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Managing Openness of the Chinese Economy to Sustain Its Economic Growth

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Abstract: Many studies suggest the positive causal effects of openness on productivity and growth. However, controversies are still prevalent among vast empirical studies on the issue. In this paper, we develop econometric models in the comprehensive framework to shed quantitative light on the implications of a scenario of deeper economic integration in China, where the barriers for trade and foreign direct investment (FDI) are preferentially eliminated. Different versions of the econometric models are specified and numerically implemented. Each provides a framework to experiment the relationship between economic growth and trade, FDI in China. Our findings include: first, both FDI and trade have positive impact on long-term economic growth and no effect on short-term economic fluctuation; second, the interactions between FDI and policy, trade openness and policy have significant impact on economic growth, and with the rapid growth of FDI and trade, their marginal effects on economic growth is reduced; third, the impact of FDI on TFP is positive, and trade openness is also showed positive effect on TFP under the role of FDI. All these findings suggest that openness is becoming an important drive force of China's economic growth. It is necessary for Chinese government to manage openness to sustain its' economic growth.

Keywords: Openness, Foreign Trade, Foreign Direct Investment, Economic Growth, China

1. Introduction

China is a very an interesting and increasingly important case for study of relationship between growth, trade and foreign direct investment (FDI). Since the initiation of economic reforms and trade liberalization from 1978, China has been one of the world's fastest-growing economies and has emerged as a major economic and trade power. Academic researchers have tried alternative explanations for China's miraculous growth. Most of papers found that exports and FDI have a strong and positive effect on economic growth. The results suggest that two development policies adopted in China are useful for other developing and transitional economies: export promotion and adoption of world technology and business practices.

However, the global economic crisis began to impact China's economy in late 2008. After growing by 13% in 2007, China's real GDP slowed to 9.6% in 2008 and to 9.3% in 2011. However, China's trade and inflows of FDI decreased sharply. After growing by 15% in 2007, China's export slowed to 1.3% in 2008 and to -17.7% in 2009. China's inflows of FDI slowed to 3.6% in 2008 and to -1.8% in 2009 (NBSC, 2012). Despite the relatively positive outlook for its economy, China faces a number of difficult challenges that, if not addressed, could undermine its future economic growth and stability. These include over-dependence on exports and fixed investment for growth, and widening income disparities.

Whether this growth performance is sustainable over the next several decades has been also actively debated both inside and outside China. Actually, in recent years, there are two academic debates on openness and economic growth in China. One is whether the ratio of trade to GDP is too high. The ratio in China reaches up 50% in 2011while other developed countries such as USA reach only about 10%. Are we dependent on global market too much? And the other is whether China utilizes FDI too much since China is the world's largest holder of foreign exchange reserves at $3.2 trillion (NBSC, 2012).

Obviously, China can't have a sustainable growth only dependent on foreign markets and FDI. In order to identify the economic growth effect of trade and FDI, in this paper,

we develop an econometric model in the comprehensive framework to shed quantitative light on the implications of a scenario of deeper economic integration in China, where the barriers for trade and foreign direct investment are preferentially eliminated. Different versions of the econometric models are specified and numerically implemented. Each provides a framework to experiment the relationship between economic growth and trade, foreign direct investment in China.

This paper is structured as follows. Section 2 reviews the corresponding academic literature. Section 3 presents an overview of China's Economic Development. Section 4 introduces the methodology, data and presents empirical results. Section 5 concludes with policy implications.

2. Literature Review

2.1. Trade and Economic Growth

The idea that international trade fuels economic growth dates back at least to Adam Smith's concept of absolute advantage and David Ricardo's notion of comparative advantage. Numerous theoretical models have been proposed to demonstrate the positive relationship between openness and economic growth. Some of the reasons cited in support of the proposition are: (a) export growth represents an increase in demand for the country's output; (b) exports promote specialization in the production of export products, which in turn may boost the productivity level and the general level of skills and result in a more efficient reallocation of resources; (c) the outward oriented trade policy may also give better access to advanced technologies, learning by doing gains, and better management practices that may result in further efficiency gains; (d) exports may loosen a foreign exchange constraint, which makes it easier to import inputs to meet domestic demand, and so enable output expansion; (e) some authors argue that an outward-oriented strategy of development may provide greater opportunities and rewards for entrepreneurial activity, the key to extended growth. However, openness does not raise economic growth unambiguously. Protection could be a strategy to increase economic growth. They are many arguments for protection such as the infant industry argument, the terms of trade argument and tariff to reduce aggregate unemployment.

Theoretical disagreement on the role of openness is matched by mixed empirical evidence. Many empirical studies have found a positive relationship between openness and economic growth in China. The empirical literature on trade-growth relationships can be classified into two broad strands of studies. One strand used time-series models and assessed mainly the demand-driven effects. Liu et al (1997) used the models of Granger to identify a bi-directional causal relationship between GNP and exports plus imports in China. He found that the bi-directional causation is consistent with China's development strategy of export promotion. Kishor and Deergha (2011) employed the more recent and robust Toda-Yamamoto-Dolado-Lutkephol Augmented vector autoregressive (VAR) technique for testing Granger causality among four time series variables. They focused on the post liberalization period and the results strongly support export-led Growth in China. Imports, however, do not have direct Granger causality towards GDP, but certainly influence it through the indirect channel of influencing Exports and Foreign direct Investment. Qazi Muhammad Adnan Hye (2012) utilized the relative new cointegration method of the autoregressive distributed lag (ARDL) approach to determine the export-led growth, growth-led export, import-led growth, growth-led import and foreign deficit sustainability hypothesis in the case of China, and the direction of long run and short run causal relationship is examined by using modified Granger causality test. The results confirmed the bidirectional long run relationship between the economic growth and exports, economic growth and imports, exports and imports.

The other strand of studies using a cross-section, and more recently panel data, approach examined the productivity and supply-side effects of trade on output and growth, traversing through the accumulation of capital and total factor productivity (TFP) parameter of production technology. Zheng et al (2009) found that reform measures often resulted in one-time level effects on TFP and suggested China needs further institutional reforms to consolidate China's move to a full-fledged market economy. Yao (2006) focused on the effect of exports and FDI on economic performance using a large panel data set encompassing 28 Chinese provinces over the period 1978-2000. Adopting Pedroni's panel unit root test and Arellano and Bond's dynamic panel data estimating technique, he found that both exports and FDI have a strong and positive effect on economic growth. Jiang (2011) investigated the effects of openness on China's regional productivity growth. By using a variety of panel data regression techniques, he showed that the direct growth effect of openness was the main effect while the convergence effect was insignificant. The findings lend strong support to the claim that the opening-up of China promotes the country's economic growth.

