

**Substitutes or Complements? An Empirical Analysis of
FDI and International Trade in China**

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Abstract

Foreign Direct Investment (FDI) and international trade are two main forces that stimulate the economic growth of a nation and the debate over the relationships between them still remains one of the most sizzling issues. Some theoretical works have predicted that there exists either a substitutive or complementary relationship between FDI and international trade (Mundell 1957; Vernon 1966; Kojima 1975; Dunning 1981). Nevertheless, such arguments only emphasize the qualitative aspects of the relationship. By contrast, this paper explores the relationship between FDI and international trade relying on empirical techniques focusing on the specific experience of China.

In this paper, we first review the existing literatures on the theoretical interrelationships between FDI and international trade. Then, we rely on the 1982-2003 samples period in China and use Engle and Yoo (1987) Cointegration with Vector Error Correction methodology to investigate the possible relationship between FDI, export and import at the aggregate level in the long run.

The major finding is that the expansion of FDI has a significantly positive relation with Chinese international trade. This finding is consistent with the fact that FDI in China is likely to be motivated by the comparative advantages, which leads to the increasing exportation and thus verifies the proposition that they are complements for each other.

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I. Introduction

The investment environment of a country affects both domestic and foreign investors. The impact of inward¹ Foreign Direct Investment (FDI) on a nation's economic performance and its relationship with international trade has been discussed over decades. An increase in FDI can promote host-country's efficiency and stimulate international trade. However, such arguments only focus on a qualitative aspect of the relationship and there still remains a controversial issue that whether there exists a substitutive or complementary relationship between FDI and international trade. The main purpose of this paper is to investigate the relationship between FDI and international trade in the specific case of China. We rely on the 1982-2003 sample period and use Engle and Yoo (1987) Cointegration with Vector Error Correction methodology to investigate the sign of the relationship between FDI, export and import at the aggregate level.

The paper is organized as follows: Section 2 provides a literature review on the relationship between FDI and international trade. Next, we bring up the specific and recent Chinese economic experience. The data description and methodology are discussed in Section 3 followed by the empirical estimation and result presentations. Section 4 concludes and the estimation outputs are also attached in the Appendix.

¹ The inward FDI is also called *FDI in the reporting economy*, namely investment by foreigners in enterprises resident in the reporting economy; outward FDI means *FDI abroad*, namely investment by residents' entities in affiliated enterprises abroad.

II: Literature Review

It is widely argued that a country's economic performance over time is determined to a great extent by its institutional environment, which establishes an infrastructure for the investment activities and thus creates favorable conditions for economic growth (Mundell 1957 and Vernon 1966). Since the investment environment of a country affects both domestic and foreign investors, the impact of FDI on a nation's economic performance and its relationship with international trade has been discussed over decades. As it is commonly believed that an increase in FDI promotes host-country's efficiency. However, there still remains a controversial issue as to whether FDI is a substitute or a complement for international trade. Before moving forward to the empirical testing of such puzzle, let's first review the literature to provide a theoretical background of the relevant debate.

FDI and international trade are closely linked to each other and the activities of Multinational Enterprises (MNEs) through FDI have substantial effects on the trade structure of home and host country (Zhang, Jacobs and Witteloostuijn 2004). There are two main possible net relationships between FDI and international trade: substitutive and complementary (Marchant, Cornell and Koo 2002). A substitutive relationship represents an opposite movement between FDI and trade: an increase in FDI reduces the level of international trade among countries. Alternatively, a complementary relationship represents a co-movement between FDI and trade: an increase in FDI promotes international trade. A number of relevant studies on the relationship between FDI and international trade are viewed below.

2.1 FDI and Trade as Substitutes:

The Heckscher-Ohlin-Samuelson Mundell model is the first theoretical benchmark in which FDI and foreign trade have a substitutive relationship.

This Heckscher-Ohlin-Samuelson-Mundell model is based on perfectly competitive product markets and no transportation costs. Either the international mobility of production factors or the international trade can produce the equalization of factor prices across countries. In other words, international trade in goods leads to the convergence of product prices during the process of global integration. Alternatively, the flow of FDI can also lead to the convergence of factor endowment and product prices. Therefore, this model concludes that international trade in goods is a perfect substitute for international factors movement of production, such as FDI. Furthermore, if international trade and FDI were substitutes, the import tariffs would reduce export and promote FDI. In Mundell (1957) words: "Commodity movements are at least to some extent a substitute for factor movements ...an increase in trade impediments stimulates factor movements and ... an increase in restrictions to factor movements stimulates trade"². Hence, FDI and international trade are considered the alternative strategies of economic development.

Vernon (1966) extends the Heckscher-Ohlin-Samuelson-Mundell theory by developing the Product Life Cycle (PLC) model. This model is about the migration of industries across countries and over time. It[LF1] attempts to explain the sequence of a product from its domestic manufacture to its exportation, and then to the alien production in the third country. More specifically, such sequence is defined to evolve over five stages: In the first stage, the innovating company produces a new good in the home market. This

² Mundell, R. (1957) 'International trade and factor mobility': pp. 1.

good originally designed and sold in the domestic market. At the second stage, when the product is matured and an export market is developed, the company starts exporting it to the foreign market. It is assumed that the foreign consumers have the same preferences and incomes as the domestic consumers.

At the third stage, with the demand in the foreign market growing, export increases accordingly and the firm starts considering setting up a factory at its larger foreign markets to meet the increasing demand. At the fourth stage, once a subsidiary abroad is established, the offshore production facilities start serving the local market with their local production, replacing exportation. As the production in foreign countries keeps rising, exportation to those foreign markets falls as a result. Then at the final stage, the lower price encourages the market growth in the less developed countries and eventually, the home country itself is served by the products manufactured offshore, or by their own subsidiaries offshore. Therefore, both PLC theory and the Heckscher-Ohlin-Samuelson-Mundell model suggest that foreign production eventually replaces exportation from the home country and even creates importation of the same products.

