

University of Groningen

A fifty-year journey of China towards the world economy

Zhang, Jianhong

IMPORTANT NOTE: You are advised to consult the publisher's version (publisher's PDF) if you wish to cite from it. Please check the document version below.

Document Version

Publisher's PDF, also known as Version of record

Publication date:

2005

[Link to publication in University of Groningen/UMCG research database](#)

Citation for published version (APA):

Zhang, J. (2005). *A fifty-year journey of China towards the world economy: an empirical study on the determinants of China's bilateral trade relations*. s.n.

Copyright

Other than for strictly personal use, it is not permitted to download or to forward/distribute the text or part of it without the consent of the author(s) and/or copyright holder(s), unless the work is under an open content license (like Creative Commons).

The publication may also be distributed here under the terms of Article 25fa of the Dutch Copyright Act, indicated by the "Taverne" license. More information can be found on the University of Groningen website: <https://www.rug.nl/library/open-access/self-archiving-pure/taverne-amendment>.

Take-down policy

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

Downloaded from the University of Groningen/UMCG research database (Pure): <http://www.rug.nl/research/portal>. For technical reasons the number of authors shown on this cover page is limited to 10 maximum.

Chapter 6

The Relationships between FDI and Trade: A Cointegration Approach

The literature is unanimous on the important link between trade and FDI. However, the exact nature of the relationship between FDI and trade is a controversial issue in international economics and business. In this chapter, by applying a cointegration approach, we unravel the causality and direction of FDI – trade linkages for the Chinese economy in the 1980 – 2003 period. The results indicate that, in the long run, FDI positively relates to exports and imports; in the short run, estimating our framework reveals bi-directional causal links between FDI and exports, and one-way causal links from imports to FDI and from imports to exports.

6.1 Introduction

In the previous chapters, we found that, in the last half-century, China's bilateral trade linkages were determined by three important factors: political relations, geographical distance and economic characteristics. In Chapter 3, the findings indicate that political relations have been an important determinant of bilateral trade intensities ever since 1949. In Chapter 4 and Chapter 5, however, we report that, after two decades of economic reform, the economic elements started to play their roles as drivers of bilateral trade linkages much more prominently in the 1990s and early 21st century, pushing the role of political affinities to the background. Among the economic elements, foreign direct investment (FDI) is a central variable that gained prominence in recent decades as a key determinant of bilateral trade intensities and trade structures. Given these findings, a natural follow-up question can be raised: what are the causal relationships between China's trade pattern and

FDI inflow? Given the extant literature, the answer to this question is not so straightforward. The current chapter aims to answer this question by applying a sophisticated cointegration and Granger-causality approach.

Indeed, the official statistics suggest that FDI by multinational enterprises (MNEs) has played an increasingly dominant role in the domain of China's trade with the outside world. An important and often-used piece of evidence as to the impact of FDI on China's trade is the share of MNEs in total Chinese export and import. As Figure 2-5 in Chapter 2 demonstrates, the shares of Foreign Invested Enterprises (FIEs) in total national export and import flows have increased considerably since China's liberalization program became effective, increasing from 1.9 and 5.6 per cent in 1986 to 54.8 and 56.2 per cent in 2003. These figures seem to imply that FDI has underpinned China's trade expansion. However, the share of FIEs in total national exports and imports is a very crude indication of the impact of FDI on trade. One reason for this is that the category of FIEs does not only include wholly-owned foreign enterprises, but also joint ventures with shared ownership by both Chinese and foreign investors in which the foreign investors' capital contribution should not be less than 25 per cent of the total registered capital.¹ Therefore, domestic investments also contribute to the FIEs' exports and imports. Furthermore, an important part of FDI's influence on their host countries' trade may follow an indirect path. For example, through spillover effects, FDI can affect the export and import performance of local firms, and hence the total export and import flows in

¹ Law of the People's Republic of China on Chinese-Foreign Equity Joint Ventures (EJV Law, Article 4), Law of the People's Republic of China on Contractual Joint Ventures (CJV Law, Article 2), and Regulations for the Implementation of the Law of the People's Republic of China on Contractual Joint Ventures (CJV Implementation, Article 18).

host countries. For these reasons, simply taking the official statistics at face value provides far from sufficient evidence – if any – as to the explanation of the FDI – trade linkages. A more sophisticated and appropriate technique is needed to uncover the effects that underlie the official figures.

In Chapter 4, by introducing lagged FDI as an explanatory variable, we found evidence for a one-way causal relationship from FDI to trade. The present chapter will go further by seeking to detect whether or not two-way causal FDI – trade linkages can be uncovered by analyzing time series data. We investigate both long-run and short-run relationships between FDI on the one hand and exports and imports on the other hand by using the Granger-causality cointegration approach. Before doing that, though, we will first briefly review the relevant literature on FDI and trade.