2.2. FDI and Economic Growth

It is a general belief among policy makers and academicians that FDI can be a source of valuable technology and know-how in addition to increased capital. Some of the popularly cited potential benefits of FDI are: (a) backward and forward linkages with the rest of the economy; (b) enhanced access to advanced technologies; (c) learning of improved management practices; (d) expansion and diversification of the production capacity of an economy; (e) transfer of best practices in corporate governance and accounting practices; (f) integration of the domestic economy with the global economy and infusion of competition in the domestic economy; and (g) relatively more stability than other forms of international capital flows because of longer-term perspective.

Notwithstanding the strong conceptual case for a positive relationship between economic growth and FDI, the

empirical evidence has been mixed. See for example, Blomström and Kokko (1998), Gorg and Greenaway (2004), and Barba-Navaretti and Venables (2006) for surveys of spillover channels and empirical findings. It has been recognized and well documented in the literature that there is possibility of two-way feedbacks between FDI and economic growth along with their long-run and short-run dynamics. John and Xin (2010) presented and assessed of the contribution of inward FDI to China's recent rapid economic growth using a two stage growth accounting approach. They suggested that the sustainability of both China's export and overall economic growth may be questionable if inward FDI plateaus in the future.

Nevertheless, some empirical investigations in the context of the Chinese economy have generally failed to provide any conclusive evidence in support of such two-way feedback effects although long-run cointegrating relation has been found (e.g., Mah, 2005). Liu (2011) used VAR and vector error correction model (VECM) to discern the long-run relations between FDI and economic development in China and found FDI tended to decrease economic growth. Economic development in China seems to be fueled by domestic capital accumulation and employment and FDI inflows do crowd out domestic capitals, and reduce employment growth.

Earlier studies, however, have several limitations in common. First, the period of observation is typically too short to capture the effects of economic reforms and the subsequent boom in trade and FDI during the last 10 years or so. In the present study we show that this factor has significant influence on the results. Second, the econometric techniques employed (even in those studies which take into account the nonstationarity properties) are highly dependent on the results of testing for the cointegration relationships. Third, only bivariate relationship is studied in most of the previous studies, which may involve biases (Love and Chandra, 2005).

In this paper we avoid these methodological problems. We add to the existing literature by (1) using Johansen's (1988) cointegration technique and VAR to test the economic growth effect of openness by using annual time-series log-level data from 1985 to 2010. (2) using two dummy variables to identify the growth effect of trade and FDI policies. (3) taking into account the TFP effect of trade and FDI that allow for further effects on economic development.

3. An Overview of China's Economic Development

Beginning in 1979, China launched several economic reforms. The central government initiated price and ownership incentives for farmers, which enabled them to sell a portion of their crops on the free market. In 1980, the government established four special economic zones along the coast for the purpose of attracting foreign investment, boosting exports, and importing high technology products into China. In 1992 the government sought to decentralize economic policymaking in several sectors, especially trade. Economic control of various enterprises was given to provincial and local governments, which were generally allowed to operate and compete on free market principles, rather than under the direction and guidance of state planning. In addition, citizens were encouraged to start their own businesses. Additional coastal regions and cities were designated as open cities and development zones, which allowed them to experiment with free market reforms and to offer tax and trade incentives to attract foreign investment. In addition, together with a gradual reduction in tariff, removal of non-tarrif barriers and privatization of many state-owned enterprises, China accessed to the World Trade Organization (WTO) in the end of 2001, China state price controls on a wide range of products were gradually eliminated. Trade liberalization was also a major key to China's economic success. Removing trade barriers encouraged greater competition and boosted foreign direct investment flows.

3.1. China's Economic Growth Since Reforms

Since the introduction of economic reforms, China's economy has grown substantially. Figure 1 shows China's Real GDP and Average Annual Growth of GDP from 1980 to 2011. During the reform period, China's average annual real GDP grew by nearly 9.9%; it grew by 14.1% in 2007, but slowed to 9.6% in 2008. Since 1980, economic reforms helped to produce a 36-fold increase in the size of the economy in real terms and a 26-fold increase in real per capita GDP (NBSC, 2012).

China's economy suffered a sharp slow-down as a result of the global financial crisis in the late of 2008, largely due to a decline in foreign demand for Chinese imports and a drop-off in FDI in China.

3.2. An Overview of China's Trade

Economic reforms and trade and investment liberalization have helped transform China into a major trading power. Figure 2 shows China's Values and Share of Merchandise Exports and Imports from 1980 to 2011. Chinese exports rose from $14 billion in 1979 to $ 1899 billion in 2011, while imports over this period grew from $16 billion to $ 1744 billion. China's trade growth has been particularly rapid after accession to WTO. From 2002 to 2011, China's exports grew by 339%, a compound annual growth rate of 23.5%; while imports increased by 283%, a compound annual growth rate of 21.2% (NBSC, 2012).

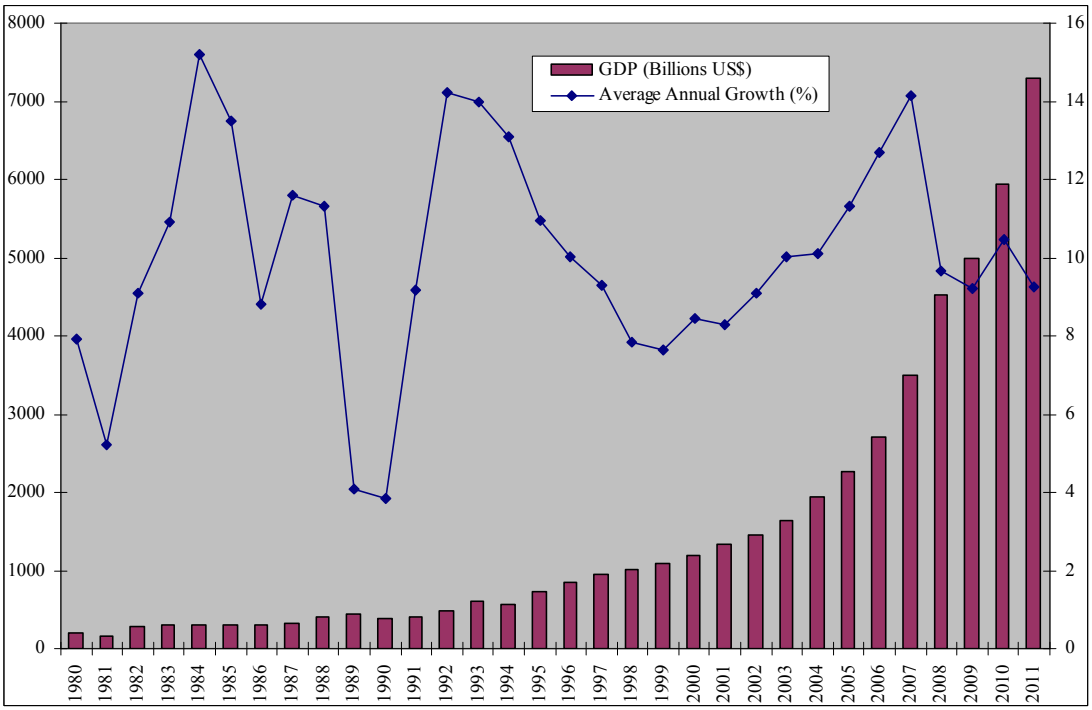
In 2007, China surpassed the United States as the world's second largest merchandise exporter, after Germany. In 2010, China was the world's the largest and was the second largest importer, after the United. China's trade surplus, which totaled $32 billion in 2004, surged to $155 billion in 2011.