Dunning (1981) develops the Ownership, Location and Internalization paradigm (OLI) as an “Electric theory” and points out that FDI and trade work as alternative strategies for multinational firms. In this framework, Dunning considers FDI as determined by ownership, location and internalization advantages hold by the MNEs against the foreign producers. He also argues that when these advantages outweigh its associated costs, FDI rises. He defines three aspects of advantages. Firstly, the ownership advantage represents a product or a production process to which other firms do not have access, such as a patent, trade secret, or intangible advantages such as reputation for quality. Secondly, the location

advantage derives directly from the foreign market, such as low factor prices or market access, associating with trade barriers or transport costs which make FDI more profitable than exporting. Finally, the internalization advantage derives from the firm's interest in maintaining its knowledge assets, such as the skillful workers. With these advantages, the home country companies are ready to set up foreign subsidiary and expand the foreign production significantly. As a result, the exportation of these products from the home country would gradually decline. Hence, we can infer the relationship between FDI and foreign trade in the OLI framework as substitutive, which is consistent with both PLC theory and the Heckscher-Ohlin-Samuelson-Mundell model (Mundell 1957 and Venron 1966).

We can conclude from this literature that, if the inflow of FDI comes from the economic sector of the home country with comparative advantage and is invested in comparative disadvantage sector of the host country, international trade would decline.

2.2 FDI and Trade as Complements

Another perspective on the relationship between FDI and international trade treats them as complements. Kojima (1975) and Kojima and Ozawa (1984) argue that FDI is a complement to trade since FDI capital outflows create or expand the opportunity to export products. Their argument is based on Ozawa (1972) classification of development stages of industry from the experience of Japan. The theory substantially depends on the concept of comparative advantage and contains two key propositions.

First and foremost, international trade is a commonly recognized strategy for countries to maximize economic welfare by exporting the comparatively advantaged goods and importing comparatively disadvantaged goods subject to their natural resources

constraints. Furthermore, countries gain even more from expanded trade when home country transfer superior entrepreneurial assets in the comparatively disadvantaged industries through FDI or non-equity types of transactions to the comparatively advantaged industries in the host country. As a result, the efficiency in the host countries increases. Kojima and Ozama (1985) argue that the second proposition distinguishes from Ricardo's trade model in that Ricardo intentionally assumed away cross-border factor movement and such movement would destroy the basis of trade, i.e., the productivity differentials between countries. An example is illustrated by Ricardo that with the higher labor productivity in Portugal, the wine and cloth should both be made in Portugal and as a result, both labor and capital of England should be removed to Portugal. However, Kojima and Ozama point out that the second proposition is ignored by Ricardo since England's comparative advantage in cloth industry would be even enhanced if the Portuguese secrets of higher productivity in cloth (superior entrepreneurial assets in the home country) are transferred to England's comparatively advantaged industry.

As is suggested, the comparative advantages of industry in host and home countries are crucial to determine whether FDI is trade-oriented or market-oriented (Kojima 1975 & 1982). Root (1977 & 1994) classifies FDI into these two general categories which are determined by different motivations of foreign investors. On one hand, trade-oriented FDI is generated through the supply side, which mainly looks for the cost competitiveness. More specifically, it includes MNEs behavior aiming at gaining the raw materials and low-cost countries. FDI, motivated by the demand for raw materials, is used to produce goods with natural resources which are in shortage of in the home country. On the other hand, market-oriented FDI is generated through the demand side. Its aim is to set up enterprises to meet the demand of goods and services to the local market. This kind of FDI may be

undertaken to exploit new markets.

Based on these two categories of FDI, Kojima (1975&1982) further points out the trade-oriented FDI would occur if the home country invests in host country sectors characterized by a comparative advantage that boosts the exports. Moreover, if the FDI invested in the comparatively advantageous sectors of the host country is funded through cutting resources in the comparatively disadvantageous sectors of the home country, international trade should be stimulated. For example, in the relatively labor-abundant developing countries, foreign investment flowing into labor-intensive industries is expected to create trade.

Ozawa (1992) argues that an increase in trade flow occurs as a result of improved comparative advantage, which is mainly generated by the FDI. He also observes a positive causal relationship between an outward-oriented economic policy and the impact of FDI on trade. In addition, the inward FDI can also promote export from domestic firms through the collaboration among industries or technology spillover. Such effect can stimulate exportation of domestic firms.

The literature thus suggests that the complementary relationship between FDI and foreign trade occurs when the source country invests in those industries in which the host country has a comparative advantage. Furthermore, in the developing host countries, if FDI flows into labor-intensive industries and is likely to be trade-creating, because the foreign investors take advantage of the low production factors in developing countries to produce goods, such as cheap labor and ample natural resources. However, if FDI flows into capital-intensive industries, it turns to be trade-replacing.

2.3 Alternative view on FDI as complements or substitutes

The theories above have predicted the possible substitutive or complementary relationship between FDI and trade by using the comparative advantage concept. However, there are some alternative theories that define FDI from another perspective to explore the interrelationship between them (Helpman and Krugman 1985, Brainard 1993). These theories are called "New theory of FDI". They mainly combine the ownership and location advantages, and introduce the activities of MNEs. They divide FDI into two categories: vertical FDI and horizontal FDI. Vertical FDI takes place when the MNEs fragment the production process internationally, locating each production stage in the country where it can be produced at the lowest cost. In contrast, horizontal FDI occurs when the multinational undertakes the same production activities in the multiple countries.

In the model of vertical FDI, FDI is generated to take the advantage of fragmentation, in other words, of factor price differences. Helpman and Krugman (1985) model is based on two main assumptions. First, there is product differentiation and economies of scale. Firms with product differentiation can differentiate factor price across countries. As a result, MNEs have an incentive geographically to separate headquarters from a plant. The resulting investment is more likely to create intra-industry trade. Second, there are some firm inputs that behave like public goods, such as management, marketing, R&D. These goods are specific to the firm and can be easily transferred from one plant to another. Therefore, intra-firm could also transfer the intangible service from parent companies to foreign affiliates. Thus, FDI is a complement to trade because increased FDI means more overseas production, some of which is shipped back to home.

Alternatively, Brainard (1993), and Markusen and Venable (1998) accounted for the horizontal FDI model and verify empirically the hypothesis on the activities of MNEs.