6.2 Literature Review

From decades of research it is clear that FDI and trade are closely interrelated. MNE activity has a distinctive effect on the trade pattern of both home and host countries because of their ability and willingness to internalize cross-border transactions, thereby affecting the value-added activities both within a country and between countries (Dunning 1992). By and large, the international business and international economics literatures are unanimous on the importance of this link. However, the exact nature of the relationships between FDI and trade is a controversial issue, because (a) causalities can run both ways, from FDI to trade and from trade to FDI and (b) the sign of any FDI – trade linkages is dependent upon the underlying MNE strategies.

The mainstream in the classic theory of international trade views the mobility of goods and factors as opposing forces. As part of international integration processes,

trade in goods leads to the convergence of product prices, and thus of factor rewards; alternatively, migration or FDI triggers a convergence of factor rewards, and hence of product prices. This is the so-called Mundell principle. The Heckscher-Ohlin-Samuelson-Mundell framework suggests that international trade of goods can substitute for international movement of factors of production, which includes FDI. Similarly, the other way around, international factor mobility, including FDI, may substitute for trade in goods. In Mundell's words, "[c]ommodity 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" (Mundell 1957: 320).

Vernon (1966) developed the product lifecycle model of internationalization to explain the sequence from domestic production of a new product to its export and then foreign production by investigating the US multinational companies in the 1950s and early 1960s. According to this model, in the first stage, new products initially are developed in the US, and sales occur first in the domestic market. Subsequently, in the second stage, export will start developing to those foreign markets where the consumers have the same preferences and incomes as at home. As the foreign markets grow, in the third stage, US firms might establish a subsidiary abroad to produce their products closer to their destination markets. When the production in foreign countries rises, US export to those markets will fall, as well as that to third-country markets. Finally, in the fourth stage, as foreign firms master the production processes and as their costs fall with the increased scale of production, they might begin to export their products to the US. This developmental sequence indicates that foreign production may substitute for export from the home country, even creating import of the same product in a later stage. From the perspective of a

host country, conversely, FDI is replacing its imports first and increasing its exports later.

From a macroeconomic point of view, Kojima (1975 & 1982) points out that the comparative advantage of industries in home and host countries is crucial in determining whether FDI is trade-oriented or not. Kojima's macroeconomic approach predicts that export-oriented FDI occurs when the source country invests in those industries in which the host country has a comparative advantage. It is beneficial for an investing country if an FDI flow goes abroad from its comparatively disadvantaged marginal industry for the purpose of producing goods in the host country at costs lower than at home through the transfer of efficient technology and effective management. Subsequently, in the next stage, importing the associated goods back into the home country (or exporting them to third markets) may gain prominence. Additionally, this kind of FDI benefits the host country, since it stimulates the export of new products from the host country. Therefore, on the one hand, if an MNE invests in a host country with comparative advantages that compensate for disadvantages in the home country, then FDI will increase the host country's trade. However, on the other hand, if an FDI flow comes from an industry with a comparative advantage in the home country but a disadvantage in the host country, then this FDI tends to be a trade substitute because this investment does not fit with the host country's comparative advantage, which eventually reduces the total output and trade volume of both countries involved. In developing host countries, FDI flowing into labor-intensive industries is likely to be trade-creating, whereas FDI flowing into capital-intensive industries is likely to be trade-replacing or trade-destroying.

A related literature investigates the relation of trade and FDI in the context of development issues. Based on the conceptual framework developed by Porter (1990),

Ozawa (1992) formulated a comprehensive theory describing linkages between economic development and competitiveness that create international trade and FDI. Ozawa argues that an increase in trade flows occurs as a result of improved comparative advantage, which is, in turn, influenced by FDI leading to changes in the pattern of this advantage. He offers an explanation of the causal relationships between an outward-oriented economic policy and the impact of FDI on trade by emphasizing the effects of FDI on comparative advantage and structural upgrading in manufacturing. In this line of argument, FDI and international trade are not only increasingly complementary and mutually supportive, but also increasingly inseparable as two sides of the process of economic globalization (Ruggiero 1996). Furthermore, inward FDI may stimulate exports from domestic sectors through industrial linkage or spillover effects, especially through backward linkages, buying local-made intermediate inputs to produce exports (O hUallachain 1984). This effect creates a strong demand stimulus for domestic enterprises, and promotes exports.

The international business literature emphasizes the role of the motives of multinational enterprises. With a different motivation, FDI has a different effect on trade. Motivations can be classified into two general categories: market-seeking and factor-seeking (Root 1977 & 1994). Market-seeking FDI follows demand, penetrating foreign markets with a promising sale potential. Market-seeking FDI may have a negative impact on the host country's trade balance, since "the affiliates of foreign firms (in the US) do show an apparent tendency to export somewhat less and import significantly more than US firms – indeed over two and a quarter times as much" (Graham and Krugman 1989: 67). Factor-seeking FDI includes MNE behavior aimed at gaining access to raw materials and low-cost locations. FDI motivated by the quest for raw materials is used to produce goods with natural sources that are lacking or under-supplied in the home country. In general, this type

of FDI increases exports from the host nation to the home country, as well as to other third countries (Root 1994). FDI motivated by low-cost production objectives takes advantage of low-cost factors, such as cheap labor, as part of an overall global sourcing strategy, leading to an ability to export products from the emerging host nation to other countries in the world, including the home country. In this case, the host country is able to increase exports and improve its trade balance (Phongpaichit 1990).

