Foreign Direct Investment and

Economic Growth in

China's Regions, 1979-2003

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Summary

From 1978 to 2007, China has gone through 30 years of exciting economic development and social changes. In this thirty-year period, China's gross domestic product (GDP) increased from 0.36 trillion RMB to about 24 trillion RMB in current prices, or a 14 fold increase in constant prices. On a per capita basis, real GDP increased over ten fold during the same period. It is predicted that China will overtake Germany to become the world's third largest economy in 2007 or 2008. In 2006, China became the world's third largest exporter, moving from the 23rd place in the world ranking in 1978. By 2010, China will become the world's largest exporter, overtaking both the US and Germany. From 1994, China has been the largest host country of foreign direct investment in the developing countries and the second largest in the world after the US. Over 1979-2006, China accumulated a FDI stock of $692 billion. The total trade volume in 2006 was $1.76 trillion, generating a surplus of $177 billion. By November 2007, China had accumulated a foreign exchange reserve of $1.45 trillion, which was the largest in the world.

The emergence of China has probably induced the most profound impact on the global social, economic and political order in world development history as the momentum of China's economic growth is predicted to last for at least another two to three decades.

Economic development in China over the last thirty years can be divided into two main stages. The first stage was from 1978 to 1991, when the economic development strategy was characterized by institutional reforms in agriculture and industry. Agricultural reform began with the introduction of the rural household production responsibility system in 1978. By 1984, rural reform had made remarkable achievements in grain output, farm income, land productivity, and above all, poverty reduction. The success of

agricultural reform provided a solid foundation for the reforms in the industrial and urban sectors, starting from the early 1980s. As the urban industrial economy was dominated by state ownership, especially the state-owned enterprises, similar reforms methods that were proved successful in the countryside such as the production responsibility did not work very well in the cities. As a result, urban and industrial reforms encountered far more complication and difficulty in the 1980s and 1990s. To break the iceberg of the traditional Chinese planned system, opening was an important strategy of Deng Xiaoping to change the urban industrial economy to a market-oriented system. This was why China began with four special economic zones and 14 open coastal cities in the 1980s to experiment with capitalism and market in order to demonstrate that state-ownership and socialist planning can be substituted by, or at least supplemented with market capitalism.

The second stage of China's economic reform started from 1992 after Deng Xiaoping made his tour to South China to encourage the people in the south, especially in Guangdong, to move faster towards a more open and market-oriented economy, allowing the inflow of foreign capital in large scale. Only after 1992 did foreign direct investment (FDI) become a significant phenomenon in China's economic growth. Before 1992, FDI was allowed in the special economic zones and open coastal cities on an experimental basis. The amount of FDI was small because the government and the people did not have experiences in attracting foreign capital and were afraid that FDI could change the nature of the socialist state and the nature of the communist party. However, the difficulty in reforming the state-owned industrial sector also meant that if the government did not allow foreign capital to flow into China, it would have been impossible to achieve the reform objectives, one of which was to increase China's international competitiveness and industrial productivity.

In short, economic reforms during 1978-92 can be regarded as reforms of domestic institutions and reforms after 1992 can be regarded as openness, export-push and globalization. One of the key elements of reforms after 1992 is FDI. The role of FDI in China's economic development is not necessary to make up the shortfall of investments in the country as China has maintained a high saving rate since economic reforms. The most important contributions of FDI to the Chinese economy include technological transfer, competition, and export promotion. This thesis uses the most up-to-date and comprehensive data covering all the Chinese provinces over the period 1979-2003 to examine how FDI has contributed to economic growth. The growth models and the empirical results prove the following two important hypotheses: (1) FDI is a mover of production efficiency. It means that the presence of FDI helps domestic firms to reduce production inefficiency. (2) FDI is a shifter of the domestic production frontier. This means that FDI can help China to move to a higher technological production frontier so that for the same amount of inputs, China is able to produce more outputs, *ceteris paribus*, because the embedded technologies in FDI have brought about new technologies, production processes and management that were not existent within the country before.

In the literature, few researchers have argued against the positive contribution of FDI to economic growth in China, but many have argued that FDI must have contributed to the rising income inequality, especially regional income inequality in the country. One important problem emerging from China's fast economic growth over the past three decades is the ever rising income inequality. Spatial inequality is an important part of total inequality. It happens that the pattern of this inequality is coincided with the pattern of FDI distribution. The east region has taken a lion's share of FDI whilst the

inland regions assume a small portion. This thesis analyses both the patterns of income and FDI distribution across the provinces. It suggests that FDI cannot be blamed for regional inequality. Instead, it is the unequal distribution of FDI that has been responsible for the rising regional inequality. Consequently, the government should encourage, rather than discourage FDI to reduce regional income inequality, but the inflows of FDI must be directed more towards to the inland regions in the future.

Another part of this thesis is to identify the main determinants of FDI in China. It is shown that market size, measured by GDP, infrastructure, population density, human capital, exchange rate, location and government policies are important factors influencing the inflows of FDI into China.

The main conclusions in this thesis are as follows: (1) Fast economic growth in China has been helped by the massive inflows of FDI. (2) FDI helped domestic firms in improving competition and productivity. FDI also helped improving China's technological progress. Over the period 1979-2003, total factor productivity in China increased about 4% per annum and the contribution of FDI was roughly one-third of this productivity growth. Technological progress in China exhibits a two-steps waterfall shape, coming down from more than 4% in the east, to less than 2% in the central, and to less than 1% in the west. (3) FDI cannot be blamed for the rising regional inequality in China. FDI should be encouraged, especially in the inland areas, to promote growth and to reduce regional inequality. (4) FDI inflows have been affected by many factors, among which government policies and macro-economic environment are important. To promote FDI, the relatively backward areas in the west and the central regions should be given more preferential policies, including taxation, infrastructure and education.

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Acronyms

ADF: Augmented Dickey-Fuller (test)
BOP: Balance of Payments
BSM: Barro and Sala-i-Martin
CD: Cooperative Development
COEs: Cooperative Operation Enterprises
CV: coefficient of variation
DI: Domestic investment
ECM: error-correction mechanism
EP: export-push
EU: European Union
FDI: Foreign Direct Investment
FIEs: Foreign Investment Enterprises
FISEs: Foreign Investment Share Enterprises
GDP: Gross Domestic Product
GMM: Generalized method of moments
GPT: General purpose technologies
HPRS: household production responsibility system
IS: import substitution strategy
JVEs: Joint Ventures Enterprises
KO: Knowles and Owen
LDCs: Less Developed Countries
LSDV: The least squares dummy variable (model)
M&As: Mergers and acquisitions
MNCs: multinational companies
MNEs: multinational enterprises
MRW: Mankiw, Romer and Weil
NBS: National Bureau of Statistics
NIEs: Newly Industrialized Economies
NMP: net material product
OLI: ownership, location, and internalization advantages.
OLS: ordinary least squares
PRC: People's Republic of China
PPP: purchasing power parity
R&D: research and development
R GDP: Real Gross Domestic Product
RMB: *ren min bi*
SEZs: Special Economic Zones
SOEs: state-owned enterprises
TFP: total factor productivity
TVEs: Township and Village Enterprises
WTO: World Trade Organization

Declaration

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Chapter 1 Introduction

1.1 Background

Since the 1980s, the globalization of economic activities has markedly expanded. This indicates world trade and financial markets are becoming more integrated and different countries ever more interdependent. As one of the most important manifestations of globalisation, similar to international trade, foreign direct investment (FDI) worldwide has been expanding dramatically with increasing liberalisation. FD1 inflows in the world increased from $55.27 billion in 1980 to $201.6 billion in 1990, peaking at $1.41 trillion in 2000. Thereafter, FDI started decreasing to reach $557.87 billion in 2003. However, it rebounded by 27% to $710.76 billion in 2004 and by a further 29% to $916.28 billion in 2005, bringing the total stock to $10.13 trillion, compared with only $1.79 trillion in 1990 (UNCTAD, 2006). As for its distribution, developed countries still received most of the FD1 inflows. In 2005 for example, they received $542 billion, taking up 59% of the total FDI inflows worldwide, while developing countries took $334 billion, the highest level ever recorded, accounting for 36% of the world's total value. FD1 grew in all of the main sub-regions, while rising to unprecedented levels in some areas, and increased in 126 out of the 200 economies covered by the United Nations Conference on Trade and Development. The recent upsurge in FDI reflects a greater level of cross-border mergers and acquisitions (M&As), especially among developed countries. It also reflects higher growth rates in some developed countries as well as strong economic performances by many developing and transition economies (UNCTAD, 2006).

In terms of economic growth, the total nominal gross domestic product (GDP) for the world, developed and developing countries, increased from $11.86 trillion, $8.2 trillion and $2.61 trillion in 1980 respectively to $22.06 trillion, $17.30 trillion and $3.81 trillion in 1990 and $44.48 trillion, $33.31 trillion and $9.96 trillion in 2005, implying an annual average growth rate of 2.68%, 2.67% and 4.52% during the 1980-2005 period, and 2.83%, 2.45% and 4.74% from 1900 to 2005 (UNCTAD, 2006). These figures show a slight decline in the growth rate of developed countries, compared with a gradual growth in developing countries that has mainly contributed to the overall growth in the world.

The massive increase of FDI worldwide over the past decades has drawn serious attention. The theoretical and empirical literature focused on the causal relationship between FDI inflows and economic growth in the host country. Economic theory provides two approaches to studying the effects of foreign direct investment (FDI) on host countries. One approach, founded by MacDougall (1960), is derived from the theory of international trade. It examines the gains by the host country directly from foreign investment (direct and portfolio) in terms of factor rewards, employment, and capital flows. The other approach, pioneered by Hymer (1960), follows from the theory of industrial organization. Other important contributions have been made by Buckley and Casson (1976), Caves (1971), Dunning (1973), Kindleberger (1969), and Vernon (1966). This approach states that firms invest abroad as a result of some imperfection in the markets for goods or factors, including technology, or some interference of competition by governments or firms, generally focusing on the indirect effects, externalities, or spillovers. The external effects or spillovers from FDI can be attributed to two factors (Blomstrom and Sjoholm, 1999). Firstly, multinational enterprises (MNEs) compete successfully with local firms with newer and more advanced technology. Secondly, local firms are thus forced to change their financing methods, marketing and production techniques, as well as managerial skills to increase their

productivity and growth in order to maintain their market shares and profits after the entry of MNEs.

To provide a foundation for evaluating policy measures in empirical study, scholars have tried to demonstrate the positive or negative effects of FDI on host countries. Even though there is no clear consensus as yet, for both developing (e.g. Haddad and Harrison 1993, Aitken and Harrison 1999) and transition economies (e.g. Djankov and Hoeckman 1998, Konings 2001), a few studies have investigated under which conditions such externalities arise. In these cases, the general belief is that the negative effects are, usually, outweighed by the positives ones (UNCTAD, 2001). For long-run economic growth, existing literature has primarily focused on capital accumulation and technological progress. In the context of increasing domestic capital stock, and as a way of transferring technology, FDI plays a special role. The recent developments in endogenous growth literature tend to suggest that long-run growth can result from more open and liberalized government policies, which are conducive for foreign capital inflow. Inflow of FDI can be an important vehicle for technological change and accumulation of human capital. Blomstrom et al. (1994, 2003) emphasize this FDI-induced human capital augmentation. Borensztein et al. (1998) claim that FDI raises economic growth by generating technological diffusion from developed economies to host countries, using the neo-classical growth model. Balasubramanyam et al (1996) and De Mello (1999) summarize FDI is a package of capital stock, know-how and technology, managerial and organization skills, and it can augment the existing stock of knowledge in the recipient economy through labour training, skills acquisition and diffusion. Elmawazini and Ngouhouo (2005) summarize five channels affecting the scope and significance of the productivity spillovers from FDI: (1) the links between foreign affiliates and local firms; (2) research and development (R&D) efforts undertaken by foreign affiliates; (3) training of local employees in the foreign affiliates; (4) demonstration effects of FDI on local firms; and (5) ownership-sharing of

foreign affiliates. With the advent of liberalization and globalization, FDI has been assuming a more prominent role in developing countries in recent years.

Being the largest developing country in the world, China has experienced impressive rates of economic growth while its FDI inflow has increased dramatically since the late 1970s. China is therefore an ideal case for studying the impact of FDI on economic growth in developing economies.

Foreign direct investment in China was authorized in 1979, as part of the economic reform and opening-up policies launched in December 1978. From an almost isolated country, China has been gradually opening its door to the outside world since then. In the early 1980s, four Special Economic Zones (SEZs), which include Shenzhen, Zhuhai, Shantou and Xiamen, were established, offering preferential treatment to joint ventures. In the following years, further efforts were made to improve the climate for foreign investment in the country. The preferential policies were extended to 14 coastal cities and Hainan Island. Subsequently, a limited foreign currency market was set up. In April 1986, for the first time in modern Chinese history, wholly foreign owned enterprises, were permitted to set up in China. In spring 1992, Deng Xiaoping made his famous tour of the southern parts of China and encouraged local governments to open up China more quickly and widely. As a result of his exhortation and encouragement, FDI inflows into China have rocketed since then. In the past two decades, FDI inflows in China have dramatically increased, jumping from virtually zero in 1979 to $4.37 billion in 1991 and to $11 billion in 1992. The widening and deepening of the economic reforms and the sustained economic growth have added to the attractiveness of China as a destination for FDI. In 1994, China received more than three times the level of FDI in 1992 and became the second-largest host of FDI in the world. Upon China's accession to the World Trade Organization (WTO) in November 2001, its internal market for trade and investment was further liberalized. Consequently, the country was able to

attract more foreign capital from more countries, thus maintaining a high growth rate. In 2003, its actually utilised foreign capital increased to $53.51 billion, which was 124 times the value of 1982 and represented an average annual growth rate of 40.85% for the period. In that year, it also surpassed the U.S.A to become the most popular FDI destination in the world. This figure continued to rise to $60.63 billion in 2004, $60.32 billion in 2005 and $69.47 billion in 2006. The accumulative value of FDI in China was only $4.7 billion in 1985, increasing to $23.31 billion in 1991, to $346.62 billion in 2000, and $691.9 billion in 2006.

Such an expansion of FDI inflow illustrates the accomplishment of China since its economic reforms. However, the substantial inflows of FDI in China are rather unevenly distributed among its regions. The eastern region took up more than 90% of total FDI through 1992, and more than 86% of the total from 1993 to 2005 while the central and western regions only accounted for 14% or less of the country's total FDI. The top five host provinces of FDI -- Guangdong, Jiangsu, Shandong, Shanghai and Zhejiang -- which took up more than 60% of the total FDI are all within the eastern region. In order to narrow or slow down the widening of the gap, China's central government has adopted a series of measures to encourage FDI in the central and western regions. These inland provinces have also tried to attract FDI. As a result, the absolute volume of FDI received has been slowly increasing since the 1990s although their shares of the total value of FDI in the country have not changed much.

Accompanying the dramatic increase of FDI, China has experienced impressive economic growth rates under the economic reform and the policy of openness. Over the last thirty years, China's real GDP increased 13-fold, real per capita GDP rose more than nine-fold, and real per-capita consumption more than six-fold. From 1978 to 2006, China achieved an average annual growth of 9.6% in terms of real GDP, almost double that of the pre-reform period. This progress indicates that the reform policies have

accelerated the growth pace of China, especially in the 1990s. The average annual growth rate of real GDP after 1992 was 2 percentage points higher than the previous years. In 2006, China was the third largest economic entity after the European Union (EU) and the U.S. and the second largest economy after the U.S.; measured in purchasing power parity (PPP) dollars, China's GDP was $10.5 trillion, compared with $12.9 trillion for the US, $13.0 trillion for the EU, $4.1 trillion for Japan, $3.9 trillion for Indian, $2.6 trillion for Germany and $1.9 trillion for the U.K. In China, like India, another poor country, the measure of PPP dollars tends to over-emphasise the level of GDP. China, based on the measurement of GDP in nominal dollars, is anticipated to surpass Germany to become the third largest economy in 2007 or 2008. It has already overtaken Britain and France to become the fourth largest economy in the world, with a total GDP of $2.72 trillion (20.94 trillion RMB).

Besides, China's trade, transportation and education have also remarkably improved. In 1978, China ranked number 23 in world trade. The country climbed to number three by 2006, with a total trade volume of $1.8 trillion and a surplus of $177.8 billion. In terms of infrastructure, China has built 3.48 million kilometres of highways and 45, 460 kilometres of motorways, amounting to five times the total length of the U.K.'s motorways. Furthermore, it is building the same length of the entire U.K. motorway system every two years. In the education sector, China had 1800 universities with more than five million students, with another 120,000 students going abroad for studies, in 2006. This is a major improvement from 1978 when there were only 598 universities with a meager 0.4 million students.

Furthermore, a sustained high economic growth has triggered fast industrialization and urbanization. The years from 1978 to 2006 saw a general decline in almost all the public sectors in China. Agriculture's share of the national GDP declined from 28% to 11%,

agriculture employment's share of the national employment dropped from 71% to 45% and the rural population dropped from 82% of total population to 57%.