They argue that most FDI are motivated by “market-access” reasons, rather than by differences in factor prices as the Helpman-Krugman theory of vertical FDI predicts. They define the horizontal FDI framework as the situation that the firm faces a trade-off between advantages of proximity (to the foreign market) and advantages of concentration (of the plant), given the firm-level economies of scale and the plant-level economies of scale. The firm will engage in multinational activities and replace exports with FDI when the proximity advantage outweighs the concentration advantage. Hence, FDI is treated as an alternative strategy. Such a substitutive relationship prevails over a complementary relationship.

Overall, the contributions within the theoretical literature show the ambiguity of the relation between FDI and international trade. Since such relationship still remains ambiguous, more light might be shed on the impact of the range and type of trade and FDI, countries involved, strategies and motivations of MNEs etc. Before we apply econometric techniques on the special case of China, let’s first of all provide a vivid picture of the FDI and trade performance in China in the following section.

2.4 FDI and International Trade in China

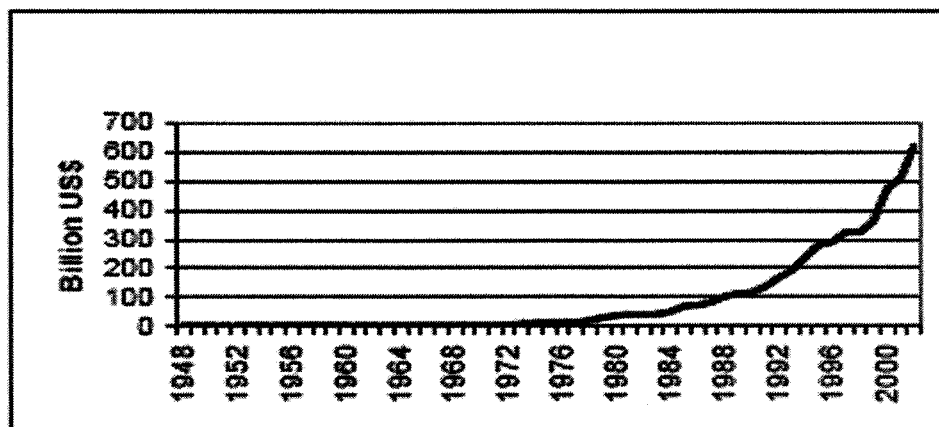
2.4.1 Recent Experience of China’s FDI and International Trade

Many economists have discussed the empirical relationship between FDI and China’s foreign trade recently. Using China’s provincial data from 1985 to 1995, Wei, Liu, Parker and Vaida (1999) find the evidence to prove provinces with a higher level of international trade attract more FDI. Sun (2001) investigates the impact of FDI on the export performance of China over the range of 1984 to 1997 and finds that a positive effect

is stronger in the coastal region than in the inland regions. Liu, Burrige and Sinclair (2002) investigate the causal relationships among economic growth, FDI and trade, showing that a bilateral connection exists between each variable.

Before we move forward, let's first give a vivid picture of the recent development of FDI and foreign trade in China. Until China opens its door to the globalization in 1978, China, as a whole, had been isolated from the global market. After the strategy of "Reforms and Open up" was implemented in 1978, the growth of foreign trade in China has substantially increased. In figure 1, the amount of total foreign trade was only \$38.14 billion in 1980 but reached a peak at \$360.649 billion in 1999. Moreover, it is reported that the growth rate of international trade greatly exceeded the growth rate of GDP during the same period, according to the official data. FDI also experienced high growth in the same period. For example, the amount of inflow FDI was only \$0.16 billion in 1980 while it had attracted more than \$40.3 billion in 1999. Over the decades, China has become the largest recipient of inflow of FDI among the developing countries in the 21st century.

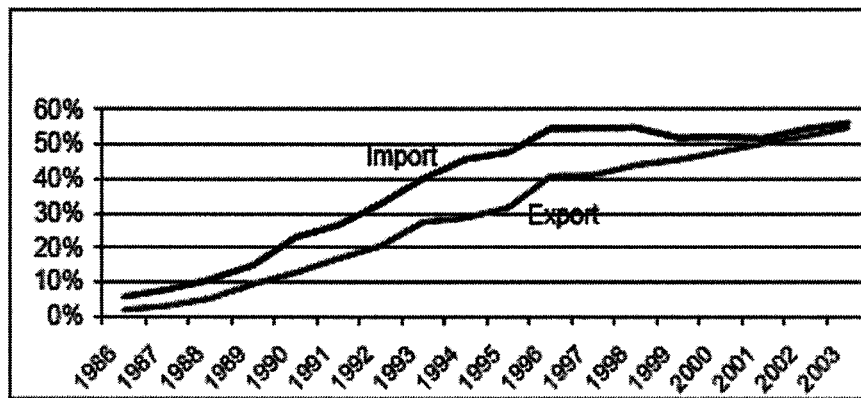
Figure 1: China's International Trade (Export and Import) in the post-1949 era



Source: IMF DOTS databank.

Zhang and Van Witteloostuijn (2004) indicate that some economic factors significantly drove the bilateral trade linkage during the China economic reform. Four models are set up to estimate these determinants by using the data from 1993 to 1999. The estimation results reveal that among these factors, FDI is a key determinant. In fact, they also prove that FDI by MNEs play an increasingly dominant role in the domain of China's foreign trade as seen from Figure 2. It is clear that the share of Foreign-Invested Enterprises (FIEs) export and import in total export and import increased from 1.9% and 5.6% in 1986 to 54.8% and 56.2% in 2003. The figure thus provides an illustrative to underpin that FDI has played an increasingly dominant role in Chinese trade expansion.

Figure 2: Foreign-Invested Enterprises (FIEs) Share in China's International Trade



Source: Ministry of Commerce of the People's Republic of China.

Lai (2002) further argues that in China, the participation of FIEs in foreign trade is closely connected with processing trade. The processing trade refers to a special type of trade in China that firms import duty-free materials and components for processing or assembling and subsequently re-export. The share of processing trade from FIEs to China's foreign trade directly reflects the expanding foreign trade. Since the early nineties, the processing trade considerably grew and has become the main mainstream of China's foreign trade. It is recorded that the ratios of processing exports and imports in China's

exports and imports increased from 27.2 percent and 30.0 percent in 1988 to 45.1 percent and 48.0 percent in 1991. These ratios further increased to 49.5 percent and 59.3 percent in 1995 respectively (Naughton 1996), then remained around 50% of the total exports and imports. In 2000, the above ratios climbed up to 55.3 percent and 41.1 percent respectively (MOFTEC 2001)³. These figures have indicated the engagement of FIEs in processing trade constitutes the main force driving the rapid growth of China's foreign trade.

