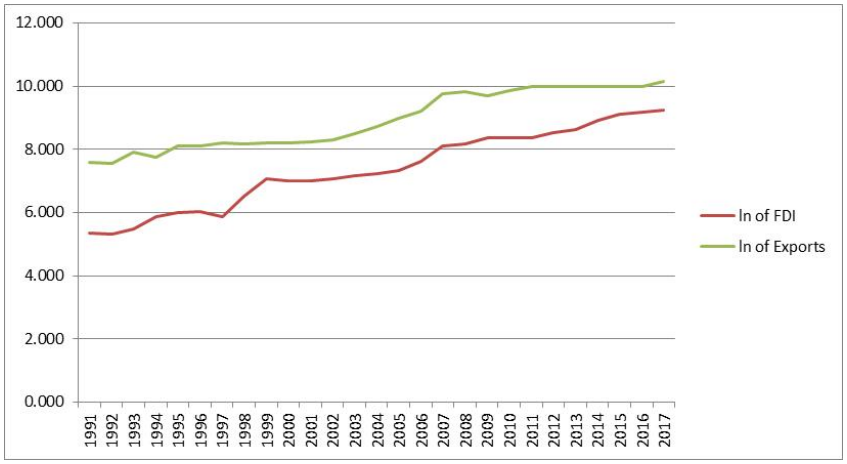


In case of Japan, it is evident from Graph 2 that both FDI and exports are maintaining a significant distance from each other. The gap has started to narrow down from 2015. The correlation among them appears to be on the lower side. Both the series are moving almost at the same pace.

c. India

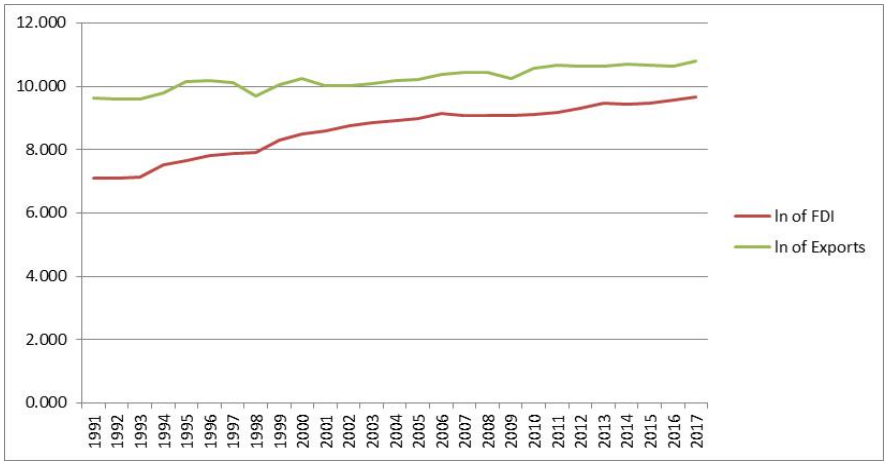
In Graph 3 pertaining to India both FDI and exports are increasing almost consistently but not aggressively maintaining equidistant relationship. Major divergence could only be observed during the period 1996-1999 where there is sudden spurt in FDI with flat movement in exports. The gap between the two series is maximum in 1991-1992 and thereafter reduced in 2016-2017 to almost to one third of that in 1991-1992. Correlation among both the time series appear to be high.

Graph 3. *Trend of US FDI Position and Exports to India from 1991 to 2017*



d. Korea

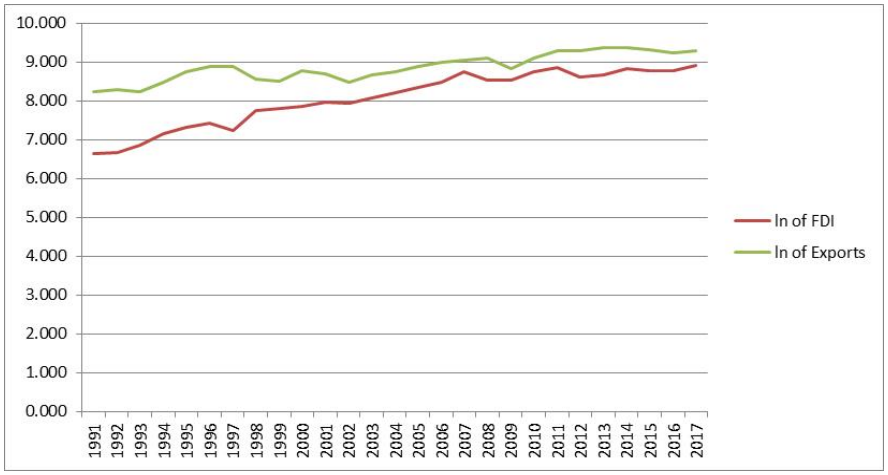
Graph 4. *Trend of US FDI Position and Exports to Korea from 1991 to 2017*