Merchandise trade surpluses, large-scale foreign investment, and large purchases of foreign currencies to maintain its exchange rate with the dollar and other currencies have enabled China to accumulate the world's largest foreign exchange reserves at $3.2 trillion at the end of 2011, making it the world's largest holder of such reserves.

3.3. An Overview of China's FDI Inflows

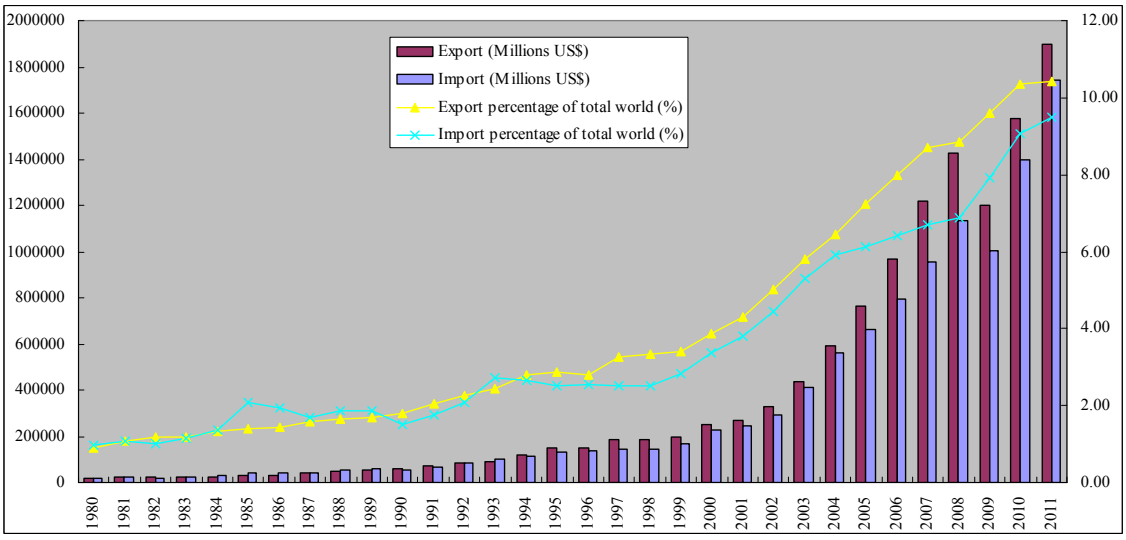
FDI inflows into China have increased rapidly over the last two decades. Before 1979, FDI was prohibited in China, a restriction which was lifted following the adoption of China's open door policy in 1979, when a new foreign investment law was adopted. In its early stages, FDI was restricted to China's Four Special Economic Zones and limited to equity joint ventures. In 1984, a new foreign investment law was adopted to accelerate FDI growth and a number of preferential policies were used by both central and local governments to attract FDI. A sharp increase occurred after 1992 when China reaffirmed policies of openness and market-oriented reforms introduced earlier.

As Figure 3 indicates, growth in China's inward FDI has been spectacular. In 1985, annual FDI inflows were less than US$2 billion; while in 2011, they were US$105.7 billion, 50 times those of 25 years earlier. Between 1985 and 1991, the annual growth rate of FDI inflows into China was 14%, and annual FDI inflows during this period remained less than US$4.5 billion. FDI inflows increased sharply to US$11 billion in 1992, with growth rates of over 150%.



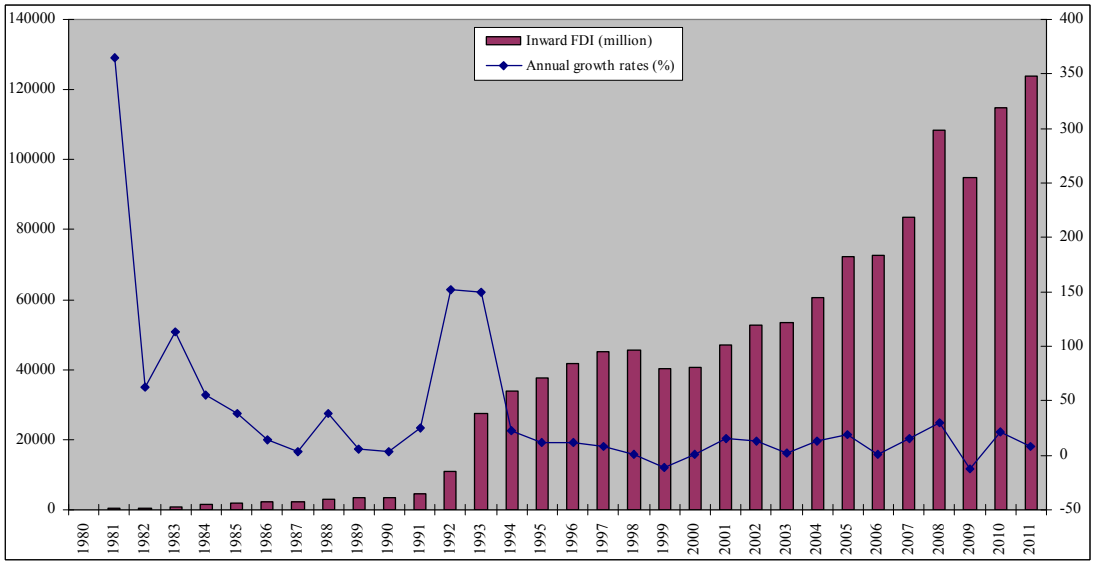
Source: International Monetary Fund, World Economic Outlook Database, April 2012

Figure 1. *China's Real GDP and Average Annual Growth, 1980-2011.*



Source: UNCTAD, UNCTAD stat.

Figure 2. *China's Values and Share of Merchandise Exports and Imports, 1980-2011.*



Sources: FDI inflows in billion US$ are from NBSC (2011); growth rates are calculated by authors.