However, the share of FIEs in total China's exports and imports is a poor indicator of the impact of FDI on trade. The reason is that FIEs should not only include wholly owned foreign enterprises, but also joint ventures with shared ownership by both Chinese and foreign investors. However, the latter is always ignored in the data given the vast changes in the infrastructure of enterprises, complicated data collecting procedures and developing national statistical administration. Therefore, a large amount of statistical discrepancy is generated and thus underestimates the influence of FDI on trade. Simply relying on the statistics is not sufficient to investigate the FDI-trade linkages. Therefore, we are motivated to examine the dynamic changes and the long-run equilibrium by applying the econometric techniques. We expect to improve the measurement and provide a better explanation of such substitutive or complementary relationship.

Before we move to the empirical investigation of the relationship between FDI and international trade, let's first review the China's open policies to FDI and foreign trade. They are important external factors that substantially boost both FDI and the international trade.

2.4.2 Policy Issues in China

³ MOFTEC refers to Ministry of Foreign Trade and Economic Cooperation

The development of FDI and international trade has undergone a substantial increase since China opened its door to the global market. Such achievements are mostly likely due to the Chinese open economic policies implemented, which have become more and more effective and successful. Next, we discuss the changes of policy regarding foreign trade and FDI that China has experienced since 1978.

The economic trade policy in China plays an important role to promote the growth of foreign trade. Although in the early eighties, the Chinese government issued the trade policy that was combining the strategies of export promotion with import protection measures, it was not fully developed in its trading policy, especially on the import side. This import protection measures severely prevented the development of Chinese exportation to the foreign countries. They mainly raised the cost of capital goods and intermediate inputs which were used to produce export goods. Noticing the disadvantage in this area, China considered modifying the relevant policy in 1986, by allowing the exporting sectors to import goods duty free. (Lemoine 2000)

In the mid-nineties, China's trade policy was further improved. On the one hand, the level of import protection decreased significantly. For example, the average tariff rate was reduced from 43% in 1992 to 23% in 1996. In 1997, the average tariff on industrial products was cut to 17%. It would be further reduced to 10% in 2005. On the other hand, China opened more industries to foreign investors, amended old foreign trade laws and regulations, and enacted new regulations that comply with WTO rules and principles. Benefiting from these effective improvement, China's foreign trade has ever grown faster than its GDP, China exports much more than it imports and it enjoys increasing trade

surpluses in the 1990s. The reformation of trade policy had likely made great a contribution to the fast-growing foreign trade in China.

China's economic policy to FDI also evolved through some changes over the past two decades. The changes of policies regarding FDI have experienced mainly three stages: gradual and limited opening, active promoting through preferential treatment, and promoting FDI in accordance with domestic industrial objective. (Fung, Iizaka and Tong 2002) Accordingly, the patterns of FDI follow three different stages as well. First, in the gradual and limited opening stage, Chinese government implemented three main policies to attract FDI, which included: initiating the new regulations to allow joint ventures using foreign capital; setting up four Special Economic Zones (SEZs)⁴ in 1980 and another fourteen coastal cities⁵ to foreign investors; building up the development triangles⁶ for the foreign investors in 1985. The door to the outside world was gradually open and the inflow of FDI increased steadily. Second, in the active promoting stages: the Chinese government promulgated the so-called "22 Article Provisions". They provide FIEs with preferential tax treatment, the freedom to import inputs such as materials and equipment, and simpler licensing procedures. Granted these favorable treatments, the foreign investors could take advantage of these additional tax benefits and explore the potential Chinese market. As a result, the FDI inflow into China significantly accelerated. Third, in the promoting FDI in accordance with domestic industrial objective stage, the government implemented more new proposals to attract FDI into the agriculture, hydropower, communications, energy and raw material sectors through favorable tax policies and selective financial support. These

⁴ Four Special Economic Zones include: Shenzhen, Zhuhai, Shantou, and Xiamen

⁵ Fourteen fourteen coastal cities include (from north to south): Dalian, Qinhuadao, Tianjin, Qingdao, Yantai, Shanghai, Nantong, Lianyungang, Ningbo, Wenzhou, Fuzhou, Guangzhou, Zhanjiang and Beihai

⁶ Development triangles refer to the Yangtze River delta, the Pearl River Delta in Guangdong, and the Min Nan Region in Fujian, Liaodong and Shandong Peninsulas, and the Bohai Sea Coastal Region.

changes inevitably affected the patterns of FDI inflow in China. The growth of FDI began to boost, given so many varieties of strategies, which help to improve for the investment climate in China.

In general, the economic policies maintain the favorable domestic investment and operation environment for foreign business. It is worth pointing out that the China's policy to FDI has proved to be a remarkable success: China has become the largest recipient country among the developing countries since 1992. Furthermore, the engagement in foreign trade of FIEs plays an increasing role to heavily push the growth of China's foreign trade. This situation is the result of China's policy toward FDI which has strongly stimulated trade-oriented activities. (Lemoine 1998&1999)

Combining the above theoretical and practical analysis, we have noted that the important characteristics of the relationship between FDI and China's foreign trade. However, these empirical findings are limited within local regions, and only few of them investigate the possible relationship among FDI, export and import in the aggregate level. Therefore, we expect to contribute to the literature by relying on Engle and Yoo (1987) Vector Error Correction Model to detect the positive FDI –trade (export and import, respectively) linkage by analyzing the annual data over the 1982 – 2003 periods. The Chinese policy of the “open economy strategy” will also be taken into account by including a dummy variable in the model. The description of data and methodology as well as the procedure of estimation are provided below.