However, China's economic integration with the world has been accompanied by growing regional inequalities. Although better growth prospects exist in the whole country due to the economic reforms, different regions have not equally enjoyed the fruits of economic reform. The provinces with the highest growth are concentrated in the Eastern region, which possesses the advantages of geography, resources, and biased policies, such as the establishment of special economic zones (SEZs) and open coastal cities, as well as policies that provide incentives to attract foreign investments. All of these have allowed the coastal region to grow much faster than inland regions. Despite the fact that the Chinese economy in the post-reform period has experienced unprecedented rapid and steady growth, it had led, on the other hand, to widening inter-regional disparities, which deteriorated after the 1990s. In 1979, the per capita real GDP was RMB 877, RMB 633 and RMB 514 for the eastern, central and western region, respectively. These figures increased to RMB 2768, RMB 1573 and RMB 1364 in 1992, jumping to RMB 11294, RMB 5923 and RMB 3788 in 2005. The ratio of East-Central-West per capita real GDP was 1.71:1.23:1 in 1979, 2.03:1.15:1 in 1992 and 2.98:1.56:1 in 2005. It implies an average annual growth rate for East-Central-West was 9.24%, 7.25% and 7.80% during the 1979-1992 period, and 11.42%, 10.74% and 8.74% from 1992 to 2005. The respective average annual growth rate for the entire post-reform period from 1979 to 2005 was 10.33%, 8.98% and 7.99%.

The story of FDI and economic growth in China has seen a similar pattern: increasing rapidly in the 1992-2005 period and distributed unevenly among the regions. These two characteristics have led to two arguments about FDI in China among many scholars and policymakers. On the one hand, FDI is regarded as an engine of economic growth for

China, on the other hand, it is also blamed as one of the main factors worsening the income disparities between the regions.

Investigating the macroeconomic impact of FDI in China from 1979 to 1996, Sun (1998) finds that besides domestic investment, FDI and the labour force also played important roles in China's economic growth. Zhang (1999c) argue that FDI is an important source of savings and an agent of technology transfer in the Chinese economy. In particular, the economy benefits from the growth of foreign trade and the spillover effects of FDI on domestic industries. Berthelemy and Demurger (2000) use an endogenous growth model to investigate the impact of FDI on economic growth across China's 24 provinces over the 1985-1996 period. They argue that FDI has played a fundamental role in boosting economic growth in China through the transfer of technology. Similar arguments relating to the positive effects of FDI on China's growth can be found in Chen, Chang and Zhang (1995), Chen (1995), Pomfret (1991), Kueh (1992), Plummer and Montes (1995), Sun (1996), Wei (1996), Lee (1994), Wang and Swain (1995).

Compared to the subject of FDI and growth in China, relatively few studies have provided a detailed assessment on the relationship between FDI and regional economic inequality. However, there are some scholars who have attempted to do so. They widely believe that FDI leads to larger income inequality. Sun and Chai (1998) argue that the effect of FDI on economic growth in China was stronger in the eastern region and very weak in the western region, reinforcing the inter-regional economic inequality. Zhang (2001a) claims that trade and FDI are the main driving forces of changes in regional disparity in China. In Zhang's findings, affected by FDI, income differences widened between some regions but narrowed within other regions. More recently, Fu (2004) investigated the spillover effects of export and FDI and estimated their impact on regional income inequalities in China. Exports and FDI are found to give significant benefits to the coastal regions. The inland regions have not experienced similar

growth-inducing effects from exports and FDI, which is another factor in driving the regional income apart. Similar findings are obtained by Bao et al (2002) and Zhang and Zhang (2003).

Two groups of exiting studies reviewed above raise a query: how can one reconcile the positive effect of FDI on economic growth with its potential 'negative' effect on regional inequality? This is a controversial and provocative issue in economic development literature. If the argument that FDI inflows worsen income inequalities between China's regions is true, controlling the scale of FDI then could be a solution in reducing regional inequality. This consequently leads to another question: have FDI inflows in China been more than enough? The fact is that China still appears to host too little FDI in comparison with an 'average' host country, especially the developed countries. For example, in 2006, China received over $69 billion, while total FDI inflow was $800 billion in developed countries and $177.3 billion in the U.S. alone. Besides, China's per capita FDI inflow was only $53, less than one third of the world's average, and one twelfth of the developed countries. Moreover, despite the rising inflows of FDI, the China's share of total FDI in the world declined from 9.59% in 2003 to 8.53% in 2004, 6.58% in 2005 and 6% in 2006. The above information indicates that FDI inflow in China is far from enough, particularly, in the inland area, which is in dire need of improvement, as it has not seen much of an increase in FDI in the past decades. Therefore, the questions of how China can receive more FDI and what advantages can inland provinces provide to attract foreign investment need to be answered for more effective application of policies.

The issues of FDI in China raised above have not been well studied in the literature. This thesis attempts to close the gaps by providing quantitative assessments of FDI in these areas. Therefore, the objective of this study is to discuss and examine the following three questions: the exact mechanism by which FDI impacts upon the

development process of newly industrialising economies; the question of whether increased FDI inflows contributed to income convergence within or among regions; and the issue of whether the determinants of FDI change through time and across regions in the same country.

1.2 Research objectives

1.2.1 Mechanism by which FDI impacts on growth in newly industrialising economies

As aforementioned, although a large body of literature on FDI focuses on its impact on economic growth, there is no consensus yet. Conflicting empirical evidences imply that the impact of FDI may be country-based, and can be positive, negative or insignificant, depending on the economic, institutional, technological conditions and human capital in host countries. Bhagwati (1994) proposes that the volume and efficacy of FDI inflows vary according to whether a country is following an export-push (EP) or an import substitution strategy (IS). Balasubramanyam, et al. (1996) proves that FDI plays a greater role in economic growth in EP countries than in IS economies. China, which has the world's largest population and one of the fastest-growing economies, has adopted an EP strategy. It has been using FDI as a stimulus in the growth process. Therefore, and as supported by many previous studies, it is widely believed that FDI has a positive effect on economic growth in China. However, this contradicts the argument that FDI has worsened income inequalities between China's regions. Did FDI play a positive role in China's economic growth? Was FDI the main factor which drove the regional incomes apart? To answer these two questions, we need to devote attention on the exact mechanism by which FDI contributes to the growth process, which has not been well studied in the literature. In addition, in the last two decades, an increasingly large amount of attention has been paid on the relationship between FDI and economic growth at the national level. But so far, little work has been done in the area of FDI and regional growth. Regional aspects of FDI and growth are strongly intertwined with the

formulation of regional policy. Only few countries have conducted evaluation of their regional policies or have been subjected to such evaluation by academic researchers. This research seeks to fill the gap in this area, aiming to test two hypotheses of the mechanism by which FDI impacts on the growth process in newly industrialising economies: FDI has played a dual role on economic growth as a mover of production efficiency and a shifter of production frontiers. They are to be tested at both the national and regional levels of China.

1.2.2 FDI and income convergence between China's regions

After revealing the exact mechanism by which FDI play a role on the growth process of China, the question of whether increased FDI inflows worsen the income inequality between China's regions will then be discussed, or in other words, to assess whether FDI has accelerated the process of convergence or divergence across the country.

Undoubtedly, economic reform has resulted in the impressive economic achievement of China. However, China's rapid growth has been accompanied by many difficulties. Increasing inter-regional inequalities is one of the most serious downsides of reform, according to many studies which claim that government policies favoring the coastal region have worsened regional income inequalities, and which argue for more resources to be allocated to disadvantaged areas (Lakshmanan and Hua, 1987; Cannon, 1990; Chai, 1996; Yao and Zhang, 2001a and 2001b; Fu, 2004; Chen and Wu, 2005). However, not all studies agree that regional inequality has widened since reforms started. They argue instead that regional inequality has actually lessened since the adoption of economic reforms, mainly as a result of diffusion, convergence, inter-regional resource transfer and rural industrialization (Hsueh, 1994; Gundlach, 1997; Raiser, 1998; Chen and Fleisher, 1996). Some other studies show two opposite trends of regional inequality in China at different sub-periods. The controversial arguments in the literature require

further research.

The issue of regional income convergence in China has been widely investigated (Chen and Fleisher, 1996; Gundlach, 1997; Raiser, 1998; Yao and Zhang, 2001a and 2001b. etc.). To the best of our knowledge, few of the existing studies have addressed the question of whether increased FDI inflows contribute to the convergence or divergence within or among countries. In limited studies where FDI has been considered in the analysis of the process of convergence or divergence, the variable of FDI is found to be significant and to have contributed to the acceleration of conditional convergence. It is hence blamed for causing regional inequality. This conclusion, as noted already, is inconsistent with the common argument that FDI accelerated economic growth in China.

The second objective of this research therefore attempts to resolve these two controversial arguments addressed in the above two paragraphs by examining whether economic reforms have brought about income convergence among China's regions, and how FDI has played a role in this process. Did it boost the process of convergence or of divergence in post-reform China? Apart from testing these issues inter-regionally, intra-region and intra-group (each pair of two regions) processes will also be examined.

1.2.3 Changes in determinants of FDI across regions and over time

If the hypotheses in the first objective are not rejected, FDI will be regarded as a mover of production efficiency and a shifter of production frontier, allowing China to catch up with the world's most advanced countries. Consequently, it is expected that the less developed regions of China such as the western and central provinces might be able to catch up with their richer eastern counterparts with more FDI. Therefore, to reduce regional income inequality, FDI should be further enhanced in China, especially in the

inland areas. Recently, with policy regimes becoming increasingly open and similar, many countries have found that they need to make further efforts to attract FDI in such a competitive climate. It is therefore more challenging for China to take its advantageous factors into account and set up more effective policies to beat the competition to attract more and more FDI. The third objective of this thesis is to provide a timely investigation of FDI decisions of MNEs and the resulting concentration of FDI across China's regions in the new international environment.

Existing studies have obtained rich insights on the determinants of FDI by providing a set of factors of the host country which affect the location choice of MNEs, such as market demand, labour cost, trade, infrastructure, human capital, exchanges rate, etc. However, the literature only focuses on analyzing the determinants of FDI on the national level over the same period, regardless that these determining factors can be different either across regions or over time. Across the 9.6 million-square-kilometre territory of China, different regions possess different natural and social resources, historical development, and the level of economy and human capital. Except for common factors, each region is expected to have its own characteristics, advantages and conditions which may influence the location choice of foreign investors. Moreover, due to Deng Xiaoping's gradualism and pragmatism in implementing the policy of economic reform and openness, the location factors of China have developed and changed over the last three decades. For example, the policy of openness before and after 1992 saw a big improvement, as a result, FDI inflows have been pouring into China since 1992. The year 1992 is also considered as the watershed of openness and FDI in China. It is therefore necessary to divide the sample post-reform period into two sub-periods, from 1979 to 1991 and from 1992 to 2003, to investigate whether the motivations of MNEs have changed in post-reform China. As such, this research attempts to enrich the literature by examining changes in the importance of FDI determinants over time and across Chinese regions, apart from examining the

determinants of FDI into China for the full sample period 1979-2003 on the national level.

1.3 Research structure

A literature review will be the subject of the next chapter to summarize and critically discuss the possible advantages and problems inherent in the previous studies. According to the objectives of this thesis, it mainly includes three issues: the relationship between FDI inflow and economic growth, the impact of FDI on the process of income convergence and the determinants of FDI inflow to host countries. For the first issue about FDI and growth, the existing theoretical and empirical studies on how FDI affect economic development in the host country and channels of spillovers from FDI to local firms will be reviewed. FDI is commonly believed to have a positive impact on host countries which own a minimum threshold stock of human capital. More precisely, a low potential for productivity spillovers result from a big gap and a low quality of technology transferred. In light of the second issue, three groups of existing studies will be reviewed: inequality and growth, convergence and divergence, and FDI and inequality. In terms of income convergence, studies concerning absolute and conditional β- and δ-convergence with respect to per capita income will be paid more attention. Most studies claim that FDI deteriorate income disparity, in contrast, some authors argue that FDI reduces income inequalities and accelerates the speed of income convergence. On the final issue of FDI's location determinants, the main FDI theories on the motivation for MNEs and a set of location factors supposed to affect FDI recipients will be summarized. By making use of information, it is possible to work out a more adequate approach and formulate a more appropriate and complete methodology for addressing the issue of FDI and economic growth in China's regions.

Following the literature review, chapter three will introduce economic performance and FDI development in post-reform China. The process of China's reform and opening-up, its impressive economic performance, output and ownership structure, as well as performance of total investment in fixed assets and trade will all be reviewed. In addition, regional income inequality will be discussed in the pre- and post-reform periods. In terms of FDI, its development stages, comparison to gross domestic product (GDP) and its main characteristics in China will also be studied as well. Summing up, both economic performance and FDI development saw impressive successes in China, accompanied by a highly uneven distribution between the coastal and the inland regions.

Chapter four discusses the role of FDI in economic growth through a theoretical framework which focuses on analyzing the exact mechanism by which FDI impacts upon the development process of newly industrialising economies. Two hypotheses which have not been considered in the economic literature will be presented and tested in this chapter. Firstly, FDI is a mover of production efficiency because it helps reduce the gap between the actual level of production and a steady-state production frontier. Secondly, FDI, being embedded with advanced technologies and knowledge, is a shifter of the host country's production frontier. Due to its dual role as a mover of production efficiency and a shifter of production frontier, FDI is a powerful driver of economic growth for a newly industrialising economy, allowing it to catch up with the world's most advanced countries. China's economic success with its huge amount of FDI over the past decades provides an ideal example to test the hypotheses. The empirical models will be based on an augmented Cobb-Douglas production function, which includes two basic input variables, labour and capital, and a set of environmental variables. FDI is calibrated into the production function along with export, human capital, transportation and the real exchange rate.

The issue of FDI's impact on regional inequality in China will then be discussed in chapter five. It intends to estimate quantitatively the link between FDI inflow and economic inequality in China's regions, examining whether and how FDI has contributed to the process of convergence or divergence of income across Chinese regions. Apart from conducting a descriptive analysis that reviews the evolution of the income ratios, the coefficient of variation on income per capita will also be measured. The resulting indices exhibit whether the income gap between Chinese regions is expanding or diminishing. In addition, the issue of β-convergence on income levels between China's regions will also be examined in both absolute and conditional manners in order to see if the inland provinces can catch up with coastal ones. Furthermore, this chapter aims to quantify the contributions of cross-border economic activities, such as trade and FDI transactions, aiming to investigate if these activities could accelerate the catching-up and convergence process. Both cross-section and panel data approaches will be adopted to study the same question. Apart from testing the models, predictions will also be made. Given the result on income convergence, suggestions to reduce the income disparity problem between China's regions will then be raised.

Chapter six will examine the determinants of FDI in China so as to find out why the country has received an impressive amount of FDI in the past two decades and to observe the changes in the importance of FDI determinants over time and across the regions, aiming to discover and highlight the particular advantages of inland regions in order to attract FDI inflows. Both long-run static and short-run dynamic models with ECM will be adopted respectively to test a set of location factors, such as market size, labour cost, export, infrastructure, human capital, agglomeration, exchange rate, geographical location, which are mainly used in the literature. Apart from estimating the determinants of FDI in China for the full 1979-2003 sample period, we will re-estimate the same issue in two sub-sample periods, 1979-1991 and 1992-2003, to see if FDI

determinants change through time. Furthermore, same as the previous chapters, we will estimate the same models with regional data to see if there is a difference in the importance of factors effecting FDI in different regions.

Chapter seven, which is the overall conclusion of this thesis, will summarize comprehensively findings on the relationship between FDI and economic growth in China's regions. Details of the estimated outcomes and contributions of this research will be thoroughly discussed in this chapter. The possible link between the three regions, as well as policy implications of these processes will also be discussed.

Chapter 2 Literature Review

2.1. FDI inflow and economic growth

2.1.1 Growth theory and FDI

The vast literature on growth theory can be categorized into three broad groups: the early post-Keynesian, the neo-classical and the new endogenous growth models. The first group emphasizes the role of savings and investment in generating growth. The second one emphasizes technical progress. The third group, the more recent new endogenous growth models, emphasizes the role of R&D, human capital accumulation and externalities and provides powerful support for FDI as a potent factor in promoting economic growth in host countries, especially in developing countries (Balasubramanyam, et al. 1996; de Mello, 1997; Wu, 2000; Nair-Reichert and Weinhold, 2001; Yao, 2006; Yao and Wei, 2007).

Early literature on economic growth, as represented by Rosenstein-Rodan (1943, 1961), Nurkse (1953) and Lewis (1954), was characterized by the emphasis on the relationship between growth and physical capital accumulation. The Harrod-Domar model (Harrod 1939, Domar 1947) assumes a constant return to scale and predicts that higher saving rate can promote higher economic growth. However, according to the law of diminishing returns to capital, the classical growth model predicts that per capita income inequality will be reduced gradually across regions or countries as capital will move from the relatively richer economies to the relatively poorer ones, promoting the growth in the latter and reducing the income gaps between the rich and the poor regions.

Neo-classical growth theory, as represented by Solow (1956 and 1957) and Abramovitz (1956) emphasizes the role of technical progress in economic growth, which effectively

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offsets the law of diminishing returns to capital. In neo-classical growth models, however, the effect of FDI on output is limited by diminishing returns to physical capital in the long-run. Long-run growth can only result from technological progress and/or population (labour force) growth, which are both considered to be exogenous. FDI would only affect output growth in the short-run, leaving the long-run growth rate unchanged (Zheng, et al., 2006).

While the failure of the Solow model to explain the large differences in income levels between countries has been interpreted as a result of differences in technology it was the new endogenous growth theory (Romer, 1986, 1987, 1990; Lucas, 1988; Krugman, 1990; Murphy et al. 1989a, 1989b; Shaw, 1992; Aghion and Howitt, 1998) that began to analyze the relationship between technology and growth in detail. Balasubramanyam et al. (1996) summarize that "externalities, human capital and learning by doing form the main springs of endogenous growth theory. Endogenous growth theory in its various formulations provides added persuasive reasons to link R&D investments in human capital and scale economies to the rate of economic growth. Many of the growth promoting factors identified by the new growth theory can be initiated and nurtured to promote growth through FDI. FDI has long been recognized as a major source of technology and know-how to developing countries. Indeed, it is the ability of FDI to transfer not only production know-how but also managerial skills that distinguishes it from all other forms of investment, including portfolio capital and aid. Externalities, or spill-over effects, have also been recognized as a major benefit accruing to host countries from FDI, it is widely recognized that technical progress accounts for a relatively low proportion of the growth experienced by developing countries in general" (p94-95).