As can be observed from Graph 4 both FDI and exports for Korea show flatter growth for most of the period. The increase in both variables is very limited but they trend along together. Though movement of FDI is smooth for the entire period the movement is erratic for exports for brief periods of 1995-1998 and 2008-2010. In 1991 there was a wide gap in the FDI and exports which started narrowing down and got much lesser from 2013 and continued till 2017 at the same level. Visually there appears to be high correlation among both the time series.

e. Thailand

Graph 5. *Trend of US FDI Position and Exports to Thailand from 1991 to 2017*



In Graph 5 for Thailand both FDI and exports are moving along quite close to each other from 2002 onwards and very close in 2009 and then maintaining some distance thereafter. The series are almost hugging each other from 1999 onwards. The increase in both

variables is very limited but they trend along together. In 1991 there was maximum gap in the FDI and exports which started narrowing down throughout. Visually the correlation among the series appear to be at medium level.

2. Correlation analysis

Table 3. *Correlation Analysis of US FDI Position and US Exports in Select Asian Economies*

China	Japan	India	Korea	Thailand
0,945512	0,543210	0,957818	0,900321	0,865688

Source: Compiled from the database of US - Bureau of Economic Analysis and UN - Comtrade.

It is observed from Table 3 that the correlation for India is highest at 0.957818 followed by China at 0.945512. Japan has lowest correlation coefficient amongst all at 0.543210. Korea has a correlation coefficient of 0.900321 followed by Thailand at 0.865688. Here we find that except for Japan the correlation for other economies is quite high. However, simple correlation is only a cursory indication of relationship among series which needs to be probed further. A first step forward is the testing of stationarity of the time series to rule out the possibility of spurious regression. We use the Augmented Dickey-Fuller Unit Root Test for this assessment.

3. Augmented Dickey-Fuller Unit Root Tests

Based on the graphical analysis of the trend of FDI and Exports for each economy we find that there appears to be a pattern of trend followed by the time series variables in each case. We therefore while using the Augmented Dicky-Fuller Unit Root Test assume presence of trend with intercept for each time series. The results are presented in Table 4. It is found that at level analysis only the series for US Export to Korea is stationary where as other variables are not stationary. On testing for unit root at first difference, we find all the variables to be stationary. However, as the Exports and FDI in case of Korea are not integrated of the same order, we exclude Korea from our study. We find that Export to China (LEXP_CHN) and FDI in China (LFDI_CHN) are stationary at 5% significance where as in case of other economies the significance is observed at 1% level for all variables except Export to Korea (LEXP_KOR) which is an I(0) integrated series and hence not considered further.

Table 4. *Unit Root Tests of US FDI Position and US Exports in Select Asian Economies*

Augmented Dickey - Fuller Test : Level

Variable	Constant & Trend	
	Test Statistic	P- value
LEXP_CHN	-0,696653	0,9627
LEXP_JPN	-2.821660	0,2026
LEXP_IND	-1.362607	0,8470
LEXP_KOR	-4.447360	0.0085**
LEXP_THA	-2.789046	0,2132
LFDI_CHN	-2.445685	0,3495
LFDI_JPN	-2.898333	0,1790
LFDI_IND	-2.916922	0,1772
LFDI_KOR	-1.196567	0,8902
LFDI_THA	-1.954124	0,5980

Augmented Dickey - Fuller Test : First Difference

Variable	Constant & Trend	
	Test Statistic	P- value
LEXP_CHN	-4.218350	0.014*
LEXP_JPN	-4.951331	0.0028**
LEXP_IND	-5.265198	0.0014**
LEXP_KOR	-5.498751	0.0009**
LEXP_THA	-4.749587	0.0046**
LFDI_CHN	-4.310293	0.0115*
LFDI_JPN	-5.163634	0.0019**
LFDI_IND	-5.375220	0.0018**
LFDI_KOR	-5.295680	0.0013**
LFDI_THA	-6.245618	0.0002**

* indicates ADF test value is significant at 5% level of significance.