III. Empirical Estimation

3.1 Data

Before proceeding with the methodology, we briefly discuss the data that will be used in this paper. The variables that used are annual Gross Domestic Product (GDP), year-to-year Consumer Price change, Export and Import as well as inward FDI (including the joint venture). The sample is from 1982 to 2003. To remove the impact of inflation, we have deflated all the time series variables by the Consumer Price Index (CPI), which is derived from the year-to-year price change variable. It's worth pointing out that since the official CPI data only released from 1986 and we take four lags in the model. So the beginning value of these data is from 1989. All variables are also transformed to natural log forms before the estimation. The main data source is the International Financial Statistics, International Monetary Fund (April, 2004). The China Statistics yearbook is also used as a reference for indicating the early data of GDP and CPI variables.

3.2 Preliminary testing

To provide a reliable picture of the economic performance during sample period, the variables are plotted in Figure 3 and Figure 4.

Figure 3: Nominal Export, Import and FDI from 1982 to 2003 Annual Data

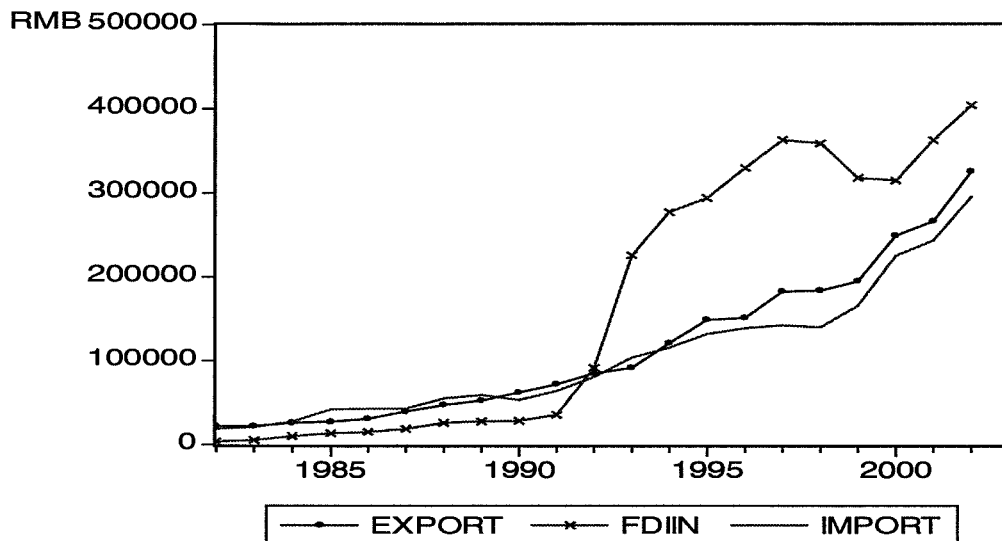
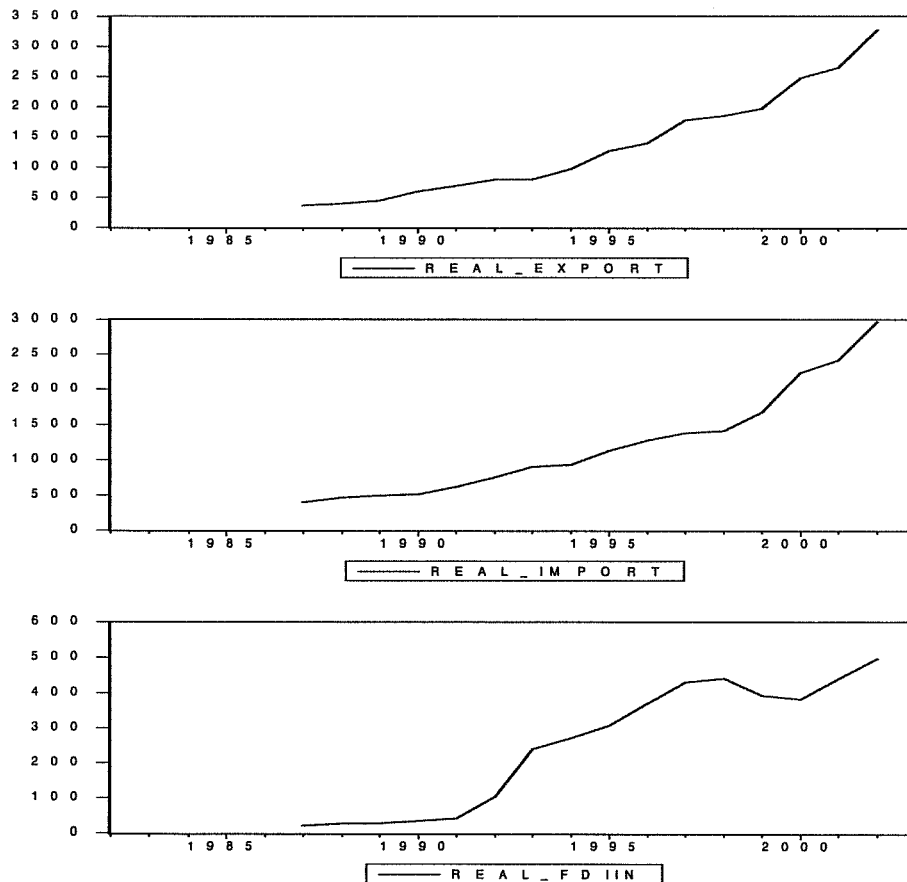


Figure 4: Real Export, Import and FDI from 1982 to 2003 Annual Data



From these figures, it is clear that the log form deflated export, import and FDI variables all have an increasing trend and therefore are non-stationary. The growth rate of FDI is higher during the 1992 to 1994 when the Chinese government issued a lot of trade-oriented policies to attract such investment. To verify the non-stationarity of the level variables, we apply Augmented-Dickey-Fuller Unit Root test (ADF test):

Table 1: Augmented Dickey-Fuller Unit Root Test

Variables	Level Statistic		Difference statistic	
	With Constant	With Constant & Trend	With Constant	With Constant & Trend
REAL_EXPORT	2.754737(2)*	0.7059(2)	-2.821652*	-2.829505
REAL_IMPORT	2.622052(2)	1.487365(2)	1.191042(4)	-2.273984(2)
REAL_FDI INFLOW	-2.207060(5)	-2.832982(5)	-1.878973(3)	-2.194664(3)

Note: (1) * is significant at 10% level.