Figure 3. *China's Inward FDI Flows and Their Annual Growth Rates, 1980–2011*

By 1997, China had FDI inflows of US$49 billion. Although the late 1990s saw a small decrease in FDI inflows, the annual growth rate of FDI inflows into China increased again to over 10% after China joined the WTO in 2001. During the three years 2001, 2002 and 2003, world FDI inflows declined sharply by 41%, 13% and 12% respectively, but China registered FDI growth of 15%, 13% and 1.4%. Global FDI inflows increased by only 2% in 2004, while China registered an inward FDI growth rate of 13% (NBSC, 2005). The global economic crisis began to impact China's FDI inflows in late 2008. China's inflows of FDI slowed to 3.6% in 2008 and to -1.8% in 2009. However, it recovered quickly in 2010. China's share of FDI inflows has thus increased sharply in recent years. China is now the world's largest developing country FDI recipient and the world's second largest FDI recipient overall after the US.

China's FDI inflows fall into two broad categories. One is horizontal FDI involving the transfer of production from abroad to China to service the Chinese internal market. The other is vertical FDI which seeks to take advantage of low cost production (and especially low wage rates) for export of products abroad. Most export-oriented FDI inflows originate from other Asia economies, including South Korea, Taiwan, and Hong Kong, and are in the vertical category which seeks to exploit low production costs. FDI flows from North America and Western Europe are more heavily in the horizontal category, which seeks to exploit the Chinese domestic market.

4. Methodology, Variables and Data

4.1. Methodology

Following the framework of Mankiw et al. (1992), we use Cobb-Douglas production function assuming marginal contribution of capital and labor in production. So production function in period t is given below:

$$Y(t) = A(t)K(t)^{\alpha} L(t)^{\beta} \tag{1}$$

Where $\alpha + \beta = 1$, $Y(t)$ is domestic output (GDP), $A(t)$ is technological progress (TFP), K is capital stock and L is employment population. Because of the constant scale return, production function can be written in per capita form:

$$y(t) = A(t)k(t)^{\alpha} \tag{2}$$

Where $y(t)$ is GDP per capita, $k(t)$ is capital stock per capita. We extend production function by assuming openness (FDI and Trade) contributes to economic growth directly. This shows that openness is contributing economic growth by efficient allocation of internal and external resources or attracting foreign direct investment. This leads us to model the empirical equation as follows:

$$y(t) = A(t)k(t)^{\alpha} fdi(t)^{\delta_1} trade(t)^{\delta_2} \tag{3}$$

Where $fdi(t)$ is FDI per capita, $trade(t)$ is Trade per capita. In addition to the direct impact of openness on economic growth, openness may impact on economic growth through TFP. This shows that openness is contributing TFP by shift of technological advancements from developed countries to developing economies. So the empirical equation is given below:

$$A(t) = \phi \cdot rfdi(t)^{\alpha} rtrade(t)^{\beta} \tag{4}$$

Where ϕ is constant term, $rfdi(t)$ is FDI Proportion, $rtrade(t)$ is Trade Proportion, $A(t)$ is TFP. Taking logs in both sides, Equation 3 and Equation 4 can be modeled as follows:

$$\ln y_t = \beta_0 + \beta_1 \ln k_t + \beta_2 \ln fdi_t + \beta_3 \ln trade_t + \mu_t \tag{5}$$

Where $\ln y_t$ is log of GDP per capita, $\ln k_t$ is log of capital

stock per capita, $\ln fdi_t$ is log of FDI per capita, $\ln trade_t$ is log of Trade per capita, μ_t is error term assumed to be constant.

$$\ln A_t = \beta_0 + \beta_1 \ln rfdi_t + \beta_2 \ln rtrade_t + \mu_t \quad (6)$$

Where $\ln A_t$ is log of TFP, $\ln rfdi_t$ is log of FDI proportion, $\ln rtrade_t$ is log of international trade proportion, μ_t is error term, which capture the impact of all the unobserved factors.

Based on the general model of the Equation 5 and Equation 6, cointegration regression model and ECM are used to investigate impact of openness on long-term economic growth and short-term economic fluctuation respectively, and a VAR model is estimated to capture dynamic details of the openness impact on economic growth. Furthermore, in order to study how openness impact on economic growth directly or through TFP in detail, we set up linear and non-linear regression with policy and interaction terms, and estimates it by using robust OLS method.

4.2. Variables and Data

Based on the objective of the study and Equation 5&6, a group of variables about openness and economic growth were considered in table 1. The variables used in empirical analysis are shown in table1. To estimate the effect of openness on economic growth, the models were estimated by using data for the period 1985-2010 from "China Statistical Yearbook (2011)" and "comprehensive statistic data and materials on 50 years of new China". In order to eliminate the impact of the price factor, all relevant data is adjusted by different price index based on 1985. For example, GDP is adjusted by GDP deflator Index, capital stock and FDI are adjusted by fixed assets price index, Import and export are adjusted by consumer price index etc.

The variable, capital stock, can be calculated by perpetual inventory method. According to the study of Guo and Jia (2004), the initial capital stock in 1985 is 1244.76 billion RMB and the rate of capital depreciation δ is 5%. Another variable, total factor productivity, can be obtained by formula:

$$\ln(FTP) = \ln(GDP) - \alpha Ln(K) - \beta Ln(L) \quad (7)$$

As to openness, there are several measures to quantify. To measure trade openness, exports per capita (exports divided by employment population) and exports proportion (exports divided by GDP), imports per capita (imports divided by employment population) and imports proportion (imports divided by GDP), trade per capita (sum of exports and imports divided by employment population) and trade proportion (sum of exports and imports divided by GDP) are used. To measure openness in investment market, two indicators are used: FDI per capita (FDI divided by employment population) and FDI proportion (FDI divided by total investment).

Other variables, such as policy variables, are based on the important policy tuning point, and are measured by dummy variable taking value between 0 and 1. Of course, in order to reduce skewness and kurtosia to a normal range, all service variables in empirical analysis were taken logs.