The new endogenous growth model considers long-run growth to be a function of technological progress. This process, therefore, provides a framework in which FDI can

be regarded as a special input, which plays a dual role as a physical input as well as a propeller of technological progress in the host country which absorbs foreign advanced technologies embedded in FDI (Mavrotas and Son, 2004). In some studies, FDI is also regarded as a propeller of human capital augmentation in developing economies because domestic workers can enhance their skills through learning by watching, training, and learning by doing. In other words, the new growth theory provides a logical explanation as to how FDI can be an important factor of economic growth. The exploitation of this potential, however, requires a proper economic climate, especially a minimum level of human capital, a relatively liberal and open economy and a minimum level of transportation and other infrastructure.

Furthermore, economic theory provides two approaches to study the effects of FDI on host countries. The first approach was proposed by Macdougall (1960), coming from the theory of international trade. It generally examines the host country's gains directly from foreign investment (direct and portfolio) in relation to factor rewards, employment, and capital flows. The other departs from the theory of industrial organization and was pioneered by Hymer (1960). Other important contributions were made by Buckley and Casson (1976), Caves (1971), Dunning (1973), Kindleberger (1969), and Vernon (1966). The second approach focuses on the indirect effects, externalities, or spillovers of FDI. The external effects or spillovers from FDI can be due to two factors (Blomstrom and Sjoholm, 1999). First, multinational enterprises (MNEs) compete successfully with local firms because the former possess advanced technologies. Second, local firms are forced to change their financing methods, marketing and production techniques, and their managerial skills so as to improve their productivity and growth in order to maintain their market shares and profits after MNEs' entry.

2.1. 2 Expected gains and spillovers from FDI

The economic theory suggests that MNEs may improve allocative efficiency and also lead to technology transfer and diffusion.Bhattacharya, *et al.* (2004), in the Civil Society Report which is a critique of the World Development Report 2005, summarize the expected gains from FDI to the host countries (Table 2.1).

Table 2.1 the expected gains from FDI

Immediate effect from FDI	Spillover mechanism	Positive effect on the host country
Micro-level: - Transfer of new technology and related skills to firms with FDI involvement - Introduction of new processes, including managerial skills and know-how	Micro-level: -Qualification and training of local staff of subcontractors - Additional and sufficiently paid jobs - Productivity gains as skilled workers move to local firms - Integration of local firms and mergers in new lines of production	- Social development through income gains and increased employment - Raising state income from corporate and income taxes - General stimulation of the domestic economy - More and better services; from financial services to healthcare and social security - Modernization and extension of physical and social infrastructure - Relaxing problems with debt services - less risk of financial crisis
Macro-level and Balance of Payments (BOP): - Foreign capital inflows to the country	Macro-level and Balance of Payments (BOP): - FDI helps generating foreign exchange by increasing export revenues or decreasing import demand - Integration into the world market thereby increasing national competitiveness - FDI inflows are more stable than other inflows	

Source: Bhattacharya, *et al.* (2004), p.27.

In relation to the spillovers of FDI, Elmawazini et al. (2005) summarize five channels affecting the scope and significance of the productivity spillovers from FDI in the literature and empirical studies:

(1) the linkages between foreign affiliates and local firms;

(2) R&D efforts undertaken by foreign affiliates;

(3) training of local firms employees in the foreign affiliates;

(4) demonstration effects of FDI on local firms; and

(5) ownership sharing of foreign affiliates.

Linkages between MNEs and local firms

The local suppliers and customers are expected to gain benefits from the MNE affiliates' advanced knowledge of product, process technologies or markets, which are very important channels of the spillovers from FDI. The backward linkage is the spillovers which happen between foreign affiliates and local suppliers while forward linkage occurs between foreign affiliates and local customers. Katz (1969) is the earliest study which estimates the linkages spillovers between MNE affiliate and local firms. Katz examines the Argentine manufacturing sector in the 1950s with the presence of foreign capital and finds that the technical progress did not only occur in the MNEs' own affiliate, but also in local firms, because the local firms were forced to modernize "by imposing on them minimum standards of quality, delivery dates, prices, etc. in their supplies of parts and raw materials" (Katz, 1969, p. 154). The author also argues that backward linkage is the most powerful channel to spill over technology and production techniques from MNEs to the host countries. However, McAleese & McDonald (1978) and Branstetter (2000) claim that both linkages have grown in the same way. Other studies on the development of linkages can be seen in Behrman and Wallender (1976), Watanabe (1983a, 1983b), and UNCTC (1981). The previous studies argue that the capabilities of local suppliers, local contents, and foreign affiliates' market orientation are the main factors to influence the spillovers of the backward linkages (Reuber et al. 1973; Lall, 1980; and Liu et al., 2000).

Differing from most other findings in this respect, Aitken and Harrison (1991) argue that FDI play a negative impact on the productivity of upstream local firms in

Venezuelan over the data period 1976-89. They state that foreign firms chose to import inputs instead of local inputs. This implies that the domestic supplier firms fail to establish linkages with foreign affiliates to attain the potential benefits.

R&D efforts undertaken by foreign affiliates

According to Hymer (1960) and Caves (1971), multinational enterprises (MNEs) tend to have better human capital and more financial resources than indigenous firms to undertake R&D activities. As a result, MNEs tend to have an absolute advantage in terms of new technologies and production processes. This is one of the reasons why MNEs can go to a new and strange host country and compete with local firms, which have superior knowledge of local markets, consumer preferences and business practices. Extension of MNEs activities to a third country leads to a geographical diffusion of technology, but not necessarily to any formal transfer of technology beyond the boundaries of the MNE. The establishment of a foreign affiliate is a decision to *internalise* the use of core technology. However, local firms can still learn from MNEs through learning by watching and a stronger desire to compete with foreign companies in order to survive. As a result, the presence of MNEs can also help domestic firms to invest more in R&D and improve their competitiveness by adopting the best possible management practices. MNEs' subsidiaries with strong R&D mandates as well as strategic geographical or product range responsibilities tend to adhere more to the host economy and are hence considered to be highly desirable in terms of their effects on local wealth generation (Chen, 2007).

Although the R&D of MNEs is concentrated on the home countries, it is still undertaken in the host countries. Dunning and Pearce (1985) report that overseas production took up around 30% of total output of the major MNEs in 1982, whilst overseas R&D accounted only for 12% of total R&D expenditure. However, since the 1980s, US

MNEs started to enhance overseas R&D deployment. As a result, a number of FDI welled up through cross-border corporate mergers and acquisitions. Japanese and European MNEs also set up their labouratories in the US in order to penetrate certain new industries, such as semiconductors, computers, communications and biotech. In 1989, 18% of researchers were employed by the top 33 European corporations worked overseas (Arimura, 1995). The efforts of MNE undertaking R&D oversea are often compared with that of local firms rather than that of their parents' firms in the home country, which is usually more efficient than that of local firms and therefore may induce technology spillovers from foreign affiliate to domestic firms (Fairchild and Sosin, 1986).

The significance of R&D spillovers from FDI depends on the level of competition in the local market (Catherin, 2000). Using panel data from 1981 to 1991 in the US, Catherin found that the industry R&D intensity is only significantly affected by non-greenfield (e.g., mergers and acquisitions) MNEs. The author attributed this result to the following factors. Firstly, the technology level of the acquired firm could be more advanced than the technology of the acquiring firm. Secondly, the foreign affiliates may want to adapt their technology to the US (host country) conditions. Finally, domestic firms may increase their R&D spending to remain competitive. Catherin (2000) also finds a significant fluctuation in non-greenfield FDI, suggesting that the US domestic firms feel more threatened by foreign affiliates from Japan than from other countries. Japanese firms were more motivated to know more about the technology they acquired than other foreign affiliates in the US. As a result, there were larger R&D effects in those industries that have more non-greenfield FDI made by Japanese firms. A similar result is obtained by Hejazi and Safarian (1999). However, some studies contradict Catherin (2000), for example, Lichtenberg and van Pottelsberghe de la Potterie (1998) did not find any impact of inward FDI flows on the knowledge spillovers in OECD countries over the period 1971-90.

Training of local employees in MNE affiliates

When a MNE set up affiliates oversea, it usually employs local employees although higher positions are often initially occupied for expatriates. Accordingly, there should be various training undertaken for the local employees, which is one of the most important channels for technology spillovers from MNE parents to affiliates. The training includes all levels of employees from machine operators to supervisors and top-level managers. Blomstom and Kokko (1997) state that when the trained or previously employed workers change their employers or start their own business they may transfer important information to local firms and may contribute to technology diffusion.

Unlike industrialised countries, the spillovers of both technical and management skills are abundantly studied in developing countries because those host countries are expected to have a lower lever of education system and human capital than developed countries. Thereby, the spillovers from training are regarded to be more important there. Focusing on the managerial skills training from MNEs in manufacturing sectors in Kenya, Gerschenberg (1987) concludes that MNEs offer more sorts of training to their managers compared with local firms. It happened that some managers switched their employers from MNEs to other firms (including local firms) and contributed to the transfer know-how, although there was lower rate of mobility for managers employed by MNEs than those in local firms. This is because MNEs pay more for their labour than local firms in order to avoid a "brain-drain" to local firms. Other studies provide similar evidence of management training, and point more clearly to the presence of spillovers (Katz, 1987; Gangti and Ding, 1998; Wasow and Hill, 1986 and Yoshihara, 1988).

The empirical studies on the training spillovers in developed countries are relatively limited. However, Caves (1996) focuses on management skills and also find that the inter-firm mobility of managers has helped to spread specific management skills between Japan, the US and Europe.

Apart from management training, evidences are found in the training and capacity development in technical areas for local employees in MNEs' affiliates. Behrman and Wallender (1976) point out that some of the sub-contractors of MNEs' affiliates are their former local employees, and also find the evidence of spillovers on both managerial and technical skills. Chen (1983) focuses on training of operatives in a study of technology transfer to Hong Kong. It was found that the incidence of training programmes and their training expenditures in the MNEs' affiliates were several times higher than in local firms. Chen thus concludes that "the major contribution of foreign firms in Hong Kong manufacturing is not so much the production of new techniques and products, but the training of workers at various levels" (p. 61). UNCTAD (1999) reports several cases where leading MNEs, for example, Daimler-Benz and Nestlé, provide extensive vocational training for the employees in their oversea affiliates.

Demonstration effects of FDI on local firms

The demonstration effects of FDI mean that local firms may adopt technologies or know-how from MNEs through imitation, learning by watching or reverse engineering. MNEs' superior technology may urge local firms to update their own production methods. In the absence of FDI, it may simply be too costly for local firms to acquire the necessary information for adopting new technologies if they are not first introduced in the local economy by MNEs (Saggi, 2000).

A few studies have paid attentions on the spillovers of demonstration from FDI to local firms. In the early studies, Tilton (1971), Swan (1973), Riedel (1975) and Lake (1979) have provided evidence of the diffusion of technology via demonstration from MNEs to local firms in host countries. Kokko et al. (2001) find that import-substituting MNEs create a larger potential of demonstration effects than export-oriented MNEs. More recently, in a case of China over the period 1995-2000, Cheung and Lin (2004) find that FDI inflow have play an important role on the increasing of the domestic different types of patent applications (invention, utility model, and external design). The authors claim that "The spillover effects are the strongest for minor innovation such as external design patent, highlighting a 'demonstration effect' of FDI".

Compared with the studies on other channels of spillovers from FDI, there is relatively less studies on demonstration effects of foreign affiliates on domestic firms. Blomstrom and Kokko (1997) summary two reasons of that: first, pure demonstration effects often occur unconsciously; and second, demonstration effects are often intimately related to competition. And it is very difficult to distinguish these two effects in practice.

Ownership sharing of foreign affiliates

There exist contradictory results regarding the MNEs' ownership sharing. Ramachandran (1993) uses Reserve Bank of India data that describe the transfer of technology from MNEs to local firms during 1971-81. Ramachandran argues that the higher the share of foreign ownership and control, the more advanced technologies can spill over from foreign to local firms, and the larger is the scope for spillovers. Since some MNEs refuse to invest or do not use advanced technologies, especially when the joint venture scheme involves a risk for them of losing their controls over profits and over their advanced technology or intangible assets. However, Bolomstrom and Sjoholm (1999) do not support the hypothesis that the joint venture facilitates

technology spillovers to local firms. Also, the degree of foreign ownership does not affect the degree of spillovers to domestic firms.

2.1.3 FDI and growth

The theoretical studies of FDI generally expect a positive impact of FDI on growth in the host country. However, the empirical studies have drawn mixed results. Besides a positive impact, negative and insignificant effects of FDI on growth are also presented in the literature.

Three earliest analyses of the effects of FDI on host country are Caves (1974), Globerman (1979) and Blomström and Persson (1983). They estimate the existence of spillovers by testing whether FDI has any impact on labour productivity in local firms in Australia, Canada and Mexico respectively. The results of all these studies, in general, are reported to be significant and positive, although how these spillovers took place has not been disclosed. Later on, Nadiri (1991) comes to similar conclusions by examining the impact of FDI (from the US) in plant and equipment on the manufacturing sectors in France, Germany, Japan, and the U.K. between 1968 and 1988. More recently, there is a number of studies provide evidence of the positive effects of FDI on the growth in host countries, especially in developing countries (Ozawa, 199; Blomström and Wolff, 1994; Zhang, 2001; Yao, 2006 and Yao and Wei, 2007).

Karikari (1992) examines the causality between FDI and economic output in Ghana from 1961 to1988, the result showed that FDI did not affect economic output while increases in economic output caused a slight decrease in the inflows of FDI. According to Karikari, this result may be due to the small volume of FDI for the data period, as well as freer trade instead of FDI promoting the country's growth. Haddad and Harrison (1991, 1993) also find no significant effects of foreign presence on the rate of

productivity growth of local firms by testing the spillover of FDI in Moroccan manufacturing during 1985-89. Similarly, in the study of 72 developed and developing countries with both cross-sectional OLS and panel data GMM analyses, Carkovic and Levine (2002) did not find a robust relation between inward FDI and growth in those host countries. Similarly, Durham (2004) investigates the role of FDI on growth in 80 countries over the period 1979-98. He did not find positive relation between these two variables and argues that the effects of FDI depend on the "absorptive capability" of host countries.

Some studies even find negative effects of FDI on host country. Cantwell (1989) examines the spillovers of local European firms in the presence US MNEs from 1955 to 1975. Not all the European industries were found to have the positive technology spillovers from US MNEs affiliates. He claims that "the technological capacity of indigenous firms" and the size of the national market were the two major factors in determining the successes of the European corporate response to the US challenge. Kokko (1994, 1996) argue that spillovers do not take place all kinds of industries. In particular, foreign MNEs may sometimes operate in "enclaves", where neither products nor technologies have much in common with those of local firms (or even be a sign of a weak local industry). In such circumstances, local firms have not been able to absorb any productivity spillovers at all and have therefore been forced to yield market shares to the foreign MNEs. Bende-Nabende et al (2003) find that FDI play a significant and positive impact on less advanced Asian countries such as the Philippines and Thailand, but play a negative role in the more economically advanced countries/regions such as Japan and Taiwan. Other studies which find negative relation between FDI and growth in host country include Aitken and Harrison (1999), Barry, Görg and Strobl (2001), Damijan, Majcen, Knell and Rojec (2001), Djankov and Hoekman (2000) and Konings (2001).

The above discussion shows that there are conflicting empirical evidences in the literature regarding the role of FDI on economic growth. It seems that the impact of FDI is country-based, and can be positive, negative or insignificant (Li and Liu, 2005). Many economists agree that the impact of FDI on growth strongly depend on the local conditions in host countries and consider them as key determinants of the magnitude and scope of spillovers. A high level of both local competence and a competitive environment contribute to raise the absorptive capacity of the host country. The local conditions can be mainly categorized into three groups: trade policy stance (Balasubramanyam et al., 1996; Zhang, 2001), human resource policies (Keller, 1996; Borensztein et al, 1998; Olofsdotter, 1998; Xu, 2000; Bengoa and Sanchez-Robles, 2003 and Bhattacharya, *et al.* 2004) and the technologic gap (Sjoholm, 1999 and Glass and Saggi, 1998). Balasubramanyam *et al.* (1996) investigate the role of FDI in the growth process in 46 developing countries characterised by different trade policy regimes over the period 1970-85. They find that FDI plays a greater role in economic growth in export-push (EP) countries than in import substitution strategy (IS) economies. Xu (2000) estimates a growth equation for 40 developed and developing countries and finds a significant positive effect of FDI on growth in samples of countries with higher levels of human capital. The countries which can have positive technology spillovers only if they possess a minimum threshold level of human capital (more than 1.4 years in terms of male secondary school attainment). Sjoholm (1999) shows the larger the technologies gap between domestic and foreign establishments, the greater the productivity spillovers.

2.1.4 FDI and China's economic growth

China's impressive economic development achievements and FDI inflow have for a long time been of interest to economists. Many cheer China's large FDI attraction as a noted achievement of its economic reforms and opening up. No doubt, the massive

receipt of FDI has important implications for economic growth, trade, politics, employment, culture and social development in China (Seyf, 2000; Cheng and Kwan, 1999). In more details, Chen et al. (1995) conclude six phenomena associated with the effects of FDI, including: spurring economic growth; increasing the total fixed asset investment; increasing the number of domestic manufacturers to compete globally; accelerating uneven development between the coastal and inland provinces; worsening income disparities; and declining ideological commitment.