(2) Figures in parentheses are the number of lags that were selected by the Akaike Information Criterion (AIC)

Table 1 report the results of the unit root test for export, import and FDI using ADF test. We consider two models with different deterministic component: one is the model with a constant only; the other is with a constant and trend. The results of the ADF tests statistic for all variables are all significant at 1% level. It is confirmed that logvariables all have a unit root at their levels. We cannot simply perform any linear regression between these level variables because of the possible correlations in between. Therefore, further tests are performed on the difference variables ADF test statistic are only significant at 10% level so that we accept I (1) as our variables for estimation.

Next, we observe that all the variables have a positive trend, so there may be some relationship between these variables. To investigate such links between variables, we

further perform the Johansen Cointegration test following Johansen (1991) methodology focusing on the co-movement among the variables in the long run, aiming to explore a possible stationary long-run equilibrium relationship between FDI, Imports and Exports. If the hypothesis of existence of such relationship cannot be rejected, we can conclude that the stochastic trend in exports and imports is related to the stochastic trend in FDI. Thus, by cointegrating variables, it will be constrained to equilibrium relationship in the long-run.

Recalling Dickey, Jansen and Thornton (1991) that, “time series variables are not stationary individually, one or more linear combinations of the variables are stationary even though individually they are not”⁷. Therefore, variables in our model should carry out the property of stationarity. Given the unit root test and cointegration test that all the variables are cointegrated of the same order, we can interpret the long-run paths of these variables are interdependent. In another words, the time paths of FDI, imports and exports are ultimately constrained to an equilibrium relationship and when deviations from equilibrium are possible, they are eventually self serving. (McNown and Wallace 1992)

We have tested bilateral Johansen Cointegration relationships between exports, imports and FDI and two null hypotheses are rejected⁸, suggesting a cointegration with Vector Error Correction model (VECM) are recommended to investigate the relationships between such non-stationary variables. As Engle and Granger (1987) point out, when a linear combination of two or more nonstationary time series is stationary, the stationary linear combination is called the cointegrating equation. Therefore, we can conclude that there is a long-run equilibrium relationship between FDI, imports and exports.

⁷ Dickey, Jansen and Thornton (1991), pp: 1

⁸ More concerned the result of Johansen test is interpreted in the part of “Estimations and Result”

3.3 Methodology

We proceed with the cointegration with VECM approach given the preliminary testing results. VECM can lead to a better understanding of the nature of any non-stationarity among the different component series and can also improve longer term forecasting over an unconstrained model. As Engle and Yoo (1987) argued, the VAR model does not take into account explicitly eventual long-run and cointegration relationship among variables and a VAR model with an error correction mechanism should outperform standard VAR over longer estimation period. In a VECM, long and short-run parameters are separated, which gives an appropriate framework for assessing the validity of the long-run implications of a relationship while also controlling the dynamic processes involved in the short-run. The long-run relationship is captured by the cointegration equation and the short-run dynamics is revealed from the responses that each variable in a cointegrated system generates to the lagged residuals or errors from the cointegrating vectors. As a result, by adopting of the cointegration with corresponding VECM approach, we can detect both long-run and short-run relationships between non-stationary variables in our sample.

A VECM model can be represented as follows:

$$\begin{aligned}
 \Delta Export_t &= c_1 + \alpha_e EC_{t-1} + \sum_{i=1}^{n-1} \beta_{1i} \Delta Export_{t-i} + \sum_{i=1}^{n-1} \gamma_{1i} \Delta Import_{t-i} + \sum_{i=1}^{n-1} \lambda_{1i} \Delta FDI_{t-i} + \varepsilon_{1t} \\
 \Delta Import_t &= c_2 + \alpha_i EC_{t-1} + \sum_{i=1}^{n-1} \beta_{2i} \Delta Export_{t-i} + \sum_{i=1}^{n-1} \gamma_{2i} \Delta Import_{t-i} + \sum_{i=1}^{n-1} \lambda_{2i} \Delta FDI_{t-i} + \varepsilon_{2t} \\
 \Delta FDI_t &= c_3 + \alpha_f EC_{t-1} + \sum_{i=1}^{n-1} \beta_{3i} \Delta Export_{t-i} + \sum_{i=1}^{n-1} \gamma_{3i} \Delta Import_{t-i} + \sum_{i=1}^{n-1} \lambda_{3i} \Delta FDI_{t-i} + \varepsilon_{3t}
 \end{aligned} \tag{1}$$

Where Δ denotes the difference operator, *Export*, *Import* and *FDI* represent annual export, import and foreign direct investment from 1982 to 2003. *EC* is the vector of residuals from the long-run equilibrium relationships. α , β , γ , λ are parameters to be estimated and ε_{it} is the error term. The dummy variables are included in the estimation but for simplification purpose, we don't present it in the benchmark model.

The following estimation of the VECM model is performed in two steps. First of all, long run relationship is estimated using either Engel-Granger or Johansen cointegration tests. In the Engle-Granger approach it is possible to test for a single cointegration vector, which can be interpreted as a linear combination of all the cointegration vectors in the cointegration space. Such approach leads a stationary system.

Next, we test if the rank, or dimension of the cointegration space, is in our model. Therefore, we apply the Johansen cointegration test to estimate the relationship. The resulting error correction term is plugged into the VECM model so that all regressors are stationary, prior means for all the coefficients are set to zero. As a result, the error-correction terms reveal the deviations from the long-run relationships between the three variables. The coefficients of *Export*, *Import* and *FDI* reflect the speed of adjustment of exports, imports and *FDI* toward the long-run equilibrium.

Secondly, we notice that the FDI variable has experienced an exceptionally higher growth in 1992 and the growth rate from 1992 to 1994 reveals a possibility of structural break in the FDI level. Such high growth is followed by the relatively stable increase until 1997 when the Asian Financial Crisis took place. Given such assumption, we include one dummy variable in later estimations to capture the structural changes that implicate the real movement of FDI variable.