Table 1. *Summery of variables.*

Variables	Name	Definition
Economic growth variables		
Output	Y	Real GDP
Per capita Output	y	Real GDP/ Employment Population
Technological progress variable		
Total Factor Productivity	FTP	$Ln(FTP) = Ln(GDP) - \alpha Ln(K) - \beta Ln(L)$
Capital and labor variables		
Capital Stock	K	$K_t = I_t + (1-\delta)K_{t-1}$
Capital Stock Per capita	k	Capital Stock/ Employment Population
Employment Population	L	Employment Population
Openness variables		
FDI Per capita	FDI	FDI/ Employment Population
Trade Per capita	trade	Imports & Exports/Employment Population
Imports Per capita	import	Imports/ Employment Population
Exports Per capita	export	Exports/ Employment Population
FDI Proportion	rFDI	FDI/Total Investment
Trade Proportion	rtrade	Imports & Exports/GDP
Imports Proportion	rimport	Import/GDP
Exports Proportion	rexport	Export/GDP
Policy variables		
Establishing market economic system	D1	Dummy variable taking value between 0 and 1
Accessing WTO	D2	Dummy variable taking value between 0 and 1

5. Empirical Analysis

Given the important role played by openness in the Chinese economy growth. The main objectives of empirical analysis are as follows: first to examine the effect of Chinese openness on its long-term economic growth or short-term economic fluctuation, and second to examine dynamic effect of the openness impact on economic growth, and third, to examine how openness impacts on economic growth with policy variable in detail, and last, to examine how openness impacts on Economic Growth through total factor productivity with interaction of FDI and trade in detail.

Before empirical analysis, the assumption of constant scale return should be examined. So First we will estimate a log-transformed Cobb-Douglas production function model by OLS:

$$\ln(Y) = -2.75 + 0.73\ln(K) + 0.46\ln(L) \quad (8)$$

t-statistic (20.47)*** (2.34)**

Notes: The 1%, 5% and 10% levels of significance are indicated by ***, ** and * respectively.

Table 2. *Result of constant scale return test*

Null Hypothesis	F-statistic	probability
$\alpha + \beta = 1$	2.387	0.1360

The assumption of constant scale return is examined by Wald coefficient restrictions test. Table 2 presents the null hypothesis of constant scale return is accept. This indicates that the constant scale return exists in Chinese economy from 1985-2010. So we can use Cobb-Douglas production

function in per capita form.

5.1. Conintegration Analysis and ECM Models

5.1.1. Conintegration Analysis

As the selected variables are all time series data, we need do variables stationary test. In this paper, we use ADF test proposed by Dickey and Fuller (1981) to do unit root test for each variable. Table 3 presents all original variables were not stationary, but variables in the first-order differential were stationary. Therefore, all variables clearly turn out to be ~I(1), they are integrated of order one.

To examine the long-term cointegration relationship among multi-variables, VAR-based multi-variables Johansen cointegration test method is mainly used. So the lag order of VAR should be determined before cointegration analysis. According to the AIC and SC criteria, the final lag order is 2.

Table 4 presents the null hypothesis of cointegration vector is rejected at the 5% significance level. There exists cointegration relationship among these variables. Based on the equation 5, we can get the following cointegration regression equation:

$$\ln(y) = -0.368 + 0.63\ln(k_t) + 0.048\ln(fdi) + 0.064\ln(trade) \quad (9)$$

t-statistic (16.71)*** (4.34)*** (2.15)**

$$\overline{R}^2 = 0.9979$$

Notes: the 1%, 5% and 10% levels of significance are indicated by ***, ** and * respectively.

Table 3. *Results of unit root test.*

Variable	Data generation process	ADF-statistic	1% Critical Value	5%Critical Value	10% Critical Value
$\ln(y)$	（C，T，1）	-2.199290	-4.394309	-3.612199	-3.243079
$\Delta\ln(y)$	（C，T，1）	-2.199290***	-4.394309	-3.612199	-3.243079
$\ln(k)$	（C，T，5）	-5.230589	-4.498307	-3.6584469	-3.268973
$\Delta\ln(k)$	（C，T，2）	-4.002130**	-4.440739	-3.632896	-3.254671
$\ln(fdi)$	（C，T，5）	-3.036018	-4.498307	-3.658446	-3.268973
$\Delta\ln(fdi)$	（C，T，4）	-4.538906***	-4.498307	-3.658446	-3.268973
$\ln(trade)$	（C，T，0）	-1.977280	-4.374307	-3.603202	-3.238054
$\Delta\ln(trade)$	（C，T，0）	-4.023122**	-4.394309	-3.612199	-3.243079

Notes: The 1%, 5% and 10% levels of significance are indicated by ***, ** and * respectively; the data generation process (c, t, n) represents the constant term, time trend, and lag length respectively.

Table 4. *Results of Johansen cointegration test.*

Hypothesized	Eigenvalue	Trace Statistic	5% Critical Value	probability
r=0 *	0.792358	77.65838	55.24578	0.0002
r≤1*	0.660496	41.50373	35.01090	0.0089
r≤2	0.512142	16.65751	18.39771	0.0862
r≤3	0.006487	0.149694	3.841466	0.6988

Notes: The 5% levels of significance are indicated by *.

The residuals of cointegration regression equation were stationary series by unit root test, and it's value fluctuated around zero, verified the cointegration relationship among the variables is correct.After finding the existence of cointegration between the economic growth and openness, the next task is to explore the long run marginal effects of FDI and trade on economic growth in the case of Chinese. The results documented in equation 8 shows that FDI is positively linked to economic growth and it is statistically significant at 1% significance level. It implies that keeping other things constant, a 0.048% economic growth is stimulated by a 1% growth in FDI. The effect of trade on economic growth is also positive and statistically significant at 5% level. A 0.064% increase in economic growth is due to a rise in 1% in trade keeping all else the same. The coefficient of k shows a positive effect on economic growth. A 1% increase in capitalization raises economic growth by 0.63%. The results show that both FDI and trade have significant impact on economic growth, the impact of trade on economic growth is greater than FDI. This implies that Chinese can attain fruitful effects of openness to sustain economic growth for long span of time by configuring internal and external resource and attracting foreign direct investment. Cointegration regression equation fits very well and eliminating the autocorrelation by using Newey-West HAC Standard Errors & Covariance. Overall, the results of the model estimation are satisfactory.

5.1.2. A Model of ECM

Cointegration regression equation describes the long-term relationship among the variables, and the error correction model describes the short-term relationship among the variables. The error correction model is proposed at first by Sargan (1964) and is further complemented by Hendry-Anderson (1977) and Davidson (1977). According to Granger causality theorem, there must exist the error correction among cointegration variables. So the error correction model can be used to study the impact of openness on short-term economic fluctuation.

$$\begin{aligned}\Delta\text{Log}(y_t) &= -0.016 + 0.787\Delta\text{Log}(k_t) + 0.034\Delta\text{Log}(fdi) \\ &+0.038\Delta\text{Log}(trade_t) - 0.571ecm_{t-1}\end{aligned} \quad (10)$$

t-statistic (10.99)*** (1.72) (1.31) (3.20)***

$$\overline{R}^2 = 0.8535$$

Notes: the 1%, 5% and 10% levels of significance are indicated by ***, ** and * respectively.