More recently, investigating the macroeconomic impact of FDI in China during 1979-96, Sun (1998) finds that besides domestic investment, FDI and the labour force also played important roles in China's economic growth. Zhang (1999a) argues that the importance of FDI as a source of saving and an agent of technologies transfer in the Chinese economy, in particular the growth of foreign trade and the spillover effects of FDI on domestic industries. Berthelemy and Demurger (2000) use an endogenous growth model to investigate the impact of FDI on economic growth across China's 24 provinces over 1985-96. They argue that FDI has played a fundamental role in economic growth in China through the spillover of technology. However, Zhu and Lu (1998) estimate the contribution of FDI to local productivity by Granger causality test using a panel data set of 50 Chinese cities as well as China's provincial data of three years. They find that the spill-over efficiency of FDI is much stronger and more evident in promoting labour productivity than in boosting total factor productivity. This finding suggests that the biggest benefit of receiving FDI in China is the improvement in human resource allocation efficiency rather than bringing in overall technology progress. Moreover, they discover that the larger average FDI project size is unlikely to increase the contributions of FDI to productivity growth. Similar arguments of the positive effects of FDI on China's growth can be found in Chen, Chang and Zhang (1995), Chen (1995), Pomfret (1991), Kueh (1992), Plummer and Montes (1995), Sun (1996), Wei (1996), Lee (1994), Wang and Swain (1995), Yao (2006) and Yao and Wei (2007).

Apart from the national level, some studies also pay attention to regional level and find that the effects of FDI vary across regions in China. Using panel data across 16 provinces in the eastern and western regions in China over 1986-1992, Sun and Chai (1998) claim that the effect of FDI on economic growth is strong in the eastern region and weak in the western region, reinforcing inter-regional inequality. Similar empirical results have been obtained by Zhang (2001b) and Buckley et al. (2002). Zhang (2001b) use both cross-section and panel data for 28 provinces over 1984-98. Zhang suggests that FDI seems to help China's transition and promote income growth, and that this positive growth effect seems to rise over time and to be stronger in the coastal than the inland regions. Buckley et al. (2002) investigate the relationship between FDI and growth and also try to find out how the locally economic and technological conditions in 29 Chinese provinces influence the spillovers of FDI for data period 1989-99. The results show that the local conditions strongly affect the magnitude and scope of spillovers of FDI at both the national and the provincial levels. FDI favors growth in the provinces with more advanced economic development, more well-built market reform and more preferential policies, etc.

Some other studies have expanded the analysis to cover economic growth, FDI and trade activities of China. Ozawa (1992) states that the strategies of export and outward orientation, and also a favorable environment for FDI inflows have contributed to the China's economic achievement since economic reform. Chen (1999) examines China's outstanding trade performance during the period 1980-95 and correspondingly investigates the relationship between FDI and trade. Chen finds that FDI has positive impact on both China's provincial and bilateral trade. Sun (1999) and Zhang and Felmingham (2001) test the causal linkage between inward FDI and exports of China. They find a bi-directional relation between these two variables, and therefore sparked a strong stimulus to exported-led economic growth. Sun (2001) investigates the impact

of FDI on the export performance of China at the provincial level during 1984-97. His results suggest that the impact of FDI on exports varies across regions according to regional economic conditions, the degree of economic openness, and the different market orientation of FDI. Sun concludes that FDI plays a stronger and more significant role in promoting exports from the eastern coastal region than from the central and western regions. More recently, Yao (2006) focuses 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. He adopted Petroni's panel unit root test and Arellano and Bond's dynamic panel data estimating technique and found that both exports and FDI have a strong and positive effect on economic growth.

Dissimilar to the findings above which address the positive effect of FDI in China, Huang (2003) counterclaims that the large absorption of FDI by China is a sign of some substantial weaknesses in the Chinese economy. Huang's premise is that FDI is, fundamentally, a microeconomic phenomenon rather than a macroeconomic phenomenon. Under certain macroeconomic conditions, such as expanding markets or low labour costs, whether a country gets more or less FDI relative to domestic investments depends on the relative competitiveness of foreign versus domestic firms. FDI inflows into China surged in the 1990s because domestic firms were uncompetitive and failed to capitalize on new business opportunities.

2.2 Inequality, convergence and FDI

2.2.1 Inequality and growth

In the literature, there are several measurements for income inequality, including the Gini coefficient, the Theil index, Atkinson index, Mean Logarithmic Deviation, squared coefficient of variation, and variance of the logarithm of incomes in an income distribution (Ulubaşoğlu, 2004, p.116). The choice of an inequality index is more than

just a technical choice. For example, in the case of the Gini coefficient, the effect of a transfer between a richer and a poorer person depends only on the difference in their ranks in the distribution it does not depend on how poor the poorer person is.

For a long time there has been an active debate over the relationship between inequality and growth, pioneered by Kuznets (1955, 1963), and fuelled further by more recent cross-country empirical studies (Forbes, 2000; Banerjee and Duflo, 2003). Aghion et al. (1999) provide an excellent survey of the theoretical side of the argument, where there is little consensus either. In short, existing theoretical and empirical works find a positive, a negative or a mixed relationship between them.

The early literature on the evolution of income inequality and output is based on the famous *Kuznets hypothesis*.[1] Simon Kuznets (1963) finds an inverted U-shaped relation between income inequality and GNP per head using both cross-country data and time series. This hypothesis suggests that, at low levels of per capita income, inequality increases with rising per capita income and decreases only in the later stages of development—based on a model where individuals migrate from a low-wage rural sector with little inequality to an urban sector characterized by high income inequality and high average income. Up to the 1970s, the Kuznets hypothesis has been tested for most of the OECD countries, including the US. In these countries, there appeared to be a virtuous circle: lower inequality would foster growth, which in turn, would reduce inequality. However, the downward trend in inequality experienced by these economies during the twentieth century has reversed sharply in recent times (Aghion et al., 1999).

Regarding the effect of inequality on growth in market economies, the conventional textbook approach is that inequality is good for incentives and therefore good for growth, even though incentive and growth considerations might be traded off against

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[1] See Kuznets (1955) and (1963).

equity or insurance goals (Aghion et al. 1999, p1615). Partridge (1997) finds a positive coefficient for the Gini coefficient but also a positive one for the income share of the middle quintile in a sample of the US states. He also conjectures that the sign of the effect of income inequality on growth varies with per capita income levels. In Li and Zou (1998), income inequality is believed to bring in higher economic growth if public consumption is taken into account. Empirical estimations show that income inequality is positively, and most of the time significantly, associated with economic growth. Welch (1999) claims that inequality is good, and increasing inequality is not necessarily bad. Inequality of priorities and capabilities is considered to be useful for trade, specialization, and cooperation. Forbes (2000) reports a significant positive coefficient in panel data using fixed effects estimation, which effectively removes the cross-sectional dimension. In a cross-country sample, Barro (2000) reports evidence consistent with this conjecture, the division coming at a PPP-adjusted per capita GDP of $2070 (1985 US dollars).

The view that inequality is growth-enhancing has been further challenged by a number of empirical studies, often based on cross-country studies, which find a negative correlation between growth and inequality.[2] Persson and Tabellini (1994) formulate a model that relates equilibrium growth to income inequality and political institutions. The key result is that income inequality is harmful for growth as inequality leads to policies that do not protect property rights and do not allow full private appropriation of returns on investment. This relation is only present in democracies. Many other empirical studies which support such a negative relationship between inequality and growth can be found in Alesina and Rodrik (1994); Alesina and Perotti (1996); Deininger and Squire, 1998; Banerjee and Duflo (2000); Chang and Ram, 2000; Sylwester (2000); Easterly (2001) and Rehme (2000, 2001). Castelló and Doménech (2002) find a more robust negative relationship using human capital inequality rather

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[2] This literature is comprehensively reviewed by Benabou (1996).

than income inequality. Perotti (1996) offers four explanations on why income inequality is detrimental to growth. First, inequality will lead to pressure for redistribution through distorted taxes and distorted government spending. Second, inequality may lead to sociopolitical instability, reducing investment and growth. Third, inequality reduces investment in human capital and hence growth potential. Fourth, inequality may lead to higher fertility and depress human capital investment fall.

Todaro (1997) also provides four arguments on why "greater equality in developing countries may in fact be a condition for self-sustaining economic growth," namely: (a) Disaving and/or unproductive investment by the rich; (b) Lower levels of human capital held by the poor; (c) Demand pattern of the poor being more biased towards local goods; and (d) Political rejection by the masses. Aghion et al. (1999) interpret the negative effect of inequality on growth lies in at least three regions: inequality reduces investment opportunities, worsens borrower's incentives and generates macro-economic volatility (p1621). More recent studies, for example, Knowles (2005) and Hopkins and Kornienko (2006) also report evidence of a significant negative correlation between inequality and economic growth.

Apart from a positive and negative relationship, a mixed linkage between income distribution and growth has been found by some other economists. Using extreme bounds analysis, Torstensson (1996) finds a fragile relationship between inequality and growth. It is sensitive to the choice of other control variables included in the regression equation. Barro (2000) finds inequality play a negative role in poor countries, but a positive one in rich countries. However, Bleaney and Nishiyama (2004) find no evidence that the sign of the initial income inequality coefficient differs between rich and poor countries in cross-country regressions.

2.2.2 Convergence and divergence

Convergence is a conceptual analysis of the dynamic evolution of inequality. Before its more accurate definition is to be presented in the following term, it can be temporarily interpreted as shorthand for the inclination towards the decrease over time of income inequalities across countries and regions. Thus, it comes to light that there is a convergence in a given sample when the poorer economies experience a faster growth increase as opposed to their richer counterparts, in so doing diminishing the income differential between them. On observing the opposite pattern (i.e. when the rich grow faster and increase their lead), we notice that there is divergence in the sample.

β- and δ-convergence are the two concepts of convergence which were proposed in the papers of Barro and Sala-i-Martin (BSM) (1990, 1991), Sala-i-Martin (1994, 1996b), Bernard and Durlauf (1996) and Raiser (1998), etc. Since the pioneer work of Baumol (1986) and BSM (1990, 1991), the test of the convergence hypothesis has consisted of fitting cross-country regressions relating the average growth rate of per capita income over a fixed period of time to the initial per capital income and country's characteristics.

β-convergence is said to occur if a negative correlation is found between the average growth rate and the initial income. It includes two different concepts: absolute or unconditional convergence and conditional convergence. Absolute β-convergence can be described as "*we say that there is absolute β-convergence if poor economies tend to grow faster than rich ones*" (Sala-i-Martin, 1996b, p1020). In its assessment, initial income level is the only factor of concern and the catching-up process will take place if the initially poorer economies have higher growth pace than the initially richer one. This argument is based on the neoclassical model with the assumptions of diminishing returns on capital, common preferences and technology. It predicts that initially poor countries will grow faster than initially rich ones if only difference across countries lies

in their initial levels of capital (Solow, 1956; Swan, 1956 and Sala-i-Martin, 1996b). However, in the real world, economies may differ in other respects such as technological progress, population growth, investment, infrastructure and political stability. If these differences are considered, the neoclassical models will predict that the growth of an economy will be positively related to the distance that separates it from its own steady state. This is the concept known in the classical literature as conditional β-convergence (Sala-i-Martin, 1990 and 1996b). This initially rather confusing concept has become very familiar now. And it indicates that an economy tends to have a higher speed of economic growth when it is far from its steady state income level. It is important to notice that conditional convergence does not imply a tendency towards equalizations of per capita incomes. Each country converges to its own steady state, which can differ permanently from the steady state income level of other countries, and that in the long run all the growth rates will be equalized. Chen and Fleisher (1996), Jian, Sachs and Warner (1996), Raiser (1998) and Yao and Zhang (2001b) are some of those which have adopted this analytical approach.

The other concept of convergence is δ-convergence which can be defined as *a group of economies are converging in the sense of σ if the dispersion of their real per capita GDP levels tends to decrease over time* (Sala-i-Martin, 1996b, p1020). It is studied to estimate the static disparities in per capita income, focusing on the actual gap between the income levels of the economies under consideration. If the income gap is declining, then the economies involved may have achieved δ-convergence which specifies that income disparities between different economies tend to diminish over time.

Islam (1998a) is a comprehensive study which has reviewed theoretically the entire literature of convergence and this process was systematically divided into convergence within or across economies, convergence in terms of growth rate or income level, β- or δ-convergence, absolute/unconditional or conditional convergence, unconditional or

club convergence, income or total factor productivity (TFP) convergence and deterministic or stochastic convergence. Capolupo (1998) comprehensively reviews empirical and theoretical issues on growth and convergence. However, Capolupo claims that the newer theories of endogenous growth provide a richer framework for thinking about central questions of growth theory than the neo-classical model, although the two sets of models are not mutually exclusive.

In this research, the β- and δ-convergence tests in absolute/unconditional or conditional convergence with respect to per capita RGDP will be applied to empirically discuss the situation in China. It is then possible to show the conventional linkages between economic growth, income convergence and FDI inflow which have not been thoroughly investigated in the literature of economic growth.

β -convergence

A number of studies have attempted to estimate β-convergence across a group of different countries, as well as across different regions of a single country. On the estimation of absolute/unconditional β-convergence, Baumol (1986) found negative relationship between the growth rate of per capita GDP and its initial level over the period 1870-1980, and the convergence coefficient was 0.9%. It indicated that there existed the unconditional income convergence across 16 major industrialised countries. However, there was not overall pattern of convergence when the sample countries were added to 72 and the period was shortened to 1950-80. Only when this increased sample was divided into different groups, did tendency to convergence emerge within each group, except for that of the very poorest economies. Baumol himself interpreted this finding as the possibility of different convergence dynamics that can be generated within groups of countries that share some common characteristics. Countries with the same fundamentals will tend to evolve toward a common distribution (Ravallion, 2003).

This idea of convergence clubs appears to be confirmed by classical studies on convergence and also by some more recent studies (Oxley and Greasley, 1995; Quah, 1997; Taylor, 1996; Yao and Zhang, 2001a).

As mentioned above, according to the neo-classical model, the initially poor countries will grow faster than the initial rich ones if the only difference across countries lies in their initial level of capital (Solow, 1956; Swan, 1956). However, in the literature, many studies fail to examine absolute convergence and find the positive instead negative correlation between growth rate and initial income level (Chen and Fleisher, 1996; Gundlash, 1997; and Raiser, 1998). Moreover, exceptions are the regressions performed by Barro and Sala-i-Martin (BSM) (1991; 1992) for groups of homogeneous countries. Sala-I-Martin (1996) shows significant divergence rather than convergence by estimating the data for 110 countries during 1960-90 and the speed of divergence was 0.4% per annum. This finding implies that economies may differ in other respects in the real world, such as population growth, saving behavior, technology and political stability. If these differences are considered, the neoclassical model will predict that the growth of an economy will be positively related to the distance that separates it from its own steady state.

In the influential papers of BSM (1991,1992), corresponding to the log-linear approximation of the neo-classical model around the steady state, the regression equation is described as:

$$\frac{1}{T}\ln\left[\frac{y_{i,t_0+T}}{y_{i,t_0}}\right] = g + \ln\left[\frac{\overset{\bullet}{y_i}}{y_{i,t_0}}\right]\left[\frac{1-e^{-\beta T}}{T}\right] + u_{it}$$

(2.1)

where i is the country, t is time, the LHS is the averaged growth rate defined in terms of per capita output, T is the length of the period of observation, g is the exogenous growth

rate or labour augmenting technical progress. The coefficient of the initial level of income is given by $(1-e^{-\beta t})/T$ where β is the rate of convergence of $y_{i,t0+T}$ to its steady-state value y^*.

Equation (2.1) indicates conditional convergence due to the negative relationship between the growth rate and the initial income level which is conditioned by the steady-state value y^*. Given the values of the steady state, lower level of initial income of economy has higher growth rate. This also supports the hypothesis of convergence.

BSM (1991, 1992) estimated β- and σ- convergence on the USA and 7 European countries during the period 1880-1988 and 1950-85 respectively. The evidence of absolute convergence is detected within the US states and in European countries with the value of 2% per year for estimated β. BSM (1991, 1992) test is sustainable for economies with homogeneous preferences, institutions and technology such as different regions in a single county, but is implausible in an analysis across countries with different conditions. BSM (1992b) further confirm this result by investigating the prefectures and districts across Japan during the period 1930-87. The authors find a significantly negative linkage between the growth rate and the initial income per capita with a value of 2.7 % per year for the estimated β. Notwithstanding, in consistent with Baumol (1986), BSM conclude that the forces of convergence act are very slow.

With a larger sample of countries, Sala-i-Martin (1996b) investigates the concepts of convergence on a variety of data sets including a large cross-section of 110 countries, the sub-sample of OECD countries, the states within the US, the prefectures of Japan, and regions within several European Countries. Absolute convergence is detected except for the large cross-section of countries where only conditional convergence exhibit, with the speed of convergence close to 2%, which is similar across data sets.

In another influential paper, Mankiw, Romer and Weil (MRW) (1992) suggest that the Solow model is consistent with international variation in the standard of living. They simply consider the differences in saving rates and population growth instead of differences in technologies in the Solow model to explain the variations cross countries in income per capita. They originally analyze the differences in steady state positions in view of examining the exhibition of convergence across large sample of countries (Capolupo, 1998). In the Solow version of the neo-classical model, the main factors which determine the steady state income level of a country include saving (s), labour force growth rates (n), the depreciation rate (δ) and some other parameters of technology (g). The basic equation of MRW with OLS is:

$$\ln y_i(t) = \ln A_i + gt + \frac{\alpha}{1-\alpha}\ln(s_i) - \frac{\alpha}{1-\alpha}\ln(n_i + g + \delta)$$

$(2.2)^3$

where $\ln y_i$ (t) is the steady state income per capita at a given time, g the rate of technical progress, s_i the share of investment in GDP, n the rate of growth of the labour force, δ the depreciation rate, α the coefficient of capital in the aggregate production function, t the time span, subscripts i indicate the variables that are considered country-specific. All the variables except for s and n are considered the same in all countries.