Therefore, we proceed by including three deterministic components – a constant, a trend and a dummy variable into the VECM system. The constant and the trend enter the VECM as part of the cointegration estimation restriction. The period dummy variable controls for the important role that the Chinese government policies have played in the process of China's integration into the world economy. As Zhang and van Witteloostuijn (2004) argue international trade and FDI has increased steadily since 1992, which might be best captured by a dummy variable deviating from the deterministic trend. Different from their study, we first focus on the cointegration relationship between FDI and Import, isolating the impact of export, and the cointegration relationship between FDI and Export, isolating the impact of import by putting restrictions on the coefficient matrix. Furthermore, we generalize the estimation and include all the endogenous variables and illustrate the equilibrium relationship among them.

3.4 Estimation and results

The estimation consists of two steps to verify the long-run relationship through Johansen cointegration test and the short-run dynamic movements through the error-correction estimation following Johansen (1991) methodology to estimate the long-run equilibrium. Noticing that as a common trend effect dominates the stationary effect and all the variables seem to rise and fall in tandem, we include a constant and a deterministic trend variable into the VAR. In addition, a dummy variable is also included as an exogenous variable to capture the policy effect independently. Dickey-Fuller test is also used on the residuals to determine the appropriate order of integration.

Table 2 presents the result of cointegration test. There are three null hypotheses in this test: (1) no co-integration equations among these three variables; (2) at most one co-integration equation; (3) at most two co-integration equations. The Trace statistic value of the first null hypothesis is 54.76, which is greater than the critical value at the 1% level. Therefore, the first null hypothesis is rejected and there is at least one cointegration equation in the system. As for the second hypothesis, the trace value is 26.12, which rejects the null hypothesis at the 5% level. Thus, we can conclude that there are at least two cointegration equations in the system. Finally, the trace value is 6.99, which can reject the null hypothesis at the 5% level. It is insignificant at the 1% level for the third hypothesis. We obtain the similar results from the Max-Eigen statistic. Summarizing the results above, we conclude that there are two cointegration relationships in the system.

Table 2: Johansen Cointegration Test for Real_Export, Real_Import and Real_FDI

Sample(adjusted): 1989 2002				
Included observations: 14 after adjusting endpoints				
Trend assumption: Linear deterministic trend (restricted)				
Series: REAL_EXPORT REAL_IMPORT REAL_FDIIN_1				
Exogenous series: DUMMY				
Warning: Critical values assume no exogenous series				
Lags interval (in first differences): 1 to 1				
Unrestricted Cointegration Rank Test				
Hypothesized		Trace	5 Percent	1 Percent
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Critical Value
None **	0.915775	54.76405	42.44	48.45
At most 1	0.608789	26.12443	25.32	30.45
At most 2	0.392833	6.985310	12.25	16.26
*(**) denotes rejection of the hypothesis at the 5%(1%) level				
Trace test indicates 2 cointegrating equation(s) at both 5% and 1% levels				
Hypothesized		Max-Eigen	5 Percent	1 Percent
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Critical Value
None **	0.915775	34.63962	25.54	30.34
At most 1	0.608789	19.13912	18.96	23.65
At most 2	0.392833	6.985310	12.25	16.26
*(**) denotes rejection of the hypothesis at the 5%(1%) level				
Max-eigenvalue test indicates 2 cointegrating equation(s) at both 5% and 1% levels				
Restrictions:				
B(1,1)=1				
B(1,2)=0				
B(2,1)=0				
B(2,2)=1				

Furthermore, we re-estimate the VECM by highlighting the number of cointegrations and normalize the relationship with respect to export and import respectively. The result of the estimation is reported in Table 3. The two cointegration relationships are summarized as below:

$$Export_t = 1.346451 * FDI_t + 201.2796 * Trend(1982) + C_1 \quad (2)$$

$$Import_t = 1.460783 * FDI_t + 83.45607 * Trend(1982) + C_2 \quad (3)$$

Equation [LF5] (2) demonstrates the relationship between FDI and export. The testing coefficient of FDI is 1.35, which indicates that there exists a long-run positive relationship. In other words, the expansion of FDI significantly promotes export in China. Equation (3) demonstrates the relationship between FDI and import. The coefficient of FDI on import is 1.46, also suggests a long-run equilibrium such that the inflow of FDI in China has a positive impact on China's international trade. We also note that the coefficients of trend in both equation (2) and (3) are so high at 201.28 and 83.46, respectively, which suggest that the trend variable has a significant effect on the two sets of endogenous variables.

Table 3: Cointegration with Vector Error Correction Estimates

Vector Error Correction Estimates			
Sample(adjusted): 1989 2002			
Included observations: 14 after adjusting endpoints			
Standard errors in () & t-statistics in []			
Cointegration Restrictions:			
B(1,1)=1			
B(1,2)=0			
B(2,1)=0			
B(2,2)=1			
Convergence achieved after 1 iterations.			
Restrictions identify all cointegrating vectors			
Restrictions are not binding (LR test not available)			
Cointegrating Eq:	CoIntEq1	CoIntEq2	
REAL_EXPORT(-1)	1.000000	0.000000	
REAL_IMPORT(-1)	0.000000	1.000000	
REAL_FDIIN_1(-1)	-1.346451	-1.460783	
	(0.74740)	(0.75969)	
	[-1.80152]	[-1.92287]	
@TREND(1982)	-201.2796	-83.45607	
	(277.993)	(282.564)	
	[-0.72405]	[-0.29535]	

C	4194.070	2972.245	
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This result is consistent with Zhang, Jacobs and Witteloostuijn (2004) conclusion that FDI has a long-run positive equilibrium relationship with both export and import in China, and such complementary force is most distinguished in the FDI inflow during recent years. Moreover, the short-run dynamics of these three variables are also affected by the trend variable and dummy. Furthermore, the relatively larger coefficient of the cointegration relationship between import and FDI also suggest that FDI and Import also stimulates each other.