So, in the business and economic approaches to FDI, trade is considered to be one of the factors that determine the MNE's choice of location for FDI initiatives. On the one hand, a high level of imports in host countries suggests a high level of penetration by foreign companies, which may start off by exporting to the host country, to subsequently switch to FDI once they have established a foothold in those countries. Following this logic, a long-run positive relationship is hypothesized between host-country import and inward FDI (Culem 1988). On the other hand, in the short run, multinational companies may regard export and FDI as alternative modes of foreign market penetration, which implies a negative relationship. Therefore, there is uncertainty as to the net effect of the level of the host-country imports on FDI (Billington 1999). Of course, an MNE's motivation may be complex, implying that FDI is undertaken for more than one reason. Furthermore, regional economic integration and growth of intra-firm trade complicates the prediction of the trade effect of FDI (Narula 1996). All this together explains why unconditional hypotheses about the causality and sign of FDI – trade linkages make no sense.

To summarize, the “quick” literature review above indicates that the relationship between the trade and FDI is complicated, implying that the sign and direction of the causal relationship depend on the range and type of trade and FDI being considered, the MNEs' dominant strategies, and the characteristics of industries and

countries involved. Figure 6.1 summarizes the possible relationships that different pieces of literature predict, depending upon the set of conditions under investigation. Obviously, the causal relations between trade and FDI are not clear-cut.

Figure 6.1 A literature review: relationships between import, export and FDI



Not surprisingly, then, the empirical evidence is mixed. The majority of the empirical studies have confirmed that outward FDI and exports are complementary, especially in the case of developed countries (e.g. Swedenborg 1979; Lipsey and Weiss 1981; Blomstrom, Lipsey and Kulckyck 1988; Pearce 1990; Pfaffermayr 1996; and Wei, Liu, Parker and Vaidya 1999). An early exception to this rule is Horst (1972), who found that trade and FDI reveal a substitutive linkage, and hence are negatively related. Yet other studies have reported that the effects of FDI on exports are different from that on imports. For example, Bayoumi and Lipworth (1997) showed that outward FDI from Japan had only a temporary impact on exports, but a permanent effect on imports.

In terms of Figure 6.1's FDI – trade relations, China is an interesting case that attracts much attention from economists and politicians. Using provincial data of China over the 1985-1995 period, Wei, Liu, Parker and Vaidya (1999) revealed that provinces with a higher level of international trade attract more FDI. Using provincial data for 1984-1997, Sun (2001) found evidence for a one-way causality from FDI to export in the coastal and central regions. Using bilateral data for China and 19 trade partners for 1984 to 1998, Liu, Parker, Vaidya and Wei (2001) applied

unit-root and Granger-causality tests, indicating that import causes FDI and FDI causes export. Using quarterly data from 1981 to 1997, Liu, Burridge and Sinclair (2002) investigated the causal links between economic growth, FDI and trade, showing that two-way causal connections exist between economic growth, FDI and export. Using case study, Zhang and Ebbers (2002) argued that the characteristics of an investing country affect the FDI-trade relationship between China and the investing country. Together, these studies reveal important features of the relationships between Chinese FDI and trade. However, these previous studies either use provincial or bilateral data, and only a few studies have investigated the causal linkages between FDI, export and import at the aggregate level. Moreover, earlier work has not incorporated the influence of policy changes into their models, and information for the period after the Asian crisis has not yet been included. The present study's aim is to extend the extant literature by filling these gaps.

6.3 Methodology and Data

6.3.1 Granger-causality test

One often applied method to investigate causal relationships between variables empirically is Granger-causality analysis. The basic principle of Granger-causality analysis (Granger 1969) is to test whether or not lagged values of one variable help to improve the explanation of another variable from its own past. Simple Granger-causality tests are operated on a single equation in which variable A is explained by lagged values of variables A and B . It is then tested whether the coefficients of the lagged B variables are equal to zero. If the hypothesis that the coefficients of the lagged values of B are equal to zero is rejected, it is said that variable B Granger-causes variable A .