In the equation 2.2, A(t) is the multiplicative factor of the production function. It may differ across countries regarding their different endowments, including technology, resources endowments, climate, institutions and so on. It also assumes that $A(0) = a +$ ε, ε denotes the specific shock in the countries. Before they adopt human capital in the equation, they found the right signs on the coefficients of saving and population growth

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[3] Capolupo, R. (1998), p520.

by estimating the regression for 98 countries. However, the value of the capital income share α is found to be 0.59, which does not fit that in Solow model ($\alpha= 0.35$). MRW then augment a new variable human capital (s_h) into the model, which is not included in the typical Solow model, as the equation (2.3) in the follow and re-run the regression.

$$Ln\left[\frac{Y(t)}{L(t)}\right] = LnA(0) + gt - \frac{\alpha + \beta}{1 - \alpha - \beta} Ln(n + g + \delta) + \frac{\alpha}{1 - \alpha - \beta} Ln(s_k) + \frac{\beta}{1 - \alpha - \beta} Ln(s_h)$$

[4]   (2.3)

where $\frac{Y(t)}{L(t)}$ is the income per capita, n, g, δ are the same to equation (2.3). s_k and

s_h are the accumulation in capital and human-capital. α and β are the capital and human-capital share of output and their sum is presumed to be under 1.

By examining the issue of convergence on the non-oil producing and OECD countries, MRW find that this new variable strongly significant in explaining the growth of economy in this augmented model in equation (2.3). In addition, this augmented model present higher estimated coefficient on physical capital and population growth. Since then, this augmented Solow model considering human capital is preached to estimate the issue of income convergence. More importantly, MRW(1992) claim that the Solow model does not predict convergence. It implies that the initially poorer countries might not be able to converge their income to the level of the initially richer ones. Instead, it addresses that the income level of a country tends to converge to its own steady-state value, which is determined by their physical and human capital as well as labor forces. And different countries still have the different levels of income. Incorporating the steady state income level y^*, the speed of convergence was defined as:

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[4] Mankiw, Romer and Weil (1992), p.417.

$$\frac{dLn(y(t))}{dt} = \lambda\left[Ln(y^{*}) - Ln(y(t))\right], \qquad\qquad (2.4)$$

where $\lambda = (n+g+\delta)(1-\alpha-\beta)$ and it implied:

$Ln(y(t)) = (1 - e^{-\lambda t})Ln(y^{*}) + e^{-\lambda t}Ln(y(0))$, then the growth function could be written as:

$$Ln(y(t)) - Ln(y(0)) = (1 - e^{-\lambda t})\frac{\alpha}{1-\alpha-\beta}Ln(s_k) + (1 - e^{-\lambda t})\frac{\beta}{1-\alpha-\beta}Ln(s_h)$$

$$-(1 - e^{-\lambda t})\frac{\alpha+\beta}{1-\alpha-\beta}Ln(n+g+\delta) - (1 - e^{-\lambda t})Ln(y(0))$$

[5]

$$(2.5)$$

where $y(0)$ is income per effective worker in the initial period.

In MRW(1992), it is found the income level of countries with similar technologies, investment rate and population growth tended to converge, at a rate slower than the one prevailed in the standard Solow model. The speed of convergence obtained in the typical Solow model without human capital is 0.04, which predicts that an economy takes only 17 years to cover half the distance to its own steady state but BSM takes about 35 years because its convergence coefficient is around 2% per year. Moreover, the investment, population growth rate and human-capital investment rates have improved the goodness of fit of the estimations and lowered the estimated coefficient of the initial income level.

Later on, the MRW model is widely discussed and expanded in many studies (such as Fuente, 1995; Islam, 1995; Knowles and Owen, 1995; Barro, 1996; Temple, 1998; McDonald and Roberts, 2002; Ram, 2007). Fuente (1995) explains the sources of growth and convergence in 21 OECD countries during the period of 1963-88, using an extension of MRW model, in which the rate of technical progress is determined

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[5] Mankiw, Romer and Weit (1992), p.423.

endogenously by the level of R&D investment together with technological diffusion across countries. The purpose of this incorporation was to examine whether the capital-poor countries could grow faster than the richer ones if technology displayed diminishing returns to reproducible factors and reduced the returns on investment. The results show that conditional convergence and a positive relation between R&D expenditure and growth, particularly for rich EU countries. Also, he finds that technological diffusion, which was the initial technological gap, is most important to explain growth differences in the cohesion countries. If technology diffuses across countries at a sufficiently rapid pace and other conditions are the same, those economies which have initially larger technical gap should grow faster than the rest. This effect, however, will gradually exhaust itself due to the approaching an equilibrium level of relative technical efficiency to each country. According to the author, this exhaustion may help explain the slowdown of growth and convergence after the mid-1970s, indicating more investment effort required on poorer economies to achieve future convergence.

Knowles and Owen (KO) (1995) extend MRW model by incorporating a proxy for health as another dimension of human capital in the production function. The authors use the life expectancy at birth, an average of health condition of the population, to measure the new variable health capital stock. Two major results are drawn from their study. First, there is evidence of a strongly positive relation between health capital and per-capita income growth. Second, the variable of education becomes insignificant when the health stock is inserted into the regression. These two findings suggest a strong correlation between health and education, and also a stronger and more robust relationship between income per capita and health capital, than between income per capita and educational human capital.

A similar analysis was found in Barro (1996), in which incorporate more variables into MRW model to explain economic growth and conditional convergence. Strong evidence of conditional convergence with the rate of around 2.5% per year is found. The results also confirms a strong positive and statistically significant correlation between economic growth and the initial health stock of the population, the male education, the maintenance of law, and trade improvements. In addition, fertility rates are found to have strong negative impact on growth.

More recently, Ram (2007) further augment MRW framework by including IQ, which is taken from the compilation by Lynn and Vanhanen (2002), to compare the performance of another two proxies of human capital (education and health) in the MRW and KO models. As mentioned above, health capital in KO report stronger and more robust effect on growth than education human capital in MRW. However, when IQ and education are both employed in Ram's regression, IQ shows high significance while the education becomes insignificant. When three proxies are used together, IQ and health are found to be significant and positive on growth while education is still insignificant. And IQ shows stronger effect than health. Moreover, when institutional quality is further extended to the model, IQ term is still found to be the strongest significant amongst four common proxies of human capital.

There are other methods to estimate income convergence. For example, Bernard and Durlauf (1995) employed an alternative approach, to apply the cointegration technique to test for convergence. Stochastic convergence in income was defined as cointegrated output levels with cointegrating vector [1, -1] and "the long-term forecast of output for all countries are equal at a fixed time t"[6]. If the long-term forecast of outputs are just proportional at a fixed time t. For example, with a cointegrating vector [1, -α], there is a common trend in outputs and economies respond to the same long-run driving process.

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[6] Bernard and Durlauf (1995). P.99.

This definition is different from the previous comprehension of the catching-up process and absolute β-convergence. The ADF tests were primarily adopted to test for unit root. For the existence of cointegrating vectors, given a unit root, the cointegration tests were performed on both multivariate and pairwise bases. Since the output series were not cointegrated, the tests made known little evidences of stochastic convergence, when applying the RGDP per capita of 15 industrialised countries into the empirical investigation, although, evidences were found pointing to cointegration and convergence across OECD economies. A number of common long-run factors which could affect the output growth of these OECD economies were also brought up in the findings.

The issue of convergence or divergence on China's regional economic growth has attracted plenty of attentions due to the rapid economic growth to be concentrated along the coastal provinces. Previous studies have drawn some controversial conclusions as to whether per capita incomes have converged across the Chinese regions or whether they have converged differently before and after the reform sub-periods (Yao and Zhang, 2001a). Lardy (1980), one of the earliest studies reviewing regional growth and income distribution in China, concludes that regional inequality was reduced over time. . Using the statistics of net material product (NMP) and provincial private consumption, Lyons (1991) assessed Chinese inter-provincial income disparities for the period 1952-87. Lyons use standard deviation or coefficient of variation (CV) of different provinces or regions to measure both absolute dispersion in NMP and consumption. In Lyons' results, an evidence of considerable disparity was found in the pre-reform period but not in the post-reforms. This finding is partly consistent with those in Tsui (1991) and Denny (1992). Tsui address regional income distribution during the data period 1952-85 and report that the regional income disparity did not reduce but a mild decline in regional inequality was seen since the economic reform. Denny also uses NMP and reveals that

the economic disparities between the rich and poor provinces in China have narrowed during the period 1978-88.

However, more recent studies argue a widening income inequality across regions in the country, especially since the late 1980s or early 1990s. Tsui (1996) adopts the measures of Gini coefficient and CV to examine inter-provincial inequality in China once again. Similar to his previous study, the author argues that inter-proinvinccal inequality in the country had declined in the first half of the 1980s, but increased again since the second half of the 1980s.

Chen and Fleisher (1996) augment the MRW model to analyze the inter-provincial income inequality in China from 1978 to 1993 after controlling for the variables of employment, physical capital, human capital and the dummy for the coastal region. The rate of convergence is found more impressive on the estimation of conditional convergence than that of absolute convergence. Income convergence is found between the coastal and inland regions although there still persisted a substantial income gap between these two regions. Moreover, the ratio of FDI to GDP is seen to be strongly significant and has contributed to speed up the conditional convergence. Similar conclusion was also found in Jian *et al.* (1996) in which the authors also examine both unconditional and conditional convergence across regions during the period 1952-93. They find some evidence of convergence for the initial stage of 1952–65 but divergence for the period of the Cultural Revolution (1965–78). For the period 1978-90, again regional income convergence was supported. From 1990 to 1993, however, income disparity between coastal and inland regions started to worsen once again although convergence continued within the coastal area. Raiser (1998) claims a reduction in interregional income inequality over the period 1978-92, but a declined speed of income convergence across regions was noted since 1985 due to the reform shift from rural sectors to industrial sectors and the fiscal decentralization.

In contrast to many previous cross-sectional studies on the Chinese regions, Yao et al. (2000) offers a new estimation method, a panel unit root test, to examine the issue of income convergence. They adopt the ADF approach to test if the deviation from the sample mean with respect to the real GDP per capita of a Chinese province has inherited any unit root. The results report that the Chinese provinces have achieved income convergence in the period 1952-77 but divergence for the period 1978-97. In addition, the authors argue that the Chinese provinces diverged into two distinct clubs (coastal and interior regions) since economic reform.

Choi and Li (2000) investigate the issue of growth convergence for 28 provinces in China during the period 1978-94 by using the OLS, shrinkage and LSDV methods. The empirical shows an evidence of growth convergence in China during the period 1978-94. Further, the poorer regions have higher convergence rates. They are catching up with the higher per capita income provinces. In addition, the authors discuss the advantages and disadvantages regarding the three estimation approaches and compare the estimation results. In particular, the shrinkage method for panel data models seems to provide a better estimate of the convergence rates of the individual provinces.

Yao and Zhang (2001a) formulate a production model to explain income disparity and the concept of "Club Divergence" in China by using both the unit root test and the decomposition of an inequality index based on real per capita GDP data from 1952 to 1997. They test the hypothesis on club divergence which is the spillover from the growth centre (East region), and declines as provinces are further away from the centre. Using a simplified augmented production function, they incorporate investment to GDP ratio, population growth, technological progress, depreciation, export to GDP ratio and two dummies for the distance between the East to Central and Central to the West as the explanatory variables. The empirical results show that the East was initially rich and

became richer over time. The Central and West were initially poor and became poorer. The divergence of regional incomes became more apparent in the reform period than in the pre-reform period. Also, the results find that distance has a significant and negative effect on regional economic growth. It suggested that the further away from the growth centre in the East, the slower would be the rate of economic growth. In their another paper Yao and Zhang (2001b),   both cross-section and panel data approach with MRW human-capital augmented Solow growth model are employed to examine the income convergence in China's provinces and regions for the period 1978-95. The authors introduce some new explanatory factors in the regression model, such as trade to GDP ratio and length of highways, railways and waterways. In the results, there are evidences for both estimations of δ-divergence and absolute β-divergence. However, conditional β-convergence was observed after controlling for population growth, depreciation, physical and human capital investment, trade and transportation. In addition, consistent with Yao and Zhang (2001a), the country has converged into three distinctive geographical clubs of economic growth: coastal, central and western regions. And income convergence is found within each club but divergence found between clubs. These two studies have altogether reconfirmed the conclusion made by Yao et al (2000) in which the convergence force was at work in pre-reform China.

Another two similar studies can be found in Zhang and Yao (2001) and Zhang, Liu and Yao (2001). The former paper presents a comprehensive analysis on China's regional inequality from 1952 to 1999 using released data on consumption and GDP for the coastal, central and western regions of China. The estimation results also suggest a widening inter-regional inequality in China. The latter paper employs time series techniques to examine the issue of regional income convergence. The results report that stochastic convergence is only attained in two regions of the east and the west. This indicates that the relatively poorer western provinces had become even poorer while the comparatively richer eastern provinces had become even richer. The income levels in

the eastern and western regions of China were converging to their own stable states correspondingly. In contrast, the central region had no clear tendency of income convergence as it was affected by both the eastern and western regions.

More recently, Chen and Wu (2005) undertake an empirical analysis of the factors that have influenced economic growth in China's provinces during the process of institutional transformation in 1988-98 to examine whether the disparities in economic growth between provinces have been expanding or diminishing. The empirical test results show that there was a general tendency towards divergence in the economic growth rates achieved within China's provinces in 1988-98. Institutional transformation has not caused a reduction in the disparities between different provinces; indeed, it seems to have exacerbated these disparities. Furthermore, the employed population, change in property rights and FDI had positive impacts on economic growth whilst the fixed asset and human resource had negative impacts.

Kanbur and Zhang (2005) construct and analyze a long-run time-series for regional inequality in China from 1950 to 2000. They find that the evolution of inequality matches different political-economic periods in Chinese history. In particular, they find that heavy-industry development strategy plays a key role in forming the enormous rural–urban gap in the pre-reform period, while openness and decentralization have contributed to the rapid increase in inland–coastal disparity in the reform period of the 1980s and the 1990s. The authors therefore suggest that convergence or divergence of a nation's economy is dependent upon not only its domestic polices but also on its openness. If the government continues to favor the coastal region in its investment strategy, then regional disparity may widen even more. Further liberalizing and investing in the economies of inland regions is thus an important development strategy for the government to both promote economic growth and reduce regional inequality.

Liu and Li (2006) use different financial resources and human capital to examine their impacts on the imbalanced growth of the coastal and inner regions in China. Regression estimates show that, the high economic growth in coastal provinces is attributed to the use of more productive inputs, such as technology, domestic bank loans, and foreign investment; the low economic growth in inner provinces is caused by the use of less productive inputs, such as state appropriations and self-raised funds. Human capital is endogenous for coastal provinces, but is exogenous for inner provinces.

σ-convergence

σ-convergence is another distinct approach to test income convergence. It can be defined as *a group of economies are converging in the sense of σ if the dispersion of their real per capita GDP levels tends to decrease over time* (Sala-i-Martin, 1996b, p1020). In other words, when the dispersion of income levels diminishes over time we say that there is a process of σ convergence. It is studied to estimate the static disparities in per capita income. Many studies have explored the links between β and σ convergence (Barro and Sala-i-Martin, 1991; 1992; Quah, 1995; Sala-i-Martin, 1996b). In general, the process of β convergence tends to generate σ convergence as the relatively poorer economies should first achieve a higher income growth before it can reduce the income gap with the relatively richer one. However, β convergence does not necessarily imply σ convergence. It may happen that the distributional dynamics are such that σ is invariant or increasing even if a country is converging towards the sample mean.

There are three indices used to measure σ-convergence in the literature, which includes the Standard Deviation, the population weighted and unweighted Coefficient of

Variation (or variation coefficient, CV) which can be expressed as the ratio of standard deviation to the mean in equation 2.4[7]:

$$CV = \frac{\sqrt{\dfrac{\sum (y_i - \bar{y})^2}{n}}}{\bar{y}} \qquad (2.4)$$

where y_i is real GDP per capita in region i and $\bar{y}$ is the mean value.

Given a contraction in CV, that is $CV_t < CV_0$ (t is time span), we can say that the economies in consideration have experienced σ-convergence with reduced difference in their income levels over time t. A higher value of CV indicates a more serious income disparity, and *vice versa*. The CV does not only quantify the income inequality problem but also measures the development of income gap between different economies. It has been widely used in the literature, such as Lyons (1991),, Fu and Li (1996), Chen and Fleisher (1996), Raiser (1998), Tian (1999), Zheng et al (2000), Xu and Zou (2000), Chang (2002) and Shan (2002), and most of these studies are focused on discussing the CV of China. The CV index in these studies are calculated by the net material product, national income or per capita GDP in nominal or real value to assess the income inequality problems of China from multiple angles, including in both pre- and post-reform periods.