** indicates ADF test value is significant at 1% level of significance.

Source: Compiled from the database of US - Bureau of Economic Analysis and UN - Comtrade.

4. Engle-Granger Co-integration Test

We know that when the variables are non-stationary they can give spurious regression results. However, the only exception to it is when the variables are cointegrated indicating a long term equilibrium. As we have only two time series variables per economy we choose the Engle-Granger Co-integration Test. We do not find any co-integration among any of the variables. The P-values are observed to be high in all the cases. The results are presented in Table 5.

Table 5. *Engle - Granger Cointegration Test of US FDI Position and US Exports for China, Japan, India and Thailand*

China:

Variable	tau-statistic	Prob.*	z-statistic	Prob.*	Max Lags based on SIC	Number of Lags used
LEXP_CHN	-1,800540	0,635	-6,158262	0,597	5	1
LFDI_CHN	-2,277022	0,404	-7,955097	0,436	5	1

*MacKinnon (1996) p-values.

Japan:

Variable	tau-statistic	Prob.*	z-statistic	Prob.*	Max Lags based on SIC	Number of Lags used
LEXP_JPN	-3,177778	0,106	-14,198510	0,100	5	0
LFDI_JPN	-2,191645	0,444	-10,013460	0,287	5	0

*MacKinnon (1996) p-values.

India:

Variable	tau-statistic	Prob.*	z-statistic	Prob.*	Max Lags based on SIC	Number of Lags used
LEXP_IND	-2,071453	0,502	-7,629570	0,466	5	0
LFDI_IND	-1,998372	0,539	-8,874942	0,363	5	1

*MacKinnon (1996) p-values.

Thailand:

Variable	tau-statistic	Prob.*	z-statistic	Prob.*	Max Lags based on SIC	Number of Lags used
LEXP_THA	-2,663232	0,244	-11,546490	0,201	5	0
LFDI_THA	-2,490347	0,310	-10,000670	0,288	5	0

*MacKinnon (1996) p-values.
Null hypothesis: Series are not cointegrated
Automatic lags specification based on Schwarz criterion (maxlag=5)
Source: Compiled from the database of US - Bureau of Economic Analysis and UN - Comtrade.

5. Granger Causality Test

As we observed that the variables in case of none of the economies are cointegrated and also they are non-stationary at level, we test causality using their first differences. As per the objective of our study we test whether changes in FDI causes changes in Exports. From Table 6, we can see that only in case of Japan causality is present. The P-value is 0.035 which is significant at 5% level. In all other cases except Thailand the P-values are very high ruling out the possibility of any causality. In case of Thailand the P-value is 0.090 which is significant at 10% level. However, we do not consider the same.

Table 6. *Granger Causality Test of US FDI Position on US Exports for China, Japan, India and Thailand*

China:

Dependent Variable (A)	Independent Variable (B)	Null Hypothesis	Obser-vations	F - Stat	P - value	Causa-lity	Lags Used	Mini-mum Lag	Optimum Lag based on VAR	Lag Criteria
D(LEXP_CHN)	D(LFDI_CHN)	B does not cause A	25	0,215	0,647	No	1	1	0	AIC & SC

Japan:

Dependent Variable (A)	Independent Variable (B)	Null Hypothesis	Obser-va-tions	F - Stat	P - value	Cau sa-lity	Lags Used	Minimum Lag	Optimum Lag based on VAR	Lag Crite-ria
D(LEXP_JPN)	D(LFDI_JPN)	B does not cause A	25	5,059	0.035*	Yes	1	1	1	AIC

India:

Dependent Variable (A)	Independent Variable (B)	Null Hypothesis	Obser-va-tions	F - Stat	P - value	Cau sa-lity	Lags Used	Minimum Lag	Optimum Lag based on VAR	Lag Crite-ria
D(LEXP_IND)	D(LFDI_IND)	B does not cause A	25	0,023	0,880	No	1	1	0	AIC & SC

Thailand:

Dependent Variable (A)	Independent Variable (B)	Null Hypothesis	Obser-va-tions	F - Stat	P - value	Cau sa-lity	Lags Used	Minimum Lag	Optimum Lag based on VAR	Lag Crite-ria
D(LEXP_THA)	D(LFDI_THA)	B does not cause A	25	3,153	0,090	No	1	1	0	AIC & SC

Significance: ** 1%, * 5%
AIC: Akaike information criterion
SC: Schwarz information criterion
Source: Compiled from the database of US - Bureau of Economic Analysis and UN - Comtrade.