The present study will test for two-way Granger-causality relationships between exports, imports and FDI. Since a single-equation specification cannot fulfil the aim of this study, we set up a Vector AutoRegression (VAR) system, which treats all variables symmetrically. In terms of the variables central to the present study, the VAR system has the following form:

$$EX_t = a_1 + \sum_{i=1}^n b_{1i} EX_{t-i} + \sum_{i=1}^n c_{1i} IM_{t-i} + \sum_{i=1}^n d_{1i} FDI_{t-i} + e_{1t}, \quad (6.1a)$$

$$IM_t = a_2 + \sum_{i=1}^n b_{2i} EX_{t-i} + \sum_{i=1}^n c_{2i} IM_{t-i} + \sum_{i=1}^n d_{2i} FDI_{t-i} + e_{2t}, \text{ and} \quad (6.1b)$$

$$FDI_t = a_3 + \sum_{i=1}^n b_{3i} EX_{t-i} + \sum_{i=1}^n c_{3i} IM_{t-i} + \sum_{i=1}^n d_{3i} FDI_{t-i} + e_{3t}, \quad (6.1c)$$

where EX , IM and FDI are exports, imports and FDI, respectively; a , b , c , and d are parameters; the e 's are error terms; and n is the order of the VAR, i.e., the maximum number of lags in the system. For the $\{FDI_t\}$ sequence to be unaffected by exports, all the b_{3i} must be equal to zero; and for the $\{FDI_t\}$ sequence to be unaffected by imports, all the c_{3i} must be equal to zero. Similar logic applies to $\{EX_t\}$ and $\{IM_t\}$.

The conventional Granger-causality test based on a standard VAR-model is defined conditional on the assumption of stationarity. If the time series are non-stationary, the stability condition for VAR is not met, implying that the Wald test statistics for Granger-causality are invalid. In this case, the cointegration approach and Vector Error Correction Model (VECM) are recommended to investigate the relationships between non-stationary variables (e.g., Toda and Philips 1993). Engle and Granger (1987) pointed out that when a linear combination of two or more non-stationary time series is stationary, then the stationary linear combination, the so-called cointegrating equation, can be interpreted as a long-run equilibrium relationship between the variables.

6.3.2 Cointegration approach

This long-run equilibrium relationship cannot determine the direction of causality, though. The direction can be obtained by estimating a VECM that explicitly includes the cointegrating relations. 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 theory, as well as for estimating the dynamic processes involved. The short-run dynamics of the model are studied by analyzing how changes in each variable in a cointegrated system respond to the lagged residuals or errors from the cointegrating vectors and the lags of the changes of all variables. Therefore, by adopting the cointegration approach and corresponding VECMs, we can detect both long-run and short-run relationships between non-stationary variables.

In the current study, we found two cointegrating relationships between exports, imports and FDI (see below). Hence, we estimate the following three-equation VECM to analyze causality:

$$\Delta EX_t = \alpha_1 + \alpha_E ect_{t-1} + \sum_{i=1}^{n-1} \beta_{1i} \Delta EX_{t-i} + \sum_{i=1}^{n-1} \gamma_{1i} \Delta IM_{t-i} + \sum_{i=1}^{n-1} \delta_{1i} \Delta FDI_{t-i} + \theta_1 D_{92} + \varepsilon_{1t}, \quad (6.2a)$$

$$\Delta IM_t = \alpha_2 + \alpha_I ect_{t-1} + \sum_{i=1}^{n-1} \beta_{2i} \Delta EX_{t-i} + \sum_{i=1}^{n-1} \gamma_{2i} \Delta IM_{t-i} + \sum_{i=1}^{n-1} \delta_{2i} \Delta FDI_{t-i} + \theta_2 D_{92} + \varepsilon_{2t}, \quad (6.2b)$$

$$\Delta FDI_t = \alpha_3 + \alpha_F ect_{t-1} + \sum_{i=1}^{n-1} \beta_{3i} \Delta EX_{t-i} + \sum_{i=1}^{n-1} \gamma_{3i} \Delta IM_{t-i} + \sum_{i=1}^{n-1} \delta_{3i} \Delta FDI_{t-i} + \theta_3 D_{92} + \varepsilon_{3t}, \quad (6.2c)$$

where ΔEX , ΔIM and ΔFDI are first differences of EX , IM and FDI , respectively; the error-correction term ect is a vector of residuals from the long-run equilibrium relationships; D_{92} is a step dummy variable, with zeros before and ones in and after 1992, to be discussed below; α , β , γ , δ , and θ are parameters; and the ε 's denote error terms.

Two aspects of the VECM system (6.2) deserve special attention. Firstly, the error-correction term consists of the linear combinations of our three variables, which are stationary. The number of combinations, also labeled as rank or the number of cointegration vectors (r), is two in our case. Below, we will apply the Johansen cointegration test to determine the rank. The error-correction terms reveal the deviations from the long-run relationships between the three variables. The coefficients of ect , α_F , α_E , and α_I reflect the speed of adjustment of exports, imports and *FDI* toward the long-run equilibrium. For example, the larger the first (second) element of α_F , the greater the response of *FDI* to the previous period's deviation from the first (second) long-run equilibrium relations. Conversely, if the two elements of α_F are equal to zero, *FDI* does not respond to lagged deviations from the long-run equilibrium relationships. In this case, *FDI* is called weakly exogenous for the system. So, Granger-noncausality in the case of cointegrated variables requires the additional condition that the speed-of-adjustment coefficients are equal to zero. For example, for the $\{FDI_t\}$ sequence to be unaffected by exports, not only all the β_{3j} must be equal to zero, but also the elements of vector α_F .