Equation 10 reveals the results of ECM models with impact of openness on short-term economic fluctuation. The coefficient of FDI and trade is not significant at 10% significance level. This shows that both trade and FDI have no significant effects on short-term economic fluctuations. It implies that openness have no effect on short-term economic fluctuation. The coefficient of ecm is -0.571, which shows that about 57.1% of the gap between actual output and equilibrium output is corrected each year. The effect of capital stock on economic fluctuation is statistically significant at 1% level. This shows other things remain the same, 0.787% economic fluctuation is caused by changing 1% of capital stock. It implies that capital stock has greater impact on both long-term economic growth and economic fluctuation.

5.2. VAR Model with Dynamic Impact of Openness on Economic Growth

Cointegration analysis presents the static characters of impact of openness on economic growth. To capture dynamic details of the openness impact on economic growth. We set up a VAR proposed by Sims (1980) and estimate it for impulse response analysis. According to equation 5, the identification of openness shocks within VAR model can be dealt with, The model includes the main variables through which openness and economic growth interact: log(y), log(k), log(FDI) and log(trade).

Let's focus on the impulse responses of economic growth to FDI and trade shock respectively (shown in figure 4). The response of economic growth to FDI shock is positive, when one S.D innovation is given to FDI in current period, economic growth will increase 0.00461. Thereafter, the intensity of impact is gradually enhanced at first, and then weakened after reaching its peak (0.0302) at sixth period. The response of economic growth to trade shock is positive at fist, when one S.D innovation is given to trade in current period, economic growth will increase 0.0177. Thereafter the intensity of impact presents sinusoidal shape, and becomes negative at the sixth period. Comparing the response of economic growth to FDI and trade shock, we can conclude that the response of economic growth to trade shock is stronger than the FDI shock at first, but Starting from the fourth period, the response of economic growth to FDI shock is stronger than the trade shock, furthermore, FDI shcok has a longer period positive impact on economic growth than trade shock.

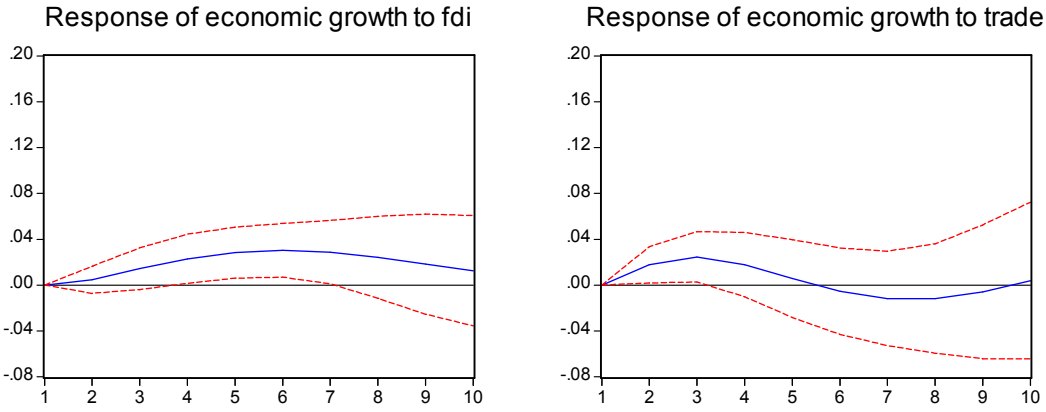


Figure 4. *The Effect of FDI Shock (Left) and Trade Shock (Right) On Economic Growth.*

5.3. Regression by Adding Policy Variables

Although the impact of openness on economic growth is preliminary analyzed, but this is not detailed enough. First, trade can be divided into imports and exports in detail, and second, openness may impact on economic growth through policy interaction.

So we designed four models including FDI model, Trade model, Imports model and Exports model to explain how openness impact on economic growth in detail. In each model, there are three liner regressions: the first is the baseline regression without policy variables, and the second is the regression with policy dummy variable D1, and the third is regression with policy dummy variable D2. In order to improve the robustness of the estimation, the autocorrelation of each model is eliminated by adding AR terms or using Newey-West HAC Standard Errors & Covariance.

Policy dummy variable is based on the important policy turning point. There are two important policy turning point since 1985: one is China established the socialist market economic system in1992, the other is China access to the WTO at the end of 2001. So we can design two policy dummy variable named D1 and D2. The definitions of policy dummy variables are as follows:

$$D_1 = \begin{cases} 0 & 1985-1991 \\ 1 & 1992-2010 \end{cases} \tag{11}$$

$$D_2 = \begin{cases} 0 & 1985-2001 \\ 1 & 2002-2010 \end{cases} \tag{12}$$

Table 5 shows the results of each model. In FDI model, FDI is positively linked to economic growth and it is statistically significant at 1% significance level. It implies that keeping other things constant, a 0.059-0.073% economic growth is stimulated

by a 1% growth in FDI. The interaction between D1 and FDI is not significant at any significance level, but the interaction between D2 and FDI is significant at 10% significance level. It implies that China's accession to WTO has greater effect on FDI and hence economic growth, however, establishing socialist market economic system doesn't any matter. The possible reason for this is that China's accession to WTO adds the confidence of foreigner's investors, thereby increases the foreign direct investment, however, due to the distrust of China's market reform, establishing socialist market economic system in China failed to enhance the confidence of foreigner's investors. The coefficient of the interaction terms between D2 and FDI is negative. This implies that with the rapid growth of FDI after China's accession to WTO, although the impact of FDI on economic growth is still positive, but its marginal effect is weakened.

In trade model, imports model and exports model, the impact of trade, import and export on economic growth is positive and it is statistically significant. This shows that the improvement of trade, import and export stimulated economic activity and hence economic growth. Comparing the imports model and exports model, the coefficient of export is larger than import. This implies that the effect of export on economic growth is greater than import. The interaction terms- D1 and trade, D1 and import, D1 and export is significant at 5% significance level, however the interaction terms- D2 and trade, D2 and import, D2 and export is not significant at any significance level. It implies that establishing socialist market economic system has greater effect on trade, import, export and hence economic growth; however, China's accession to WTO doesn't any matter. The possible reason for this is that in 1992 when china starts establishing socialist market economic system, Chinese government carried out a number of reforms involving in exchange rate, foreign trade and financial etc, which promote international trade, however by the end of 2001 when China access to the WTO, these reforms were almost completed, which limited to promote international trade. The coefficient of the interaction terms- D1 and trade, D1 and import, D1 and export- are all negative. This implies that with the rapid growth of trade, import and export after establishing socialist market economic system in China, although the impact of trade, import and export on economic growth is still positive, but their marginal effect is weakened.

5.4. Regression with Impact of Openness on TFP by Adding Interaction Terms

Except the direct impact of openness on economic growth, openness may impact on economic growth through total factor productivity.