6. Vector Autoregression (VAR)

As causality is observed only in case of Japan we run the Vector Auto Regression (VAR) for this economy. Based on Akaike Information Criteria (AIC) we use 1 lag which is the optimum lag length. Here, we have used first difference of the variables as their level series are not co-integrated and also non-stationary. It is observed from Table 7 that the coefficient of the intercept is almost zero at 0.005473 which is not significant. D(LEXP_JPN(-1)) i.e. First lag of the first difference of the log of US exports to Japan is negative at -0.089671 which is also not significant. However, when we observe the coefficient of US FDI position in Japan in the form D(LFDI_JPN(-1)) it is 0.280702 which is significant as per the t-statistic of 2.24926. This indicates that in case of Japan US FDI has positive effect on exports.

Table 7. *Vector Autoregression Test (VAR) of US FDI Position and US Exports for Japan*
Japan:

Dependent Variable	Independent Variables		
D(LEXP_JPN)	D(LEXP_JPN(-1))	D(LFDI_JPN(-1))	C
Coefficient	-0,089671	0,280702	0,005473
Standard Error	(-0.19363)	(-0.1248)	(-0.01934)
t - statistic	[-0.46312]	[2.24926]	[0.28299]

Additional Information:

Granger Causality	Yes	Log likelihood	39,29752
Included Observations	25	Akaike information criterion	-2,663801
Lags Used	1	Schwarz criterion	-2,371271
Minimum Lag	1		
Optimum Lag based on VAR	1		
Lag Criteria	AIC		

AIC: Akaike information criterion
SC: Schwarz information criterion
Source: Compiled from the database of US - Bureau of Economic Analysis and UN - Comtrade.

VII. Conclusions

The objective of this paper was to analyze the substitution effect of outward FDI on the exports of the home country. We selected US as the home country considering its position amongst the top FDI providing countries and select Asian economies as host countries viz. China, Japan, India, Republic of Korea (Korea) and Thailand based on their average of GDP for F.Y. 2013 to F.Y. 2017 and also availability of data for analysis. These are major emerging economies in Asia and their international activities have influence on world trade and investment. The study period covered was from 1991 to 2017. After setting the background of the study we discussed the various prominent theories of FDI such as MacDougall-Kemp Hypothesis, Industrial Organisation Theory, Location Specific Theory, Product Cycle Theory, Internalisation Approach and Eclectic Paradigm. Previous work on substitution effect was also discussed. We found that the previous empirical work has given mixed results as different authors have found different outcomes in their studies. GDP data for selection of top Asian economies was obtained from the World Bank Database. Data on foreign direct investment of US in the shortlisted Asian economies was obtained from the website of the United States, Bureau of Economic Analysis. Data on Exports from US to these economies was collected from the website of United Nations, Comtrade Database. Due to limited availability of data for services, the paper only considered exports of goods and FDI in manufacturing sector. We performed graphical trend analysis of the US FDI position and US exports in the selected Asian economies and found various patterns. In correlation analysis the correlation between FDI and exports for India was highest at 0.957818 followed by China at 0.945512. Japan had lowest correlation coefficient amongst all at 0.543210. Korea had a correlation coefficient of 0.900321 followed by Thailand at 0.865688. Except for Japan the correlation for other economies was quite high. To rule out the possibility of spurious regression, we used the Augmented Dickey-Fuller Unit Root Test. Presence of trend with intercept for each time series was assumed based on visual observation. It was found that at level analysis only the series for US Export to Korea is stationary where as other variables were not stationary. On testing for unit root at first difference, we found all the variables to be stationary. As the Exports and FDI in case of Korea were not integrated of the same order we excluded Korea from the study. To test for co-integration we used the Engle-Granger Co-integration Test and did not find co-integration among any of the variables. Since the variables for none of the Asian economies were cointegrated and also were non-stationary at level, we tested causality using their first differences using Granger Causality Test. It was tested whether changes in FDI causes changes in exports. We found that only in case of Japan causality is present. Since causality was observed only in case of Japan we used the Vector Auto Regression (VAR) for this economy. Here, we used first difference of the variables as their level series were not co-integrated and also non-stationary. It was observed that the coefficient of the intercept was almost zero at 0.005473 which was not significant. D(LEXP_JPN(-1)) i.e. First lag of the first difference of the log of US exports to Japan was negative at -0.089671 which was also not significant. However, when we observed the coefficient of US FDI position in Japan in the form D(LFDI_JPN(-1)) it was 0.280702 which was significant as per the t-statistic of 2.24926. This makes us to conclude that in case of Japan, US FDI in Japan had positive effect on exports of US to Japan. In case of all other economies no relation between US

FDI and exports was observed. Thus substitution effect was not observed from US FDI on US exports in respect of the selected Asian economies viz. China, Japan, India, Republic of Korea and Thailand.