Secondly, three deterministic components – a constant, a trend and step dummy D_{92} – may enter the VECM system. The form in which the constant and the trend enter the VECM is found as part of the cointegration estimation strategy. The step 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. China's liberalization policies followed a gradual step-by-step approach before 1992 (as was explained in Chapter 3). In that period, international trade and FDI increased steadily. Since 1992, however, China has speeded up the pace of liberalization impressively. The Chinese trade system has been adapted to better reflect international norms, and

incentive measures have been launched to attract inward FDI. Consequently, China's FDI inflow has increased tremendously due to these changes in policies.

6.3.3 Estimation procedure

Figure 6.2 (see below) indeed reveals a structural break in the FDI time series as of 1992. The Chow breakpoint test confirms that the influence of this break on the relationship between our time series is significant, with an F-statistic of 41.2 ($p < 0.001$).² We considered three alternatives for the structural break: the break may change (1) the constant, (2) the trend, or (3) both the constant and the trend. We started from the most complicated case (3), including a step dummy (D_{92}), the product term of D_{92} and EX , and the product term of D_{92} and IM . The result indicates that the coefficient of D_{92} is significant, while the two product terms are not, which implies that case (1) is empirically validated. Therefore, we only include the step dummy D_{92} into our VECM and cointegration test.

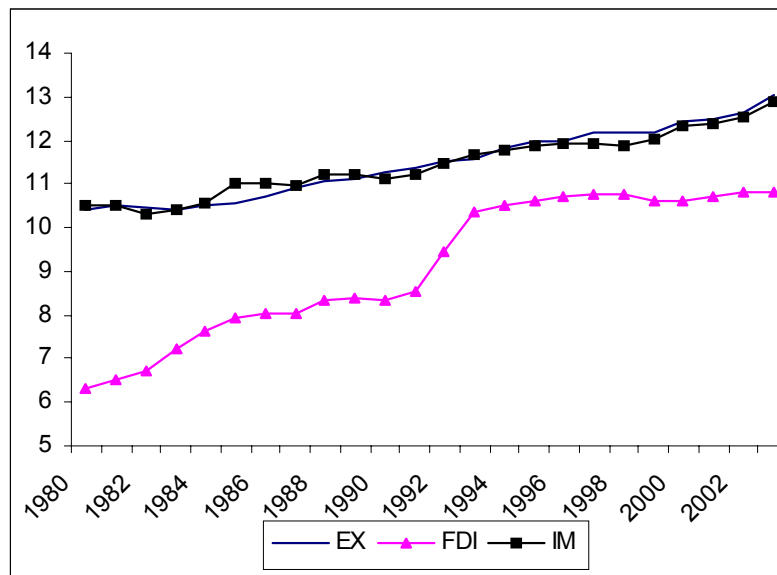
The estimation comes of three steps. First, we test whether the three variables involved are stationary with the Augmented Dickey-Fuller (ADF) unit root test. Additionally, due to the fact that there could be structural breaks in the time series concerned, we apply the Zivot-Andrews (1992) unit root test, which allows for one structural break in the time series. When the null hypothesis of non-stationarity is not rejected by these two tests, we move to the second step: the cointegration test in Johansen's (1991 & 1995) framework. If the first two steps indicate that the three variables are non-stationary and cointegrated, we take the third step: estimating the VECM of system (6.2), and testing for weak exogeneity and Granger-causality relationships between the three variables.

² We also applied the Chow breakpoint test for other years, such as 1989, 1996 and 1994, as suggested in Table 6.2 below. However, these other step dummies are not associated with significant breaks.

6.3.4 Data

The current study examines the relationships between FDI inflows, exports and imports for China using annual data from 1980 to 2003. The three time series are deflated by using a GDP deflator, and are converted to constant US dollars (2000 = 100). All variables are transformed to natural logs before estimation. GDP deflators are obtained from the OECD (SourceOECD). Annual realized FDI values are collected from the Ministry of Commerce of the People's Republic of China (MOC) and the Chinese Ministry of Foreign Trade and Economic Cooperation (MOFTEC). Exports and imports information is from the Customs of General Administration of the People's Republic of China. Figure 6.2 shows exports, imports and FDI in logarithms from 1980 to 2003.

Figure 6.2: China's FDI, exports and imports 1980-2003



Note: FDI, EX and IM stand for logarithms of FDI, exports and imports, respectively.

Clearly, our three variables reveal an upward trend during the sample period. FDI increased faster than exports and imports did, however, especially in the 1992 – 1994 period.