Table 5. *Models of Openness and Economic growth, Includes Policy Variables*

Dependent Variable=lny												
Variables	**FDI model**			**Trade model**			**Imports model**			**Exports model**		
	(1)	**(2)**	**(3)**	**(1)**	**(2)**	**(3)**	**(1)**	**(2)**	**(3)**	**(1)**	**(2)**	**(3)**
Constant	-0.369	-0.394	-0.441	-0.503	-0.594	-0.498	-0.495	-0.534	-0.498	-0.453	-0.592	-0.442
	(4.52)***	(3.60)***	(10.06)***	(6.68)***	(9.46)***	(7.04)***	(4.61)***	(5.78)***	(4.48)***	(4.85)***	(7.51)***	(4.58)***
lnk	0.683	0.685	0.667	0.626	0.663	0.625	0.64	0.656	0.639	0.631	0.678	0.63
	(34.99)***	(32.78)***	(28.79)***	(10.36)***	(15.85)***	(10.67)***	(10.78)***	(14.86)***	(10.56)***	(10.69)***	(17.37)***	(10.51)***
ln(FDI)	0.073	0.069	0.059	—	—	—	—	—	—	—	—	—
	(3.88)***	(3.52)***	(5.53)***									
D1×ln(FDI)	—	-0.0019	—	—	—	—	—	—	—	—	—	—
		-0.38										
D2×ln(FDI)	—	—	-0.0107	—	—	—	—	—	—	—	—	—
			(1.84)*									
ln(trade)	—	—	—	0.114	0.085	0.116	—	—	—	—	—	—
				(2.30)**	(2.32)**	(2.50)**						
D1×ln(trade)	—	—	—	—	-0.0281	—	—	—	—	—	—	—
					(2.95)***							
D2×ln(trade)	—	—	—	—	—	0.0033	—	—	—	—	—	—
						-0.15						
ln(import)	—	—	—	—	—	—	0.088	0.086	0.088	—	—	—
							(2.25)**	(2.30)**	(2.17)**			
D1×ln(import)	—	—	—	—	—	—	—	-0.0203	—	—	—	—
								(2.77)**				
D2×ln(import)	—	—	—	—	—	—	—	—	-0.0028	—	—	—
									-0.24			
ln(export)	—	—	—	—	—	—	—	—	—	0.104	0.065	0.107
										(2.51)**	(1.96)*	(2.58)**
D1×ln(export)	—	—	—	—	—	—	—	—	—	—	-0.0237	—
											(2.97)**	
D2×ln(export)	—	—	—	—	—	—	—	—	—	—	—	0.0046
												-0.26
Adj- R^2	0.9989	0.9989	0.9979	0.9954	0.9985	0.9952	0.9982	0.9986	0.9981	0.9953	0.9984	0.9952

Notes: Numbers in parentheses are t-statistic, the 1%, 5% and 10% levels of significance are indicated by ***, ** and * respectively.

Table 6. *Models of Openness and TFP, Includes Interaction Terms.*

Dependent variable=ln(TFP)							
variables	**Trade & FDI model**			**Import & FDI model**		**Export & FDI model**	
	(1)	**(2)**	**(3)**	**(1)**	**(2)**	**(1)**	**(2)**
Constant	-0.7744 (23.24)***	-0.8106 (41.51)***	-0.753 (24.19)***	-0.7715 (26.64)***	-0.7483 (28.26)***	-0.7592 (28.90)***	-0.7388 (30.71)***
ln(rtrade)	0.0135 -1.61	0.0037 -0.84	0.0074 -0.91	—	—	—	—
ln(rimport)	—	—	—	0.0158 -1.76	0.00755 -0.87	—	—
ln(rexport)	—	—	—	—	—	0.0115 -1.47	0.0044 -0.58
ln(rtfp)	0.0143 (3.68)***	0.0999 (4.63)***	—	0.0145 (3.79)***	—	0.0141 (3.58)***	—
ln(rtrade)×ln(rFDI)	—	—	0.004 (3.76)***	—	—	—	—
ln(rimport)×ln(rFDI)	—	—	—	—	0.0051 (3.88)***	—	—
ln(rexport)×ln(rFDI)	—	—	—	—	—	—	0.0048 (3.66)***
ln(rFDI)×ln(rFDI)	—	-0.0226 (4.05)***	—	—	—	—	—
Adj-R^2	0.42	0.64	0.43	0.44	0.44	0.41	0.42
F-statisic	4.81***	6.91***	4.95***	5.04***	5.21***	4.63***	4.77***

Notes: Numbers in parentheses are t-statistic, the 1%, 5% and 10% levels of significance are indicated by ***, ** and * respectively.

So we designed three models to explain how openness impact on economic growth through TFP in detail. In Trade & FDI model, considering the non-linear relationship and interaction between variables, there are three regressions: the first is the linear regression without interaction terms, and the second is the non-linear regression by adding FDI square terms, and the third is linear regression with interaction terms. In Imports & FDI model and Exports & FDI model，each model has two linear regressions：the first is the linear regression without interactions, and second is the linear regression with interaction terms. Of course, in order to improve the robustness of the estimation, the autocorrelation of each model is eliminated by adding AR terms or using Newey-West HAC Standard Errors & Covariance.

Table 6 shows the results of each model. In each model, FDI is positively linked to TFP and it is statistically significant at 1% significance level, but trade, import and export is not significant at any significance level. It implies that increase the proportion of FDI in total investment can spur TFP and hence stimulate economic growth, however increase the proportion of trade, import, export in GDP have no effect on TFP. The possible reason for this is that FDI may help China in introducing advanced technology and enhancing skilled labor, which can increase TFP through technology diffusions and spillover effects. In the first linear regression of Trade & FDI model, FDI have a linear positive effect on TFP, but FDI impacting on TFP may be in non-linear way. So we estimated the non-linear regression with FDI square term. According to the results which are shown in the second non-linear regression of Trade & FDI model, we found 9.12% is the appropriate proportion of FDI in total investment. It implies that the reasonable structure of domestic and foreign investment is necessary for china to spur TFP and hence sustain economic growth.

The results of interactions between FDI and indicators of trade openness are also shown in table 6. The coefficient of interactions between trade and FDI, import and FDI, export and FDI are 0.0040, 0.0051 and 0.0048 respectively. This shows that all integrations have positive effect on TFP and it is statistically significant at 1% significance level. It implies that the interaction term between import and FDI has greater impact on TFP. The possible reason for this is that Chinese imports more than 60% share of manufacture items of total imports that help an economy in attracting foreign direct investment which impact on TFP and hence economic growth positively. This implies that China can attain fruitful effects of trade openness to stimulate TFP and hence economic growth by furthering foreign direct investment in the country.