With respect to net material product per capita for the period 1952-87 in China, Lyons (1991) utilizes both the weighted and unweighted (by population) CVs with different composition to investigate the income distribution of the country. Lyons finds that the value of CV fluctuated over time in the pre-reform period but showed a declining trend in the early years of the post-reform period. Tsui (1996) also estimates the income inequality in China for the first decade of economic reform and finds that the CV value

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[7] Yao and Zhang (2001b) measure σ-convergence by the inter-provincial Gini coefficient and the time standard deviation of log (GDP per capita).

on the provincial level declined from 0.445 in 1978 to 0.416 in 1984, after which it

began to increase again to 0.422 in 1989. A similar result was found by Jian et al.

(1996), albeit the fact that they have employed standard deviation instead of CV to

measure the extent of income inequality. The income disparity saw a significant

improvement at the early years of the reforms and then suffered another setback

subsequently. On estimating the same issue for longer period 1978-1993, Chen and

Fleisher (1996) find that the CV value had increased before 1980, and declined since

then. However, the index showed a tendency of increasing again after 1990 as a result

of the widening disparities between the coastal and non-coastal provinces after the

1990s. Raiser (1998) considered the issue of income inequality on both the provincial

and regional levels. On the provincial level, the CV declined from 0.98 in 1978 to 0.56

in 1992. On the regional level, The CV showed a very impressive contraction for the

coastal region from 0.78 to 0.35 and a very slight declining from 0.38 to 0.35 over the

period 1978-92. Zheng et al. (2000) and Chang (2002) argue that the year of 1990 is the

turning point for the CV, which declined before 1990 and started to increase after then.

Similar result can also be found in Demurger (2001), Cai et al. (2002) and Wu (2002).

Lyons (1991) suggests that CV could be used to measure relative inter-regional income

inequality while the standard deviation of regional GDP per capita could show the

absolute inequality. A decline in CV or standard deviation is an indication of an

improvement on income inequality. This phenomenon is termed σ-convergence of per

capita incomes across regions or countries. Compared to σ-convergence, β-convergence

captures more research interest because it is parametric approach with statistical testing.

CV is not an ideal measurement for income convergence for all regions within a country

although it can be used to indicate the trend of overall inequality. The last disadvantage

of CV is that it cannot show why regions are converging or diverging in per capita

incomes. In contrast, β-convergence is a more useful tool to measure income

convergence as it can testify whether poor regions are catching up with rich ones. It can also explain why regions are converging or diverging in per capita incomes.

2.2.3 FDI and income inequality

In the growth literature, there are two important areas of research, one focusing on how growth relates to inequality, and the other on how growth is linked with FDI. A growing number of studies are trying to integrate these two areas together. Some studies on the effects of FDI on income and wage inequality have reached mixed conclusions (Basu and Guariglia, 2005). Most studies claim that FDI deteriorates income and wage disparities, especially in Less Developed Countries (LDCs). In contrast, some authors have opposite evaluations of FDI. They argue that FDI reduces income inequalities and accelerate the speed of income convergence. However, some other studies show no significant effect of FDI on income inequality. Cooper (2002) claims that "the theoretical case that foreign investment should stimulate growth, and even diminish world and host country inequality of income, is stronger; but the actual history of foreign assistance, some of which was supposedly targeted on improving growth, is disappointing in this regard. And FDI historically has been drawn by natural resources, by trade barriers, and by low domestic competition -- which gives little confidence that FDI has either enhanced growth or reduced inequality in income distribution. Nonetheless, some aggregate evidence credits FDI with a significant growth-enhancing impact, especially where adequate skills are locally available." Tsai (1995) reports generally positive relationship between FDI and income inequality in LDCs, but varies significantly across different conditions countries.

More efforts in the literature are focus on the relation of inward FDI and wage inequality and most studies conclude that FDI inflows worsen income distribution by raising wages due to the increasing demand for skilled workers. Basing on analysis of

Mexico, Ireland, Korea and U.K., Feenstra and Hanson (1997), Figini and Görg (1999), Mah (2002) and Taylor and Driffield (2005) all find that rising wage inequality is associated with the increasing of foreign capital inflows in these four countries' manufacturing respectively. More recently, for cross-country analysis on a panel data of 119 countries in the period 1993-2003, Choi (2006) finds that the Gini coefficient increases as FDI stocks as a percentage of GDP increase. Furthermore, rich countries and fast growing countries turned out to have a more even income distribution. Bigger countries tend to have a less equal income distribution. Latin American and Caribbean countries were found to have worse income inequality. Other similar finding which argue that FDI deteriorate the income inequality can be found in Aitken et al. (1996), Wang (1997), Aghion and Howitt (1998), Lipsey and Sjöholm (2001), Matsuoka (2001) and Velde and Morrisey (2001). However, Basu and Guariglia (2005) state that a positive relation between FDI and wage inequality does not necessarily imply a positvie linkage between FDI and income inequality as well. FDI is, actually, most likely to have an effect on the middle income groups within the host country. As a result of higher wages making these income groups better off, they will, hence, move closer to the top income groups (which would reduce income inequality), however farther apart from the bottom income groups (which would increase income inequality).

Yet, Deardorff and Stern (1994) argue that FDI helps to reduce income inequality when implemented to utilize abundant low-income unskilled labor. Zhang (2001) investigate the role of trade and FDI in cross-country convergence. On top of the conventional specification in unconditional convergence, the exports to GDP and FDI to GDP ratios were introduced into the regression. Based on the sample of Asian economies, the estimations indicated a statistically significant exports and FDI ratios in some of the sub-groups, for example the Asian Newly Industrialized Economies (NIEs) and Japan, and suggested that these two ratios tended to accelerate the convergence process since given these two ratios, the size of β had increased from 1.1% to 2.89% per year. Dollar

and Kraay (2002) argue that the current wave of FDI since the 1980s has actually promoted economic equality and reduced poverty. Choi (2004) investigates that the role of FDI in the convergence of income level and growth by using bilateral FDI data from OECD during the period 1982-97. Choi finds that FDI is a driving force in convergence between homes and host countries by pooled ordinary least squares regressions and panel data regressions. It is also found that geographical closeness and common language play an important role in convergence in income level and growth. Some other studies do not find any significant relationship between FDI and income and wage inequality (Freeman et al., 2001; Lindert and Williamson, 2001; Milanovic, 2002 and Velde and Morrissey, 2002).

In terms of China, compared to other empirical studies of FDI topics in China, relatively few studies have provided a detailed assessment of FDI and regional economic inequality. However, there are some scholars who have attempted to do so. The overwhelming arguments claim that FDI leads to larger inequality.

Sun and Chai (1998) complete a regression analysis of effects of FDI on economic growth in the eastern and western regions of China by using panel data across 16 provinces over the period 1986-92. They pointed out that economic structure and resource conditions, economic reforms and open-door policy emphasized on the eastern region led to an unbalanced spatial pattern between the eastern and western regions. Their results indicate that the effect of FDI on economic growth was stronger in the eastern region and very weak in the western region, which reinforced the inter-regional economic inequality. Moreover, rural industry development and domestic capital flow from the inland regions to the coastal region have also widened inter-regional inequality.

Wu (2000) incorporates FDI and product differentiation in a general equilibrium trade model. The theoretic results demonstrate that FDI can upgrade technology, improve the skills of China's work force, enhance the product quality of local industries, and increase their competitiveness in international markets. Wu suggests that policy implication can be drawn by eliminating the special treatments of FDI in those sectors to reduce the negative impact on income distribution and provide a level playing ground for stable long-term FDI.

Zhang (2001b) examines a conditional convergence in China over the period 1985-95 and find that FDI along with international trade is the key factor driving regional income apart. In particalar, He found income divergence between inland and coastal areas but income convergence within the coastal regions. As for the whole country, FDI led to faster growth in the coastal area and thus induced an expansion of the existing income differences between the coastal area and the non-coastal areas. In light of the coastal region, the surge of FDI accelerated the growth in some initially poor coastal provinces, which actually promoted income convergence rather than divergence within the coastal area.

Bao et al (2002) develop a model for the regional growth pattern of the Chinese economy during the period 1978-97, characterised by FDI and mobilization of rural surplus labour. They claimed that the coastal regions have spatial and topographic advantages characterised by more FDI and mobilization of rural surplus labour plus lower costs of transportation and communication, which produce the disparity from coastal to inland regions.

Using a provincial level data set for the period 1986-98, Zhang and Zhang (2003) estimate a model to decompose the contributions of two major driving forces of

globalization, foreign trade and FDI on regional inequality and applying it on Chinese regional inequality. They suggest that globalization through foreign trade and FDI indeed played an important role in worsening Chinese regional inequality.

Fu (2004) examines the spillover and migration effects of exports and FDI on regional income inequalities in China. She finds that export and FDI have significantly stimulated economic growth in the coastal regions but not so much in the inland regions. Besides, development in the coastal regions has encouraged migration from the inland to the coastal regions which has led to an enlargement in income gap. Overall speaking, "exports and FDI have played an important role in increasing regional disparities in China"[8].

2.3 FDI location and determinants

2.3.1 Theoretical research of MNEs activity and FDI motivations

An enterprise has to answer several kinds of questions when considering investment decision, such as: (a) whether to invest, (b) when to invest, (c) where to invest, (d) how to invest and (e) how to finance (Chen, 2000, p8). This section will review the previous studies of MNEs activity and FDI location by answering questions: (a) and (c). Question (a) discovers the motivations and determinants of MNEs' investment, while question (c) considers the relevant costs for an MNE to select an investment location abroad.

Since the late 1950s, enormous studies have been developed to explain the reasons of that a MNE set up a plant abroad instead of other options such as exporting or licensing arrangements.These theoretical perspectives range from mainstream economic theories

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[8] Fu (2004), p.162.

(Hymer, 1960, 1976; Kindleberger, 1969; Vernon, 1966; Caves, 1971), internalization models (Buckley and Carson, 1976; Rugman, 1981) to Dunning's eclectic paradigm (1973, 1988 and 1993). Among them the work of Hymer and Dunning is particularly worthy of note.

Hymer's celebrated thesis (1960, published in 1976) is the pioneer work to tackle the problem of definition and determinants of FDl and have in fact laid the foundation of the development on the theory of FDl. According to Hymer, FDI differs from portfolio investment as the capital-arbitrage hypothesis explaining international capital movements was unable to explain the causes of FDl. Firstly, othe portfolio capital-arbitrage theory can come up with different predictions on the behaviour of FDI. Secondly, MNEs have to transfer technology, management skills, and entrepreneurship while they are making investments abroad in order to compete successfully with local firms. Thirdly, FDl does involve the change of ownership of resources or rights.

Based on an industrial organization theory, Hymer suggests that foreign MNEs may not be able to compete with domestic firms if they are exactly identical to domestic firms due to the added costs of doing business in another country, including communications and transport costs, higher costs of stationing personnel abroad, barriers due to language, customs, and being outside the local business and government networks. MNEs must occupy some sort of firm-specific ownership advantages (superior technology or lower costs, for example), which can make them overcome the disadvantages and rival with local firms in the host country.

Following Hymer, many economists have made further contributions to explain the motivations and determinants of FDI (Vernon, 1966; Buckley and Casson, 1976; Lundgen, 1977; Swedenbogy, 1979; Buckley, 1987; Casson, 1987 and Dunning, 1977, 1981, and 1993). In particular, Dunning's "OLI" (ownership, location and

internalisation) framework has been the most ambitious and comprehensive explanation of FDI, which is now still commonly accepted.

Dunning (1977, 1981, 1988, 1993, 1995, 1998 and 2000) identify and evaluate the factors influencing both the initial act and the growth of foreign production, and suggest that the composition of three sets of conditions need to be present for a firm to have a strong motive to undertake direct investment abroad. This has become known as the "OLI" framework: ownership advantages (O), location advantages (L), and internalization advantages (I).

First, like Hymer, Dunning states that the MNEs must have *ownership advantages (O)*. It implies that the MNEs should possess specific advantages to the nature and the nationality, including kinds of forms, such as patents, trade secrets, trademarks, human capital, management, reputation for quality, marketing and entrepreneurial skills, organizational systems and access to intermediate or final goods markets. Whatever its form, the ownership advantage confers some valuable market power or cost advantage on the firm specific assets that give them an advantage over local firms (Hymer, 1976; Caves, 1982; Buckley and Casson.1976 and Markusen, 1995). Although ownership advantages are firm specific, they are closely related to the technological, innovative capabilities as well as the economic development levels of source countries. Recent work has applied more formal theory of the firm, such as hold-up issues and agency theory, to provide more formal frameworks for understanding market failures that lead to a firm to become an MNE (Blonigen, 2005, p384).

Second, the host countries must have *Location advantages (L)*. It is external to the foreign firm and arises from the fact that different locations with different economic characteristics which can affect the cost of production and profit for foreign investors to produce the product abroad instead of producing it at home. Foreign firms are able to

increase the production efficiency when the host country possesses abundant and cheaper production factors of production, and also achieve benefits by exploiting the economies of scale in a large market. In sum, location advantages include not only resource endowments, but also economic and social factors, such as market size and structure, prospects for market growth and the degree of development, the cultural, legal, political and institutional environment, and government legislation and policies.

Finally, the MNEs must have an *internalization advantage (I)*. This arises from transferring ownership advantages across national boundaries within own the organization. If a firm only has *O-* and *L*-type advantages which imply it possesses a proprietary product or production process and advantages to produce the product abroad rather than export it, it is still not necessary that the firm should establish a foreign subsidiary. It can license or co-operate agreements with an independent foreign firm to produce the product or use the production process. However, due to market failures in the transaction of intangible assets, it should be more beneficial for the firm possessing *O*-type advantages to produce the product internally within the firm rather than at arm's length through markets. This is pointed to as an internalization advantage. These incentives are determined by the form of corporate governance, internal transaction costs versus market costs (Casson, 1987; Williamson 1975, 1981), and the specific characteristics of the knowledge to be transferred and the cost of transferring it (Rugman, 1986; Teece, 1977; Ethier, 1986).

Although widely accepted (for example, Agarwal and Ramaswami, 1992; Brouthers et al. 1999; Nakos and Brouthers, 2002).), the Dunning paradigm is criticized. Grosse and Berham (1992) consider it a good summary of the several determinants of FDI. Likewise, Graham (1996) says that the OLI paradigm is just taxonomy and not a behavioral model. It puts together different theories of FDI without adding any new element. Rugman (1985) argues that only the internalization advantages are relevant.

Markusen (1995) points out that the OLI paradigm does not consider alternative choices, such as joint-ventures; while Smith and Rebne (1992) highlight that the OLI paradigm does not pay particular attention to political and social elements. Recently, Buckely and Casson (1998) stressing the static nature of it, say that it is not a good instrument for addressing the crucial issue of the 1990s, characterised by a high degree of volatility in the international business environment.

2.3.2 Major determinants of FDI to host countries

Due to the nature of our objective and data availability, the focus of this study is much more on the locational determinants of inward FDI, which is often used to explain why a MNE would choose to invest in a particular host country. It can also be used to explain why foreign investors would choose to invest in a specific location within a particular host country. Every potential host location is characterised by a set of factors. The elements of host country location factors can be broadly classified into two types. First, there are Ricardian-type endowments, which mainly comprise natural resources, most kinds of labour, and proximity to markets. Second, there exists a range of environmental variables acting as a function of political, economic, legal, and infrastructural factors of a host country. Both types of factors play a crucial role in a firm's decision to enter a host country. The sub-themes dealing with host country location factors can be summarized into market size and economic growth, raw materials and labour supply, political and legal environment, host government policies, level of industry competition in the host country market, geographical proximity and transportation costs, and host country infrastructure (Yao, 2006).

In the literature, a set of factors including market demand and market size, labour cost, international trade, infrastructure, human capital, agglomeration, exchange rate, country

risk, institutional regime, taxes, geographical location, etc are the most popularly discussed influences of FDI inflow into the host country. A detailed review of the previous studies on this issue is presented in section 6.2 of chapter 6.

2.4. Chapter summary

The literature reviewed in this chapter, according to the objectives and contents of this research, mainly includes three issues: the impact of FDI inflow on economic growth, the effect of FDI on the process of income convergence and the motivation and determinants of FDI inflow to host countries.

There are three broad categories in the vast literature of economic growth theory, namely: the early post-Keynesian, the neo-classical and the new endogenous growth models. The emphasis of the early post-Keynesian models on the role of savings and investment in promoting growth (Harrod, 1939 and Domar, 1947) makes it difficult to predict how growth can continue beyond a few decades, given the assumption of diminishing returns. The neo-classical models view growth largely as the outcome of exogenous technical progress (Solow, 1956 and 1957; Abramovitz, 1956), which effectively offsets the law of diminishing returns to which inputs are subject. However, in neo-classical growth models, the effect of FDI on output is limited by diminishing returns to physical capital in the long run. FDI would only affect output growth in the short run, leaving the long-run growth rate unchanged. The more recent new endogenous growth models which focus on the role of R&D, human capital accumulation and externalities (Romer, 1986, 1987, 1990; Lucas, 1988), provide powerful support for FDI as a potent factor in promoting economic growth in host countries especially in developing economies (Balasubramanyam, et al. 1996; de Mello, 1997; Wu, Y. 2000; Nair-Reichert and Weinhold, 2001).

Furthermore, two approaches resulting from the theory of international trade and industrial organization have been adopted to study the effects of FDI on host countries. While, the former founded by MacDougall (1960), is based on the theory of international trade and, in general, examines the host country's gains directly from foreign investment (direct and portfolio) in relation to factor rewards, employment and capital flows; the latter, pioneered by Hymer (1960), departs from the theory of industrial organization and is consequently widely employed in the literature. It addresses the fact that firms investing abroad is due to some imperfection in markets for the goods or factors, including technology or some interference with competition by governments or by other firms; and generally focuses on the indirect effects, externalities or spillovers. The external effects or spillovers from FDI can be caused by two factors (Blomstrom and Sjoholm, 1998); the first factor in the equation is MNEs competing successfully with local firms with new advanced technology, the second factor is local firms being forced to change their financing methods, marketing and production techniques as well as managerial skills to promote their productivity and growth in order to maintain their market shares and profits after MNEs' entry.