6.4 Evidence

6.4.1 Unit root tests

Table 6.1 reports the results of the unit root tests for exports, imports and FDI using the ADF test. Two models with different deterministic components are considered: the model with a constant only, and a model with a constant and a trend. It is clear that all the log-variables have a unit root in their levels. However, the null hypothesis of a unit root in first difference of the three variables is rejected at the 10 and 5%-level in the model with a constant and a trend. Additionally, the hypothesis is rejected at the 5%-level for all variables in the model with a constant only. Therefore, according the ADF test we can treat exports, imports and FDI as integrated of order one in our sample, denoted $I(1)$.

The ADF test is biased toward accepting the null of non-stationarity if the time series has a structural break. Therefore, we apply the Zivot-Andrews unit root test. Table 6.2 shows the results. Again, the findings suggest that the three time series are $I(1)$. These results permit us to proceed with the next step, cointegration tests, in order to investigate the long-run relationships between exports, imports and FDI.

Table 6.1: Augmented Dickey-Fuller unit root test

Variables	Level		First difference	
	With constant and trend	With constant only	With constant and Trend	With constant only
EX	-2.723(2)	0.912(4)	-3.937**(0)	-3.303**(0)
IM	-3.120(3)	1.081(7)	-3.462*(5)	-3.398**(5)
FDI	-1.701(3)	-1.793 (3)	-3.722**(1)	-3.442**(1)

Notes:

- (1) *EX*, *IM* and *FDI* denote the logs of exports, imports and FDI, respectively.
- (2) **, and * are significant at the 5% and 10%-level, respectively.
- (3) Figures in parentheses are the number of lags that were selected by the Akaike Information Criterion (AIC).

Table 6.2: Zivot-Andrews unit root test: minimum t-statistic

	Level		First difference	
	With constant and trend	With constant only	With constant and Trend	With constant only
EX	-2.093 (1994)	-2.093 (1994)	5.126 (1996)**	5.126 (1996)**
IM	-4.019 (1990)	-4.019 (1990)	4.800 (1989)	4.800 (1989)**
FDI	-4.567 (1992)	-4.567 (1992)	5.893(1992)***	5.893 (1992)***

Notes:

- (1) *EX*, *IM* and *FDI* denote the logs of exports, imports and FDI, respectively.
- (2) **, and * are significant at the 5% and 10%-levels, respectively.
- (3) Figures in parentheses are break points.

6.4.2 Cointegration test and long-run relationships

The purpose of the cointegration test is to determine whether our three non-stationary time series are cointegrated – that is, to detect whether there are long-run equilibrium relationships among the three variables. As mentioned above, we include the step dummy D_{92} as an exogenous variable. We test for cointegration using the

methodology developed by Johansen (1991 & 1995). We first need to find the optimal lag order for the VECM model. Lag-exclusion Wald tests indicate that three lags is the optimal lag structure in our VECM. With this optimum number of lags, we move on to choose the appropriate cointegration model for the constant and the trend. We estimated the five models considered by Johansen (1995: 80-84). The results indicate that a model with a linear trend and cointegrating equations with intercepts is supported. Therefore, we use this model to perform the cointegration test.

Table 6.3 reports the results of the cointegration test. Trace statistics and L -max statistics indicate that the null hypotheses of no cointegration, $r=0$, and one cointegration vector, $r = 1$, are rejected at the 1%-level. However, the null hypothesis of two cointegrating vectors, $r = 2$, is not rejected. Consequently, we conclude that there are two cointegrating relationships among the three selected variables in the model. Based on the normalization used in Table 6.3, the two cointegration vectors are:

$$EX-1.97FDI+7.01, \text{ and} \tag{6.3}$$

$$IM-1.36FDI+1.28, \tag{6.4}$$

which are included in the *ect* term in the VECM system of Equation (6.2). The results indicate (a) a long-run positive relation between FDI and exports, and (b) a long-run positive relation between FDI and imports. These relationships imply that China's FDI inflow is positively associated with China's exports and imports in the long run. Combining Equations (6.3) and (6.4) yields the following positive relationship between EX and IM :

$$EX-1.45IM+5.16. \tag{6.5}$$

Table 6.3: Johansen's cointegration tests (with three lags)

$H_0=r$	Eigenvalue	λ_{\max}	5% critical value	λ_{trace}	5% critical value
0	0.970	70.41***	21.13	102.53***	29.80
1	0.778	30.14***	14.26	32.12***	15.49
2	0.094	1.97	3.84	1.98	3.84
Normalized cointegrating coefficients (standard error in parentheses)					
One cointegrating equation: log-likelihood = 109.31.					
β	EX	IM	FDI	c	
	1.00	-1.06	-0.571	6.08	
		(0.192)	(0.073)		
Two cointegrating equations: log likelihood = 119.37.					
β	EX	IM	FDI	c	
	1.00	0.00	-1.97	7.01	
			(0.14)		
	0.00	1.00	-1.36	1.28	
			(0.10)		

Notes:

- (1) ***, **, and * are significant at the 1%, 5% and 10%-level, respectively.
- (2) D_{92} is included as an exogenous variable.