An alternative VAR estimation is performed without setting the cointegration restrictions. The result is reported as follow:

Table 4: Cointegration with Vector Error Correction Estimates without Restrictions

Vector Error Correction Estimates			
Date: 09/10/05 Time: 12:01			
Sample(adjusted): 1985 2002			
Included observations: 18 after adjusting endpoints			
Standard errors in () & t-statistics in []			
Cointegrating Eq:	CointEq1		
FDIIN(-1)	1.000000		
IMPORT(-1)	-4.738337 (1.70929) [-2.77211]		
EXPORT(-1)	-1.257481 (1.04856) [-1.19924]		
@TREND(1982)	13316.45 (7059.33) [1.88636]		
C	309654.5		
Error Correction:	D(FDIIN)	D(IMPORT)	D(EXPORT)
CointEq1	0.409466	-0.151456	-0.164286

	(0.15485)	(0.07559)	(0.04773)
	[2.64422]	[-2.00360]	[-3.44206]
D(FDIIN(-1))	0.047579	-0.046140	0.010582
	(0.36665)	(0.17898)	(0.11301)
	[0.12977]	[-0.25779]	[0.09364]
D(FDIIN(-2))	-1.243102	0.260176	0.360576
	(0.41920)	(0.20463)	(0.12921)
	[-2.96539]	[1.27142]	[2.79068]
D(IMPORT(-1))	1.173103	-0.054008	-0.029992
	(0.88849)	(0.43372)	(0.27385)
	[1.32033]	[-0.12452]	[-0.10952]
D(IMPORT(-2))	3.245353	-0.473171	-0.104367
	(1.48258)	(0.72372)	(0.45696)
	[2.18899]	[-0.65380]	[-0.22839]
D(EXPORT(-1))	1.053258	-1.136901	-1.413842
	(0.88247)	(0.43078)	(0.27199)
	[1.19354]	[-2.63919]	[-5.19805]
D(EXPORT(-2))	0.072746	-0.555749	-0.777525
	(0.94111)	(0.45940)	(0.29007)
	[0.07730]	[-1.20972]	[-2.68048]
C	-81866.89	38171.78	41454.03
	(34286.0)	(16736.7)	(10567.7)
	[-2.38776]	[2.28072]	[3.92273]
DUMMY	95008.95	2347.746	-1624.716
	(36179.7)	(17661.1)	(11151.3)
	[2.62603]	[0.13293]	[-0.14570]
TREND	-7544.762	2469.111	3583.288
	(11082.9)	(5410.13)	(3415.99)
	[-0.68075]	[0.45639]	[1.04898]
R-squared	0.739708	0.708061	0.886253
Adj. R-squared	0.446879	0.379629	0.758287
Sum sq. resids	6.15E+09	1.47E+09	5.84E+08
S.E. equation	27726.72	13534.79	8545.943
F-statistic	2.526073	2.155886	6.925719
Log likelihood	-202.3853	-189.4769	-181.2003
Akaike AIC	23.59836	22.16410	21.24448
Schwarz SC	24.09301	22.65875	21.73913
Mean dependent	21889.44	14875.61	16636.22
S.D. dependent	37281.06	17184.07	17382.43
Determinant Residual Covariance		2.83E+24	
Log Likelihood		-561.4612	
Log Likelihood (d.f. adjusted)		-583.3563	

Akaike Information Criteria	68.59515	
Schwarz Criteria	70.27696	

The result further verified that the long-run relationship among FDI, Imports and Exports can be denoted:

$$FDI_{t-1} = 4.738337Import_{t-1} + 1.257481Export_{t-1} + Trend(1982) + C_1 \quad (4)$$

We also notice from the Error Correction that FDI has a higher adjustment speed at 0.409466 which is higher than that of the Imports and Exports which are 0.151456 and 0.164268, respectively. Moreover, there is a lag effect of FDI on Chinese imports and exports which can be seen from the comparably low coefficient at -0.046140 and 0.010582 in the first lag period, while increase to 0.260176 and 0.360576 in the second lag period. This suggests that it takes average two years for the FDI to take effect from the setup of the production, establishment of the infrastructure and equipment, intensive labor training to the exportation of the final product. In addition, both trend variable and dummy variable have significant impact on the temporary volatility of the three endogenous variables, which indicates that our model has well captured the features of time series.

Recalling the literature we have investigated (Kojima 1975, Ozama 1992), the estimation results suggest that FDI inflow and export has a positive relationship. Thus it verified the proposition that they are complements for each other. More interestingly, we notice that with the increase in FDI, the import grows up accordingly as well. Such movement is also consistent with Lemoine (2000) argument that with Chinese trade liberalization, more equal access to foreign resources is provided and Chinese firms take greater advantage of low tariff and non-tariff barrier to enhance their competitiveness in domestic and world market.

IV. Conclusion

In this paper, we analyze the relationship between FDI and foreign trade in Chinese economy focusing on the long term. First of all, we give a quick theoretical review on the possible relationships between them: substitute or complement. From the existing literatures, we find that FDI and trade are tightly linked with each other. The specific relationship between them is largely determined by the comparative advantages possessed by countries and the MNEs dominant motives and strategies. The substitutive relationship view argues that, if the flowing of FDI comes from the sector of the home country with comparative advantage and is invested in comparative disadvantage sector of the host country, international trade would decline and eventually output would decline as well. In contrast, the complementary relationship between FDI and Foreign trade occurs when the source country invests in those industries in which the host country has a comparative advantage.

We applied Engle and Yoo (1987) Cointegration with vector error correction methodology to estimate the relationship between FDI and foreign trade in China. There are two main results.

First, the relationship between China's exports and FDI suggests that expansion of FDI has significantly promoted China's exports. This result is in line with the statement of Kojima (1975). The increasing growth of export indicates China's competitiveness in the world market. This competitiveness comes from China's comparative advantages in the global market. For example, the largest consumer capacity in the world; the ample natural

resources; the cheap labor cost and the preferential treatments for the foreign investors. These comparative advantages encourage more MNEs to invest in China, accelerating the growth of FDI. Using these advantages, firms utilize the funds and to enhance their competitiveness in the world market and increase the exportation abroad.

Second, the positive relationship between China's imports and FDI is also consistent with Lemoine (2000) argument. With Chinese trade liberalization, more equal access to foreign resources is provided and Chinese firms can take greater advantage of low tariff and non-tariff barrier to enhance their competitiveness in domestic and world market.

The finding that FDI has a positive relationship with Chinese international trade has indirectly reflected the success and effectiveness of China's open policy. The trade liberalization program has been playing a significant role to facilitate China's imports, and hence, indirectly, FDI and exports. In order to fulfill its promise to the WTO, such trade-oriented policy is worth emphasizing and developing in the future to facilitate a more efficient economy in China.

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