Besides the theory studies, there is a large body of empirical studies that investigate host countries' gains and spillovers from FDI. Elmawazini et al. (2005) review the exiting empirical studies and summarize five channels which affect the scope and significance of the productivity of FDI in host countries including the linkages between foreign affiliates and local firms, R&D efforts undertaken by foreign affiliates, training of local firms' employees, demonstrative effects of FDI on local firms and ownership sharing of foreign affiliates. Albeit the fact that FDI is widely considered to have a positive effect on the host country's growth, there is still some contrary argument in the literature and some studies demonstrate that the FDI has negative or no significant effect on host country's growth.

In China's case, the massive inflows of FDI have had important implications for economic growth, trade, politics, employment, culture and social development in the country (Seyf, 2000; Cheng and Kwan, 1999). In a detailed study, Chen et al. (1995) argue that FDI may have the following effects on China: on the one hand, spurring economic growth, increasing the total fixed asset investment and the number of domestic manufacturers to compete globally whilst on the other hand, accelerating uneven development between the coastal and inland provinces, worsening income disparities as well as reducing ideological commitment. This study will use the newest data set to not only estimate the impact of FDI on China, but also to reveal the exact mechanism by which FDI impacts upon the development process of the country.

To test the presence of a catching-up process and to estimate the actual income gap between different economies, the β- and σ-convergence tests are the more commonly-used techniques to estimate income convergence. Chen and Fleisher (1996), Jian, Sachs and Warner (1996), Gundlach (1997), Raiser (1998), Yao and Zhang (2001a, 2001b), etc. have all adopted these techniques to assess the issue of income convergence of China. Relative to the GE and the decomposition of Gini coefficient, the β- and σ-convergence tests do not only indicate the degree of inequality, but also the speed of income convergence and the contributions of different factors, such as investment, trade and FDI to the convergence process. For this reason, they will be employed in this research to examine the convergence issue between China's three regions.

There are varied conclusions reached by previous studies on the analyses of the linkage of FDI and income inequality. Most studies claim that FDI deteriorates income disparities, especially in LDCs (Tsai, 1995; Feenstra and Hanson, 1997; Choi, 2006), other, in contrast, bring out opposite evaluations about FDI. They argue that FDI reduces the income inequalities and accelerates the speed of income convergence (Deardorff and Stern, 1994; Zhang, 2001; Dollar and Kraay, 2002). In China, the

overwhelming arguments claim that FDI leads to a larger inequality (Chen et al., 1995; Sun and Chai, 1998; Bao et al, 2002; and Fu, 2004). Employing the MRW augmented model, this research will use the newest data set to examine how FDI plays a role on regional inequalities in China.

In relation to the main FDI theories and the motivation for FDI, the theoretical perspectives range from mainstream economic theories (Hymer, 1960, 1976; Kindleberger, 1969; Vernon, 1966; Caves, 1971), internalization models (Buckley and Carson, 1976; Rugman, 1981) to Dunning's eclectic paradigm (1977, 1980, 1993). Among the vast array of studies, the works of Hymer and Dunning is particularly worthy of mention. Hymer distinguished the difference between portfolio investment and direct investment, and raised an argument that the capital-arbitrage hypothesis explaining international capital movements was inconsistent with several obvious patterns in the behavior of MNEs, but was unable to explain the causes of FDI. In addition, Hymer applied industrial organization theory to point out that foreign MNEs will not have profitability when entering the domestic market if they are exactly identical to domestic firms due to the costs of doing business in another country.

Consequently, according to Hymer, in order for MNEs to perform foreign production, MNEs must acquire a form of firm-specific ownership advantages, in terms of greater technology or lesser costs due to scale economies, which would prevail over the disadvantages they encounter in rivaling with local firms in the country of production. The ownership advantages could vary from the control of superior technology to ownership of a brand name. The probability of the use of the firm of such advantages by means of licensing or FDI relies on the nature of the advantages and the level of imperfections in the markets for the advantages it has. Dunning extended on Hymer's argument and synthesized the main elements of various explanations of FDI, thus raising the suggestion that the three conditions (Ownership, Location and Internalization

advantages, 'OLI' framework) all need to be present for the firm to have a strong motive to undertake direct investment abroad.

Due to the nature of our objective and data availability, the focus of this study is to a large extent on the location advantages, which is often used to explain why an MNE would choose to invest in a particular host country. And it can also be used to explain why foreign investors would choose to invest in a specific location within a particular host country. Every potential host location is characterised by a set of factors, which are reviewed in the previous studies as: market size, labour cost, international trade, infrastructure, human capital, agglomeration, exchange rate, country risk, institutional regime, taxes, etc. This research will apply these factors to China and its three regions to investigate the determinants of FDI inflow to China, as well as their differences in each of the regions.

Chapter 3 Economic Performance and Foreign Direct Investment in Post-reform China

3.1 China's economic reform

In quest of a new path to realize socialism, the former Chinese leader Deng Xiaoping in December 1978 made two important decisions for China, to open the door of China to the outside world and to revitalize the country's economy through reform. These two significant decisions opened a historic page in modern Chinese history and laid the cornerstone for China's rise as a world superpower in the decades to come. Since then, China has been gradually transformed to a socialist market economy from a planned economy, which was set up with the establishment of the People's Republic of China (PRC). The remarkable increase of China's economic efficiency and adjustment of its economic structure were due to the reforms. The reforms have made China one of the fastest-growing and most robust economies in the world. During the 1978-2006 period, China's gross domestic product (GDP) increased at a rate of 9.6% per year in real terms. By 2006, China became the world's fourth largest economy measured in nominal GDP, the third largest trading nation and the second largest host country of foreign direct investments. It is predicted that by 2008, China will overtake Germany to become the world third largest economy, and follow the US to become the world's second largest exporting nation, even by excluding the exports from its two special administrative regions of Hong Kong and Macau. Measured in PPP dollars, China's GDP is already twice as large as that of Japan, the world's second largest economy measured in nominal dollars (Yao, 2007).

China's economic success has been due to its gradual economic reforms, extending from the countryside to the state-owned industrial enterprises and to all parts of the national economy.

Rural Reforms

In order to improve labour incentives in agriculture production, in the late 1970s, the Chinese government implemented the household production responsibility system (HPRS) and abolished the commune system established during the Great Leap Forward Movement in the late 1950s. The HPRS established clear and precise responsibilities and viewed peasant households as separate production and management units. In the HPRS, each household was given a plot of land. During harvest, households would deliver parts of their production to the state and the production team. These obligations were called production quotas, or responsibilities that households owed to the state and the production team (Yao, 1994; Shen, 2000; Lin et al, 2003). After fulfilling these responsibilities, households were entitled to the remainder. As the quotas were fixed and pre-set on individual households, the more households were able to produce, the more they would be able to retain the residuals. This system was in sharp contrast with the former commune and production team system where all production had to be delivered to the state and the production team, which in turn, re-distributed its share back to its member households. While the change from the commune and production team to the HPRS appeared trivial; it had an unprecedented and enormous impact on the production incentives of households. Such incentives were the key to the great success of China's rural reforms.

As a result, the country's agriculture output has largely increased. Furthermore, the agriculture abundant labour, which is China's comparative advantage, could be fully exploited. In addition, rural markets were re-opened and the farmers were permitted to

sell their residual products. Not only were the farmers' right on using the assigned pieces of land extended, but also ownership of the lands became transferable. Under the name of Township and Village Enterprises (TVEs), farmers were also urged to build up some sideline economic activities. In the 1980s, rural industry became the major force behind rural economic development; 60-70% of rural output value was produced by TVEs (Lin et al, 2003, p147). Moreover, different sorts of rural cooperative organization, such as agriculture technology associations, farmers' economic associations, specialized technique associations and rural cooperative funds have significantly contributed to social and economic development in rural China.

SOEs Reform

The success of rural reforms from the late 1970s to the early 1980s encouraged the government to launch a comprehensive urban reform programme, starting with the reforms in the state-owned enterprises (SOEs). The enterprise reforms experienced three strands since 1979: the relocation of control rights between government agencies and enterprise management, the organizational restructuring of enterprises and the transformation of ownership (Hussain and Chen, 1999). Lin et al. (2003) conclude that the essence of enterprise reforms was to decentralize decision-making power from the central and regional authorities to the SOEs, which started from 1980 and went through three different phases. The first phase was to give more independence to the SOEs in decision-making relating to production responsibility, bonus payment, production plan and profit retention during 1980-84. This reform was intended to improve SOE efficiency by giving managers more autonomy. The sharing of management power and profit between SOEs and their higher authorities (central and regional governments) was a powerful instrument through which the initial reform was implemented.

This reform was anchored on the economic theory relating to the agency problem. SOEs were regarded as agents of their principals, either central or regional governments (Cauley and Sandler, 1992&2001; Zhou and Wang, 2000). In the past, the principals were solely responsible for all the profits and losses of SOEs and the agents would have no incentives to do more than what their principals dictated them to do according to the production plan set by a state planning authority. With reform, as the agents were allowed to retain a certain part of the profit and given some autonomy in making production decisions, managers of SOEs and their workers shared similar incentives to improve productivity, efficiency and profitability (Cauley and Sandler, 1992&2001). The end result was that both the social welfare and individual income increased accordingly. The exact reform measures included pay raises, bonuses and retention of profits in enterprises. So as to make workers and managers more concerned about the performance of enterprises, fiscal authority was decentralized and resource-allocation autonomy given to the local governments and concerned ministries by the central government (Yao, 1999; Harvie, 2000; Lin et al., 2003).

The first-phase reforms were partially successful but did not fundamentally resolve the SOEs efficiency and competitiveness problems. As a result, the second phase of reforms focused its efforts on improving SOEs' vitality (1984-86). A director responsibility system, the new system of tax for profits, and further decentralization were introduced. To some extent, these further reforms were brought about by the competitive pressure exerted by the emerging non-state enterprises (i.e., TVEs). Unlike SOEs, non-SOEs such as TVEs did not have access to reasonably-priced resources within the state plan, thus gaining the upper hand in a fiercely-competitive market was the only method to survive and develop (Perotti et al., 1999; Harvie, 2000; Lin et al., 2003). The responsibility system and the shareholding system was adopted in the second round of reform, which also changed direct fiscal appropriation to indirect bank loans and replaced profit remittance with corporate taxes and all the aforementioned measures

were taken to deal with competitive pressure (Robert and Dodds, 1996). Moreover, a series of administrative regulations were promulgated to expand SOEs' decision-making power. Such power included the ability to control sales and marketing, set prices, select factors of production, use corporate funds, distribute salaries and bonuses (Schipani and Liu, 2002).

The third phase of SOEs reforms started in 1987. In this phase, the reconstruction of the SOE management mechanism was the chief focus. The key reform measure was the implementation of a system of management responsibility, including the contract system in the large- and medium-sized SOEs, leasing in small SOEs, and experiments with the shareholding system, which has become widespread up to the present time (Brean, 1998). The development of the Shanghai and Shenzhen Stock Exchanges in the 1990s provided a useful platform for the largest and subsequently medium-sized SOEs to go through the process of joint shareholding. The latest round of reforms has been characterised by the massive number of banks, large corporations and large non-state-owned enterprises listing on the bullish equity markets in China since late 2005. Despite these recent dramatic changes, many policy makers and academic researchers believe that the fundamental problems of SOEs have not been resolved. There are still concerns about SOEs' corporate governance and efficiency, the absence of competitive markets for products, production factors and managerial personnel (Lardy, 1998; Lin et al., 2003).

Price Policy Reform

China's price reform started with a dual-track price system in the early 1980s, which sustained both planned and market prices, targeted at consumer goods, intermediate inputs and production factors. Before 1984, a market price mechanism had not been created. However, some prices could be adjusted. The government balanced differences

between planned and market prices, by increasing the price of goods in shortage and reducing those in surplus. Since 1985, the market mechanism was applied to price determination, in combination with the planned price. The dual-track price system thus was established. Enterprises were free to set prices in accordance with supply and demand of the market to an extent permitted by price-relevant laws, regulations and policies. Only the prices of goods or products within the state plan were set by the government (Fan, 1994; Lau et al., 2000 and Lin et al., 2003).

Due to the continued reform of China's price system, the role of government-planned prices have reduced substantially and that of market prices in resource allocation have been enhanced greatly. In 2002, for example, the share of market-regulated prices was 94.7% for retail products, 83.3% for agricultural products, 86% for production inputs.[9] In short, after over two decades of reform, China's price system has become a mechanism of market-based pricing under macro-economic adjustment. It has become increasingly rationalized, creating a relatively fair marketplace for all enterprises to compete on an equal footing.

The Open Door Policy

The open-door policy was another important aspect of China's economic policy and reform. Before 1978, influenced by Mao's politically-oriented and self-sustaining policy, China closed its door to foreign countries. Deng learned from the country's history of failure and started to advocate opening to the outside world, allowing foreign direct investment, joint ventures or exclusively foreign-owned enterprises and expanding foreign trade. Since then, foreign investments have been pouring in and Joint Ventures Enterprises (JVEs) and Foreign Investment Enterprises (FIEs) have been mushrooming, especially in the coastal areas, where the open door policy started.

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[9] Source: http://english.china.com/zh_cn/busUSiness/economy/11021617/20040830/11855481.html

To take advantage of their geographic proximity to overseas Chinese communities such as Hong Kong, Taiwan and Macau and their vast overseas connections, Shenzhen, Zhuhai, Shantou and Xiamen were established as four Special Economic Zones (SEZs) in the late 1970s. SEZ could be defined as a region where special and more attractive economic policies and economic management systems were allowed to operate. As its main means of economic development, it attracts and uses foreign funds. Also to be found in these regions are policies which promote foreign trade and inward FDI. Foreign-funded enterprises are given priority, while the existence of various ownership structures was permitted in the SEZ. To encourage foreign trade and attract foreign investment, open cities, apart from the SEZs, were also set up in the coastal area of China later on, such as in the Yangtze River Delta, the Pearl River Delta, the southeast area of Fujian Province, and Bohai Bay in Guangxi. In the south, the island province of Hainan was approved as a special economic area. Last but not least, Pudong, in the eastern part of Shanghai, was also designated as a special economic zone. From the mid 1990s, the inland provinces were opened and reformed one after the other.

3.2 China's economic performance in the post-reform period

Agricultural reforms, urban and SOE reforms, and the open policies have produced remarkable successes in the Chinese economy. Such successes can be regarded as a China economic miracle in world development history. Over three decades, China has been transformed beyond recognition by foreigners and by her own people. Thirty years ago, China was a poor country, struggling to produce enough food and clothing to feed and keep its huge population warm. Thirty years later, despite the many social, economic and environmental problems, China has become a world power and a growth engine of the world economy. The prosperity of the Chinese people and the dynamism

of the Chinese economy and its impact on the world could not be exaggerated by any description.

Table 3.1 Real GDP and its growth rate of China, 1979-2005, billion RMB

Year	RGDP	Growth rate	Year	RGDP	Growth rate
1979	670.38	6.96	1994	3082.98	14.86
1980	730.12	8.91	1995	3483.75	13.00
1981	774.23	6.04	1996	3894.57	11.79
1982	850.82	9.89	1997	4322.66	10.99
1983	943.26	10.87	1998	4742.68	9.72
1984	1087.67	15.31	1999	5161.55	8.83
1985	1234.53	13.50	2000	5660.40	9.66
1986	1327.18	7.50	2001	6205.73	9.63
1987	1478.67	11.41	2002	6881.16	10.88
1988	1650.59	11.63	2003	7727.95	12.31
1989	1717.70	4.07	2004	8784.87	13.68
1990	1812.37	5.51	2005	9940.79	13.16
1991	1986.90	9.63	1979-92		9.95
1992	2300.20	15.77	1992-05		11.92
1993	2684.20	16.69	1979-05		10.93

Notes: GDP is measured in 1990s prices. Growth rate is average annual growth rate of GDP in 1990 prices.

Sources: Statistical Yearbook of China (NBS, 1998-2006, various issues).

As reported in Table 3.1, the real GDP (RGDP) of China increased from RMB 670.38 billion in 1979 by 14.83 times to RMB 9940.79 billion in 2005. It implies an average growth rate of 10.93% per annum during 1979-2005, which was almost twice as high as in the 1952-78 period. Similar to the RGDP, per capita RGDP increased by 10.92 times from RMB 711 in 1979 to RMB 7763 in 2005. Its growth rate was 9.63% per annum (Table 3.6), which was more than 5 percentage points higher than that in the pre-reform period.[10] This progress indicates that the reform policies have accelerated the growth pace of China, especially in the second phase of reform and the open door policy. For

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[10] The average annual growth rate of RGDP and per capita RGDP (1990 price) over 1952-78 was 5.84% and 3.99% respectively, calculated by the author.

example, the average growth rate of RGDP in 1992-2005 was almost 2 percentage points higher than that of the period 1979-92.