We must exercise caution, however, when interpreting this result. The reason is that, although the cointegration implies positive relations between the three variables, cointegration tests cannot determine the direction in which causality flows. The causality relationships can be ascertained from performing Granger-causality tests that incorporate the cointegrating relation. This is what we do next.

6.4.3 VECM and short-run relationships

Given the existence of two cointegrating relationships between exports, imports and FDI, we test for weak exogeneity and Granger-causality by using the VECM of

Equation (6.2).³ In line with the outcomes of the cointegration test, the order of the VECM is three, and a linear trend and cointegrating relations with constants are included in the model. Again, D_{92} is taken on board as an exogenous variable. The vector error correction estimates are shown in Table 6.4. The results indicate that D_{92} is positively significant in export and FDI equation, which confirms the effect of policy on exports and FDI.

Table 6.5 reports the results of the weak exogeneity test. Weak exogeneity is rejected for *EX* and *FDI* at the 1%-level. However, weak exogeneity is not rejected for *IM*. This result implies that two of the three variables, *EX* and *FDI*, are weakly caused by all variables in the system. This conclusion is complemented by the result of the VECM Granger-causality test, as displayed in Table 6.6. The first column defines the equations of system (6.2). The other columns display χ^2 (Wald) statistics for the joint significance of each of the other lagged endogenous variables and the error-correction term in the associated equation. In the exports Equation (6.2a), the hypothesis that imports does not Granger-cause exports is rejected at the 1%-level, and the hypothesis that FDI does not Granger-cause exports is rejected at the 5%-level. In the imports Equation (6.2b), the hypothesis that exports does not Granger-cause imports cannot be rejected, and the hypothesis that FDI does not Granger-cause imports is not rejected either. In the FDI Equation (6.2c), the hypothesis that exports does not Granger-cause exports is rejected at the 5%-level, and the hypothesis that FDI does not Granger-causes imports is rejected at the 1%-level. In summary, the Wald test statistics indicate that bi-directional causal links in the short-

³ When variables are non-stationary at their levels but stationary at their first differences, some studies employ a vector autoregression (VAR) in first differences to detect the causality relation (e.g., Liu, Wang and Wei 2001). However, when non-stationary variables are cointegrated, then a VAR in first differences is misspecified (Engle and Granger 1987). In the current study, two cointegration vectors are found. Therefore, a VECM is used.

run dynamics exist between ΔEX and ΔFDI , and that one-way causal links run from ΔIM to ΔFDI and from ΔIM to ΔEX .

Table 6.4: Vector Error Correction Estimates

Cointegrating Eq:	CointEq1		CointEq2			
EX(-1)	1		0			
IM(-1)	0		1			
FDI(-1)	-1.968	-13.1 (t)	-1.358	-13.088 (t)		
C	7.010		1.280			
Error Correction:	D(EX)	t	D(IM)	t	D(FDI)	t
CointEq1	-0.966	-2.290	-0.643	-0.477	2.194	3.983
CointEq2	1.539	2.386	1.020	0.494	-2.959	-3.511
D(EX(-1))	-0.340	-1.820	0.177	0.297	0.411	1.685
D(EX(-2))	-0.481	-2.064	-0.754	-1.012	0.878	2.884
D(EX(-3))	0.021	0.087	-0.875	-1.108	0.984	3.050
D(IM(-1))	-0.991	-1.743	-0.996	-0.548	2.318	3.121
D(IM(-2))	-0.645	-1.797	-0.864	-0.752	1.637	3.488
D(IM(-3))	-0.147	-0.519	-0.245	-0.271	1.171	3.171
D(FDI(-1))	0.055	0.496	0.128	0.359	0.004	0.028
D(FDI(-2))	0.225	2.768	0.177	0.680	-0.192	-1.802
D(FDI(-3))	0.056	0.475	-0.044	-0.116	-0.364	-2.347
C	0.209	1.894	0.317	0.900	-0.940	-6.536
D92	0.196	2.686	0.186	0.797	0.812	8.524
R-squared	0.882		0.472		0.977	
Adj. R-squared	0.680		-0.432		0.936	
F-statistic	4.360		0.522		24.293	
Log likelihood	40.790		17.536		35.443	
Determinant resid covariance (dof adj.)			5.22E-08			
Determinant resid covariance			2.24E-09			
Log likelihood			114.038			
Akaike information criterion			-6.904			
Schwarz criterion			-4.663			

Note: t-statistics are reported in the column at the right-hand side of the parameter estimates.