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ANNEXURES

Annexure I

Data of US FDI Position and Exports to China from 1991 to 2017

(USD in Millions)

Year	Variables			
	FDI	ln of FDI	Exports	ln of Exports
1991	196,00	5,278	6278,34	8,745
1992	363,00	5,894	7469,57	8,919
1993	523,00	6,260	8767,10	9,079
1994	1000,00	6,908	9286,69	9,136
1995	1263,00	7,141	11748,11	9,371
1996	1837,00	7,516	11977,75	9,391
1997	2737,00	7,915	12804,86	9,458
1998	3862,00	8,259	14257,94	9,565
1999	5787,00	8,663	13117,67	9,482
2000	7076,00	8,864	16184,68	9,692
2001	7727,00	8,952	19181,94	9,862
2002	5554,00	8,622	22127,51	10,005
2003	5499,00	8,612	28367,72	10,253
2004	9008,00	9,106	34427,69	10,447
2005	9346,00	9,143	41190,67	10,626
2006	14759,00	9,600	55224,10	10,919
2007	18461,00	9,823	65237,88	11,086
2008	24004,00	10,086	71456,41	11,177
2009	23972,00	10,085	69575,61	11,150
2010	25422,00	10,143	91910,98	11,429
2011	27501,00	10,222	104121,00	11,553
2012	29389,00	10,288	110517,00	11,613
2013	33165,00	10,409	121721,00	11,709
2014	38315,00	10,554	123676,00	11,725
2015	43245,00	10,675	116072,00	11,662
2016	47847,00	10,776	115602,00	11,658
2017	54158,00	10,900	129894,00	11,774

Source: US - Bureau of Economic Analysis, UN - Comtrade Database.

Annexure II

Data of US FDI Position and Exports to Japan from 1991 to 2017

(USD in Millions)

Year	Variables			
	FDI	ln of FDI	Exports	ln of Exports
1991	11463,00	9,347	48107,62	10,781
1992	11873,00	9,382	47748,66	10,774
1993	12778,00	9,455	47932,75	10,778
1994	14292,00	9,567	53453,45	10,887
1995	15760,00	9,665	64259,69	11,071
1996	15867,00	9,672	67514,64	11,120
1997	11505,00	9,351	65657,90	11,092
1998	11428,00	9,344	57884,42	10,966
1999	14947,00	9,612	57480,84	10,959
2000	13838,00	9,535	64921,65	11,081
2001	11142,00	9,318	57449,65	10,959
2002	15507,00	9,649	51447,93	10,848
2003	11609,00	9,360	52003,77	10,859
2004	13534,00	9,513	53568,57	10,889
2005	15908,00	9,675	54679,31	10,909
2006	16745,00	9,726	59647,55	10,996
2007	17078,00	9,746	62663,67	11,046
2008	17440,00	9,767	66573,42	11,106
2009	16628,00	9,719	51178,32	10,843
2010	17699,00	9,781	60469,05	11,010
2011	18517,00	9,826	65791,78	11,094
2012	16396,00	9,705	69971,99	11,156
2013	17112,00	9,748	65213,79	11,085
2014	18480,00	9,824	66825,97	11,110
2015	22080,00	10,002	62441,25	11,042
2016	26514,00	10,185	63234,27	11,055
2017	26067,00	10,168	67602,40	11,121

Source: *US - Bureau of Economic Analysis, UN - Comtrade Database.*

Annexure III
Data of US FDI Position and Exports to India from 1991 to 2017

(USD in Millions)