6. Conclusion

Openness promotes economic growth through various channels e.g., achieving efficiency in allocation of internal and external resource due to trade policies; attracting foreign direct investment; enhancing total factor productivity through creating FDI and trade openness integration, to name a few. In line with the theoretical arguments, the present study examines how openness impact on Chinese economic growth and whether openness can sustain Chinese economic growth. Using Cobb–Douglas production function framework of Mankiw et al. (1992), the paper includes economic growth, TFP and four indicators of openness [FDI, exports, imports and trade (exports+imports)], and uses this specification to derive meaningful results, thereby contributes to the literature of openness and economic growth.

According to the results of empirical analysis, we can get

the following findings: first, there exists long run relationship between trade, FDI and economic growth, both FDI and Trade have positive impact on long-term economic growth and no effect on short-term economic fluctuation; and second, although the impact of trade to economic growth is greater than FDI at the beginning，but from the whole period, the impact of FDI to economic growth presents greater interaction strength and length than Trade; and third, Interactions between FDI, trade openness and policy have significant impact on economic growth, and with the rapid growth of FDI and Trade, their marginal effect on economic growth is reduced; and last, the impact of FDI on TFP is positive, and with the interaction of FDI, trade openness also presents positive effect on TFP.

The findings suggest that openness is becoming an important drive force of Chinese economic growth. It is necessary for Chinese government to manage openness to sustain its' economic growth. First, the government should pay more attention on foreign investment market openness, and hence further foreign direct investment which can obtain more fruits in spurring TFP and stimulating economic growth; and second, the government should continue the market-orient reforms and play a more important role in WTO, thereby promoting trade openness and increasing the confidence of foreign investors; and last, the government should control the scale of FDI and trade, and focus on improving the quality and structure of FDI and trade.

The global economic crisis began to impact China's economy through FDI and trade in late 2008. Higher trade dependence and lower proportion of FDI in total investment have brought a number of difficult challenges to Chinese economy. For example, in 2010, the trade dependence has reached more than 50%, while the proportion of the foreign direct investment in total investment is 2.57%, which dramatically deviate from its' reasonable value (9.12%). So under the uncertain international economic situations, improving the quality and structure of FDI and trade may be a better choice for Chinese government.

Appendix

Appendix 1. *China's Average Annual Real GDP Growth, GDP and GDP per capita, 1980-2011.*

Years	Average Annual Growth (%)	GDP (Billions US$)	GDP per capita (Units US$)	Years	Average Annual Growth (%)	GDP (Billions US$)	GDP per capita (Units US$)
1980	7.91	202.46	205.12	1996	10.01	856.08	699.48
1981	5.20	168.37	168.25	1997	9.30	952.65	770.59
1982	9.10	281.28	276.70	1998	7.83	1,019.48	817.15
1983	10.90	301.8	292.99	1999	7.62	1,083.28	861.21
1984	15.20	310.69	297.72	2000	8.43	1,198.48	945.60
1985	13.50	307.02	290.05	2001	8.30	1,324.81	1,038.04
1986	8.80	297.59	276.81	2002	9.08	1,453.83	1,131.80
1987	11.60	323.97	296.41	2003	10.03	1,640.96	1,269.83
1988	11.30	404.15	364.01	2004	10.09	1,931.65	1,486.02
1989	4.10	451.31	400.44	2005	11.31	2,256.92	1,726.05
1990	3.84	390.28	341.35	2006	12.68	2,712.92	2,063.87
1991	9.18	409.17	353.27	2007	14.16	3,494.24	2,644.56
1992	14.24	488.22	416.68	2008	9.64	4,519.95	3,403.53
1993	13.96	613.22	517.41	2009	9.21	4,990.53	3,738.95
1994	13.08	559.22	466.60	2010	10.45	5,930.39	4,421.00
1995	10.93	727.95	601.01	2011	9.24	7,298.15	5,413.57

Source: International Monetary Fund, World Economic Outlook Database, April 2012

Appendix 2. *China's Values and share of merchandise exports and imports, 1980-2011.*

Year	Export (Millions US$)	Percentage of total world (%)	Import (Millions US$)	Percentage of total world (%)	Year	Export (Millions US$)	Percentage of total world (%)	Import (Millions US$)	Percentage of total world (%)
1980	18099	0.89	19941	0.96	1996	151048	2.79	138943	2.53
1981	22007	1.09	22015	1.06	1997	182792	3.27	142189	2.50
1982	22321	1.18	19285	0.99	1998	183712	3.34	140305	2.49
1983	22226	1.20	21390	1.13	1999	194931	3.41	165788	2.83
1984	26139	1.33	27410	1.36	2000	249203	3.87	225024	3.38
1985	27350	1.39	42252	2.08	2001	266098	4.30	243553	3.79
1986	30942	1.44	42904	1.93	2002	325596	5.03	295170	4.43
1987	39437	1.56	43216	1.67	2003	438228	5.79	412760	5.31
1988	47516	1.65	55268	1.86	2004	593326	6.46	561229	5.92
1989	52538	1.70	59140	1.85	2005	761953	7.25	660206	6.11
1990	62091	1.78	53345	1.49	2006	969380	7.99	791797	6.40
1991	71910	2.05	63791	1.76	2007	1217790	8.69	956233	6.70
1992	84940	2.25	80600	2.08	2008	1428660	8.85	1131620	6.86
1993	91744	2.43	103959	2.71	2009	1201790	9.60	1004170	7.91
1994	121006	2.80	115637	2.64	2010	1578270	10.34	1396200	9.05
1995	148780	2.87	132079	2.52	2011	1899180	10.43	1742850	9.48

Source: UNCTAD, UNCTADstat.

Appendix 3. *China's inward and outward foreign direct investment flows, 1980-2011.*

Year	Inward (millions)	Outward (millions)	Year	Inward (millions)	Outward (millions)
1980	57	-	1996	41725.52	2114
1981	265	-	1997	45257.04	2562.49
1982	430	44	1998	45462.75	2633.807
1983	916	93	1999	40318.71	1774.313
1984	1419	134	2000	40714.81	915.777
1985	1956	629	2001	46877.59	6885.398
1986	2243.73	450	2002	52742.86	2518.407
1987	2313.53	645	2003	53504.7	2854.65
1988	3193.68	850	2004	60630	5497.99
1989	3392.57	780	2005	72406	12261.17
1990	3487.11	830	2006	72715	21160
1991	4366.34	913	2007	83521	22468.86
1992	11007.51	4000	2008	108312	52150
1993	27514.95	4400	2009	95000	56530
1994	33766.5	2000	2010	114734	68811
1995	37520.53	2000	2011	123985	65117

Source: UNCTAD, UNCTADstat.

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