Table 6.5: Weak exogeneity test

	χ^2	p-value
ΔEX weakly exogenous to the system	21.00	0.0018
ΔIM weakly exogenous to the system	3.32	0.7678
ΔFDI weakly exogenous to the system	22.08	0.0012

Table 6.6. VECM Granger-causality test

Dependent variable	Wald test statistics (χ^2)		
	ΔEX	ΔIM	ΔFDI
ΔEX		12.44***	9.95**
ΔIM	1.52		1.20
ΔFDI	15.37**	12.53***	

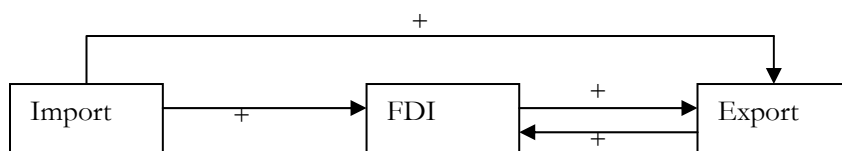
Note: *** and ** are significant at the 1% and 5%-level, respectively.

6.5 Conclusion and Discussion

In this chapter, we focused on analyzing two relationships, FDI and exports, and FDI and imports. Our empirical study confirms the interactive causality relationships between China's exports, imports and FDI, as summarized in Figure 6.3. Moving beyond previous studies, the present study finds evidence in support of more relationships between the three variables, although the findings are in line with that

in the extant literature.⁴ In the long run, FDI positively relates to exports and imports, and exports is positively associated with imports. This result implies that multinational enterprises' investments in China do not substitute for China's exports and imports. In the short run, the VECM framework reveals bi-directional causal links between FDI and exports, and one-way causal links from imports to FDI and from imports to exports. In addition, this confirms the significant impact of liberalization policy on China's exports and FDI inflows.

Figure 6.3: Relations between FDI, exports and imports



First, the two-way causal link between exports and FDI suggests that growth of exports has made China more attractive to foreign investors, and foreign investment, in turn, has promoted China's exports. According to Kojima's (1975 & 1982) macroeconomic approach, export growth reveals a country's competitiveness in the world market. This competitiveness derives from the country's comparative advantages. The comparative advantages encourage multinational companies to invest in this country, so making use of these advantages to enhance their competitiveness in the world market. In the case of China, the growth of exports since 1978 has been four and a half times that of world exports, which demonstrates

⁴ Most studies concern to relationships between China's exports, imports and FDI. Wei (1999), Sun (2001), and Liu, Wang and Wei (2001) found only one-way relations between the three variables. Liu, Burridge and Sinclair (2002) traced a two-way relationship between FDI and export, and one-way linkages from FDI to imports, and from imports to exports.

that China can benefit from noticeable comparative advantages. These advantages attract FDI into China that seeks low-cost production and raw-material access. Given the nature of these types of FDI inflows, they, in turn, promote China's exports. This finding is consistent with the arguments of Vernon (1966), Ozawa (1992) and Root (1977 & 1994). The causal link from FDI to export also reflects China's FDI policies, with an overall bias toward stimulating export-oriented FDI. That is, export-oriented foreign investments were (and still are) highly encouraged by the Chinese government through special tax rebates, low land-usage fees, and offering water, electricity and other infrastructure services. Furthermore, there were restrictions and regulations imposed on foreign invested enterprises (FIEs) in the area of export obligation. For example, under the *Law of the People's Republic of China on Wholly-Owned Foreign Enterprises* (1986, Article 3), FIEs have to export all or the majority of their products.⁵ This is one of the reasons why FDI had a positive impact on exports in both the long run and the short run.

Second, the causal link from import to FDI found in our VECM cointegration test is in line with the internationalization argument advocated in the extant international business and international economics literatures. That is, multinational enterprises are likely to first penetrate a new market by export, to subsequently switch to FDI once they have established presence in that market.

Third, the lack of significance of causation from FDI to import can be explained by the contradictive impact of FDI on imports. On the one hand, FDI may replace import when the motivation for the investment is market-seeking. On the other hand, FDI might promote import when the motivation for foreign investment is factor-seeking. China is not only potentially the largest market in the world, but also

⁵ This restriction was relaxed in 2000, but the Chinese government still encourages FIEs to market their products outside of China.

features very low labor costs. Therefore, multinational companies may be driven by both motives, which causes opposing effects on import. As a result, empirical studies do not find clear-cut evidence for either a negative or a positive relationship. In Chapter 4, we found that the impact of FDI on imports is less significant than the impact on exports, which is likely to be caused by the same reason.

In summary, the findings of this chapter indicate a virtuous process of the development of China's outward-oriented economy. As shown in Figure 6.3, more imports lead to more FDI, more FDI leads to more exports, and more exports lead to more FDI. This virtuous process reflects China's open-door policy. The trade liberalization program that started in 1978 initially facilitated China's imports, and hence, directly and indirectly, FDI and exports. In order to fulfill its promise to the WTO, China is currently further opening up its markets to the outside world. This virtuous circle is therefore likely to continue, or even accelerate, which will eventually underpin a high economic growth rate in China for many years to come. In the process, the role of MNEs through FDI is crucial.