Year	Variables			
	FDI	ln of FDI	Exports	ln of Exports
1991	210,00	5,347	1999,31	7,601
1992	202,00	5,308	1914,40	7,557
1993	239,00	5,476	2761,09	7,923
1994	357,00	5,878	2296,32	7,739
1995	399,00	5,989	3295,74	8,100
1996	417,00	6,033	3318,09	8,107
1997	359,00	5,883	3615,60	8,193
1998	674,00	6,513	3544,68	8,173
1999	1163,00	7,059	3707,36	8,218
2000	1098,00	7,001	3667,13	8,207
2001	1120,00	7,021	3757,04	8,231
2002	1166,00	7,061	4101,05	8,319
2003	1284,00	7,158	4979,69	8,513
2004	1402,00	7,246	6109,36	8,718
2005	1549,00	7,345	7918,60	8,977
2006	2060,00	7,630	10091,10	9,219
2007	3328,00	8,110	17592,45	9,775
2008	3595,00	8,187	18666,53	9,834
2009	4344,00	8,377	16462,44	9,709
2010	4243,00	8,353	19248,89	9,865
2011	4260,00	8,357	21542,18	9,978
2012	5009,00	8,519	22105,72	10,004
2013	5532,00	8,618	21811,34	9,990
2014	7519,00	8,925	21607,50	9,981
2015	8951,00	9,100	21451,88	9,974
2016	9702,00	9,180	21652,27	9,983
2017	10483,00	9,258	25688,82	10,154

Source: US - Bureau of Economic Analysis, UN - Comtrade Database.

Annexure IV

Data of US FDI Position and Exports to Korea from 1991 to 2017

(USD in Millions)

Year	Variables			
	FDI	ln of FDI	Exports	ln of Exports
1991	1226,00	7,112	15504,11	9,649
1992	1199,00	7,089	14629,69	9,591
1993	1255,00	7,135	14775,54	9,601
1994	1870,00	7,534	18028,33	9,800
1995	2083,00	7,642	25413,12	10,143
1996	2501,00	7,824	26582,87	10,188
1997	2661,00	7,886	25066,62	10,129
1998	2712,00	7,905	16538,27	9,713
1999	4059,00	8,309	22949,36	10,041
2000	4845,00	8,486	27829,96	10,234
2001	5422,00	8,598	22180,58	10,007
2002	6385,00	8,762	22575,71	10,025
2003	6922,00	8,842	24072,54	10,089
2004	7385,00	8,907	26186,73	10,173
2005	7909,00	8,976	27571,60	10,225
2006	9345,00	9,143	32455,28	10,388
2007	8920,00	9,096	34702,62	10,455
2008	8829,00	9,086	34806,59	10,458
2009	8660,00	9,066	28639,75	10,263
2010	9217,00	9,129	38820,63	10,567
2011	9807,00	9,191	43461,39	10,680
2012	11107,00	9,315	42282,53	10,652
2013	12905,00	9,465	41686,04	10,638
2014	12440,00	9,429	44470,81	10,703
2015	13014,00	9,474	43444,79	10,679
2016	14504,00	9,582	42308,10	10,653
2017	15909,00	9,675	48326,09	10,786

Source: US - Bureau of Economic Analysis, UN - Comtrade Database.

Annexure V
Data of US FDI Position and Exports to Thailand from 1991 to 2017

(USD in Millions)

Year	Variables			
	FDI	ln of FDI	Exports	ln of Exports
1991	780,00	6,659	3752,66	8,230
1992	798,00	6,682	3982,31	8,290
1993	960,00	6,867	3768,47	8,234
1994	1306,00	7,175	4861,00	8,489
1995	1525,00	7,330	6401,91	8,764
1996	1671,00	7,421	7211,29	8,883
1997	1400,00	7,244	7357,19	8,903
1998	2313,00	7,746	5233,36	8,563
1999	2457,00	7,807	4983,52	8,514
2000	2627,00	7,874	6617,49	8,797
2001	2931,00	7,983	5989,36	8,698
2002	2837,00	7,951	4860,19	8,489
2003	3223,00	8,078	5835,28	8,672
2004	3745,00	8,228	6368,29	8,759
2005	4221,00	8,348	7256,62	8,890
2006	4905,00	8,498	8152,47	9,006
2007	6295,00	8,748	8444,88	9,041
2008	5144,00	8,546	9066,83	9,112
2009	5176,00	8,552	6920,20	8,842
2010	6325,00	8,752	8976,30	9,102
2011	7074,00	8,864	10929,77	9,299
2012	5610,00	8,632	10887,76	9,295
2013	5784,00	8,663	11797,15	9,376
2014	6892,00	8,838	11809,68	9,377
2015	6557,00	8,788	11230,09	9,326
2016	6566,00	8,790	10444,61	9,254
2017	7518,00	8,925	10991,20	9,305

Source: US - Bureau of Economic Analysis, UN - Comtrade Database.