Table 3.2 Investment and trade statistics of China, 1979-2005, RMB billion at 1990 price

Year	Investment in Fixed Assets	growth %	Investment to GDP ratio%	Export	growth %	Trade	growth %	Trade to GDP ratio%
1979	117.85		17.58	117.7		252.8		37.71
1980	137.67	16.81	18.86	138.7	17.83	287.2	13.60	39.33
1981	151.59	10.12	19.58	151.5	9.20	303.0	5.51	39.14
1982	189.47	24.99	22.27	144.9	-4.37	269.9	-10.94	31.72
1983	213.24	12.54	22.61	139.6	-3.67	273.9	1.48	29.03
1984	265.65	24.58	24.42	157.3	12.71	322.2	17.67	29.63
1985	354.63	33.50	28.73	159.0	1.11	404.6	25.57	32.78
1986	392.46	10.67	29.57	176.4	10.93	421.1	4.07	31.73
1987	443.02	12.88	29.96	216.9	22.93	454.5	7.93	30.74
1988	479.56	8.25	29.05	251.2	15.83	543.4	19.56	32.92
1989	402.05	-16.16	23.41	264.9	5.44	563.0	3.61	32.78
1990	411.89	2.45	22.73	297.0	12.15	552.3	-1.90	30.47
1991	486.48	18.11	24.48	329.8	11.04	622.4	12.70	31.33
1992	670.48	37.82	29.15	378.4	14.71	737.3	18.46	32.06
1993	948.35	41.44	35.33	396.8	4.88	846.5	14.81	31.54
1994	1086.64	14.58	35.25	510.1	28.54	997.3	17.82	32.35
1995	1178.71	8.47	33.83	609.9	19.58	1151.4	15.44	33.05
1996	1280.05	8.60	32.87	601.7	-1.35	1154.7	0.29	29.65
1997	1385.92	8.27	32.06	712.1	18.35	1266.7	9.70	29.30
1998	1615.31	16.55	34.06	704.8	-1.03	1242.8	-1.89	26.20
1999	1700.39	5.27	32.94	731.4	3.78	1353.1	8.88	26.22
2000	1848.36	8.70	32.65	904.5	23.67	1721.6	27.23	30.41
2001	2079.19	12.49	33.50	939.5	3.87	1799.4	4.52	29.00
2002	2419.35	16.36	35.16	1102.4	17.34	2101.7	16.80	30.54
2003	2864.77	18.41	37.07	1426.7	29.42	2770.4	31.82	35.85
2004	3618.91	26.32	41.19	1871.1	31.15	3641.0	31.42	41.45
2005	4366.41	20.66	43.92	2333.7	24.72	4354.9	19.61	43.81
Average output growth, %								
1979-91		12.54			8.96		7.80	
1992-05		15.50			15.02		14.64	
1979-05		14.90			12.17		11.57	

Notes: Total exports and trade are deflated by GDP deflator.

Source: Statistical Yearbook of China (1988-2006), various issues.

China's fixed asset investments have also surged in the reform era. This can be explained mainly by rapid economic growth. As summarized in Table 3.2, in 2005, total investment in fixed assets amounted to RMB 4366.41 billion at 1990 prices and accounted for 43.92% of the year's GDP, compared with 17.58% in 1979. The average growth rate of real fixed assets investments was 14.90% for the period 1979-2005. Before 1990s, the investment in fixed assets kept growing at a two-digit rate except for 1988-1990. This probably was due to the the Tiananmen Square Incident. Since 1992, China started to receive a large amount of FDI, as a result, the total investment in the country jumped dramatically with a growth rate of 37.82% and 41.44% in 1992 and 1993 respectively. Although investment growth fluctuated in the second period of reform from 1992 to 2005, similar to GDP, its growth rate was almost three percentage point higher than that of the first stage of economic reform from 1979 to 1991. The increase in investment ratio indicates that more resources were pulled out from GDP for investment purposes, and it can partially explain the rapid economic growth experienced by China in the post-reform period (Lei, 2006).

The increase in external trade is regarded as another explanation for China's impressive economic performance. Total real export and trade value (Table 3.2), for example, increased by 19.82 and 17.23 times from RMB 117.7 billion and RMB 252.8 billion in 1979 to RMB 2333.7 billion and RMB 4354.9 billion in 2005 respectively. It implied an average growth rate of 12.17% and 11.57% respectively for both measurements in the post-reform period. Similar to investment, the average annual growth rate of exports and trade after 1992 were almost double of those before 1992. Moreover, the ratio of its trade to GDP increased continuously from 37.71% in 1979 to 43.81% in 2005. Such a growing trend indicated that China has evolved from a relatively closed economy in the pre-reform period to an open economy in the post-reform period. Although as a result of the "Asian financial crisis" in 1997-98, both exports and trade saw negative growth

rates in those years because many Asian countries or regions such as Japan, Korea and Hong Kong are the major trade partners of the country.

As for export compositions, since 2001, manufactured goods started to make up over 90% of the total exports. In 2005, for example, this ratio was 93.57%. In particular, machinery and transport equipment, machinery, electric equipment and accessories, recorders, video recorders and accessories accounted for around 80% of total exports, while textile materials and products had an export share of nearly 20%. For imports, in 2005, manufactured goods accounted for 77% of total imports whereby over half of them were machinery and transport equipment. Similar to exports, machinery, electric equipment and accessories, recorders, video recorders and accessories was the largest import category, making up over 40% of total imports. The second largest category was base metals and related products which had an import share of nearly 10% in 2005.

Regarding the trade balance, China has been running a trade surplus since the 1990s, with an exception in 1993. In 1998, the country achieved its highest-ever trade surplus at RMB345.18 billion, or 4.55% of its GDP. In 2005, a trade surplus of RMB835.55 billion was recorded and it accounted for 4.54% of China's GDP.

In relation to its trade partners, three 'developed' areas (EU, Japan and the US) and the so-called Asian newly industrializing economies (NIEs) are the principle sources of imports and main destinations of exports of China (Chen, et al., 1998). In 2005, China exported 21.38% of its total shipments abroad to the United States, 16.34% to Hong Kong, 11.02% to Japan, 4.61% to Korea, 4.27% to Germany, 3.40% to the Netherlands, 2.49% to United Kingdom, 2.18% to Singapore, 2.17% to Taiwan and 1.73% to Russia. At the same time, China purchased 15.21% of its total imports from Japan, 11.64% from Korea, 11.32% from Taiwan, 7.37% from the United States, 4.66% from Germany, 3.04% from Malaysia, 2.45% from Australia, 2.41% from Russia, 2.12% from Thailand

and 1.95% from the Philippines. Given these figures, it is not hard to tell that the United States was the most important market for China's exports, while Japan was the most important source of imports for China.

Looking at another flow of external transactions, inward FDI, which was welcomed and encouraged by the government and various preferential policies were introduced to improve the attractiveness of China to foreign investors. Given these policies, the country has successfully attracted huge amount of foreign capital from abroad. In 2005, a sum of $60.33 billion FDI was received and the cumulative total amount of FDI that China obtained rose to $622.43 billion since 1979. Despite the sluggish progress in the past few years, the incoming FDI actually used has been growing at an average rate of almost 30% a year. This pace of growth not only exceeds the growth rate of RGDP and total investments in fixed capital, but is also higher than those of total exports and imports. Simultaneously, the significance of FDI, stated as the FDI to GDP ratio, has been increasing from less than 1% in the 1980s, to a peak of 6.26% in 1994. Although the ratio has dropped to less than 3% in 2005, its importance and contribution to China's growth and development should not be ignored. In particular, further details of FDI inflows in China will be discussed in the next section.

Moving to the performance of the three production sectors in the post-reform period, the rural reforms have improved the performance of the primary industry. The real output expanded from RMB 207.82 billion in 1979 to RMB1252.54 billion in 2005. In relation to the GDP share of the sector, in line with the industrialization process, its GDP share has fallen from 31.0% in 1979 to 12.6% in 2005. As for the second industrial sector, its real output increased from RMB315.75 billion in 1979 by 15 fold to RMB4721.88 billion in 2005, which made up 47.5% of the country's total output for the same year. Over the past two decades, the output share of the second sector has been rather stable, moving within the levels of 41%-48%, the fluctuations being the lowest among the

three sectors. In relation to the tertiary industry sector, its real output increased from

RMB146.81 billion in 1979 to RMB3966.38 billion in 2005. Its GDP share, in contrast

to the primary industry, increased from 21.9% in 1979 to 39.9% in 2005.

Considering the employment situations in three sectors, as shown in the columns of 4, 7

and 10 of Table 3.3, the primary sector was still the largest sector of China according to

its 44.8% of employment share in 2005. The tertiary sector has replaced the industrial

sector to be the second largest employer in China since 1994. The industrial sector,

though it was the largest GDP contributor, employed the least number of personnel in

the country. In the post-reform period, the total number of employed persons in China

increased at 2.39% a year from 410.24 million in 1979 to 758.25 million in 2005.

Consequently, the total number of people employed in all three sectors has increased.

Table 3.3 Value-added & employment in China, 1979-05, RMB billion (1990 prices)

Year	Primary sector			Secondary sector			Tertiary sector		
	Value-added	GDP share	Emp share	Value-added	GDP share	Emp share	Value-added	GDP share	Emp Share
1979	207.82	31.0	69.8	315.75	47.1	17.6	146.81	21.9	12.6
1981	244.66	31.6	68.1	356.92	46.1	18.3	172.65	22.3	13.6
1986	357.01	26.9	60.9	579.98	43.7	21.9	390.19	29.4	17.2
1991	482.82	24.3	59.7	830.52	41.8	21.4	673.56	33.9	18.9
1992	494.54	21.5	58.5	1000.59	43.5	21.7	805.07	35.0	19.8
1996	759.44	19.5	50.5	1849.92	47.5	23.5	1285.21	33.0	26.0
1997	782.40	18.1	49.9	2053.26	47.5	23.7	1487.00	34.4	26.4
1998	820.48	17.3	49.8	2191.12	46.2	23.5	1731.08	36.5	26.7
1999	836.17	16.2	50.1	2363.99	45.8	23.0	1961.39	38.0	26.9
2000	837.74	14.8	50.0	2598.12	45.9	22.5	2224.54	39.3	27.5
2001	875.01	14.1	50.0	2804.99	45.2	22.3	2525.73	40.7	27.7
2002	928.96	13.5	50.0	3082.76	44.8	21.4	2869.44	41.7	28.6
2003	973.72	12.6	49.1	3554.86	46.0	21.6	3199.37	41.4	29.3
2004	1150.82	13.1	46.9	4058.61	46.2	22.5	3575.44	40.7	30.6
2005	1252.54	12.6	44.8	4721.88	47.5	23.8	3966.38	39.9	31.4

Notes: All values are measured in 1990 constant prices. Emp = employment.

Source: Statistical Yearbook of China, various issues.

When the paces of growth are compared, the total employed in the primary sector increased from 286.34 million in 1979 by just 1.19 times to 339.70 million in 2005. In contrast, the total employed in the industrial sector expanded from 72.14 million in 1979 by 2.51 times to 180.84 million in 2005. The highest growth rate could be found in the tertiary sector in which the total employed expanded from just 51.77 million in 1979 by 4.59 times to 237.71 million in 2005. In line with this rapid expansion, the tertiary sector has also become the second largest sector in China in terms of employment. Its employment share grew from 12.6% in 1979 to 31.4% in 2005. The industrial sector, on the other hand, has become the sector with the smallest number of labourers, though its employment share increased from 17.6% in 1979 to 23.8% in 2005. As for the primary sector, despite its dominant position in the labour market, the sector's employment share has declined from over 69.8% in 1979 to just 44.8% in 2005.

In short, since the economic reform and open-door policy implemented in the late 1970s, China has achieved an impressive economic growth. However, one downside of economic reform has been the ever-rising inter-regional inequality.

3.3 Regional income inequality in China

Income inequality in China reflects many dimensions, such as inequality between rural and urban, inequality within urban or rural, and inter-regional inequality. This research only focuses on the inequality between regions. According to their geographic locations, China's 31 provinces are officially classified into three macro-regions: the East, the Central and the West, as shown in Figure 3.1. The eastern region includes 12 coastal provinces: Liaoning, Beijing, Tianjin, Hebei, Shangdong, Jiangshu, Shanghai, Zhejiang, Fujian, Guangdong, Guangxi and Hainan. The central region includes 9 provinces: Jilin, Heilongjiang, Inner Mongolia, Shanxi, Henan, Anhui, Jiangxi, Hubei and Hunan. The western region includes 10 provinces: Sichuan, Chongqing, Guizhou, Yunnan, Shaanxi,

Gansu, Tibet, Ningxia, Qinghai and Xingjiang. The eastern region is also called the Coastal region while the central and western regions together are called the Inland region. The eastern region is the richest and the western region is the poorest.

Figure 3.1 Mainland China divided into three macro-regions
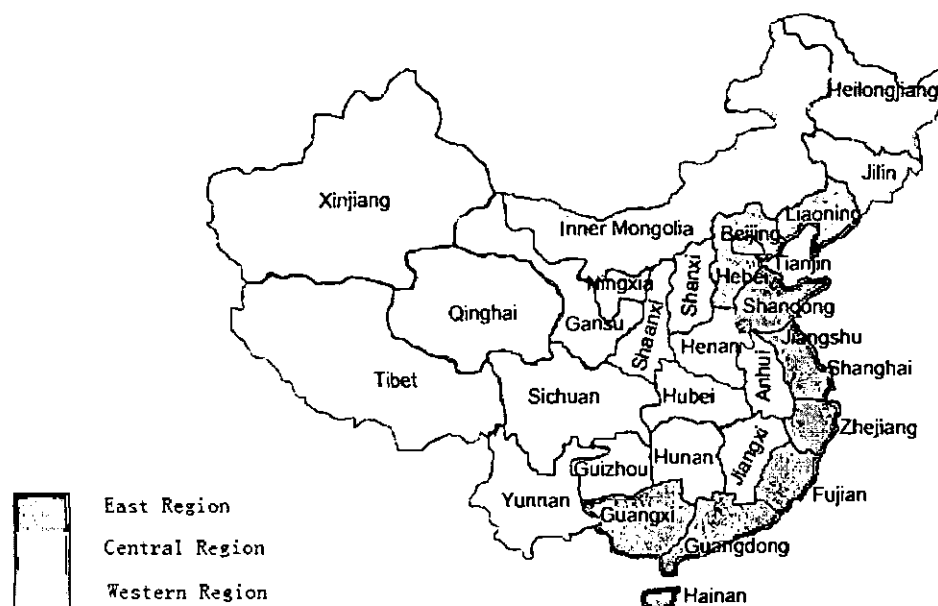
Source: National Bureau of Statistical (NBS), modified by the authors

Many previous studies claim that economic reforms deteriorate income disparity within China. To see whether income inequality was already embedded before 1978, a brief literature survey of this issue is conducted for the pre-reform period before a more detailed analysis of post-reform income inequality.

3.3.1 Regional inequality in the pre-reform period

The average annual growth rate of real GDP during 1953-78 was 5.68% at the national level, 6.16% in the East, 5.06% in the Central and 5.59% in the West (Table 3.4). The GDP growth during this period was generally characterised by erratic fluctuations. The

growth rates in 1960-62, 1967-68, 1974 and 1976 were even negative, especially in 1961 when China's national output growth rate was -38.11%.

Table 3.4 Real GDP annual growth rate in comparison, 1953-78 (%)

Year	East	Central	West	China	SD
1953	13.38	8.06	13.80	11.48	3.20
1954	6.72	2.53	12.30	6.23	4.90
1955	7.12	11.81	6.80	8.73	2.81
1956	11.53	6.95	13.83	10.33	3.50
1957	6.30	11.71	5.07	8.00	3.53
1958	16.85	18.59	14.61	17.08	1.99
1959	12.89	5.87	0.96	8.27	6.00
1960	3.97	0.77	-6.23	1.18	5.22
1961	**-38.90**	**-41.32**	**-28.77**	**-38.11**	**6.66**
1962	**-6.60**	**-0.37**	**-4.91**	**-4.11**	**3.22**
1963	8.80	6.35	10.21	8.16	1.96
1964	14.12	14.55	13.82	14.22	0.37
1965	14.69	15.48	17.05	15.38	1.20
1966	9.68	10.07	9.61	9.81	0.25
1967	**-5.78**	**-3.04**	**-9.95**	**-5.50**	**3.48**
1968	**-1.17**	**-4.16**	**-21.07**	**-5.33**	**10.73**
1969	15.54	8.20	19.37	13.45	5.68
1970	15.24	18.05	21.13	17.14	2.94
1971	9.07	6.71	9.81	8.36	1.62
1972	4.73	3.02	3.69	3.97	0.87
1973	6.93	6.41	5.87	6.59	0.53
1974	2.74	-1.35	-2.02	0.60	2.58
1975	9.20	8.17	10.70	9.09	1.27
1976	2.79	-1.15	-6.52	0.07	4.67
1977	8.11	8.68	16.80	9.61	4.86
1978	12.16	10.86	19.35	12.90	4.57
Average 1953-78	6.16	5.06	5.59	5.68	3.41

Notes: RGDP = real GDP measured in 1990 prices. SD = standard deviation.

Sources: *China Statistical Data for 50 Years 1949-98* (NBS, 1999).

The fluctuations in economic growth in the pre-reform period were largely due to two distinct historical episodes. The first was the "Great Leap Forward" and the breaking of trade relations with the Soviet Union during 1958-60, subsequent agricultural failures

and a nation-wide famine. The second was a large decline in the latter half of the 1960s due to political and social chaos that followed the initiation of the Cultural Revolution from 1965 to 1976. Since the country was struggling with various kinds of political unrests, economic turbulences and natural disasters, it had encountered difficulties in achieving stable income growth. The country's output started to stabilize with much less fluctuation from 1976, especially after the implementation of the economic reform to transform China from a centrally-planned to a market-oriented economy by the end of the 1970s. The trend of growth in China's regions in the pre-reform period is presented in Figure 3.2. The political unrests and natural disasters, which spread to the whole country, resulted in similar fluctuations of growth in all three regions.

Figure 3.2 Real GDP annual growth rate in China's regions, 1953-78
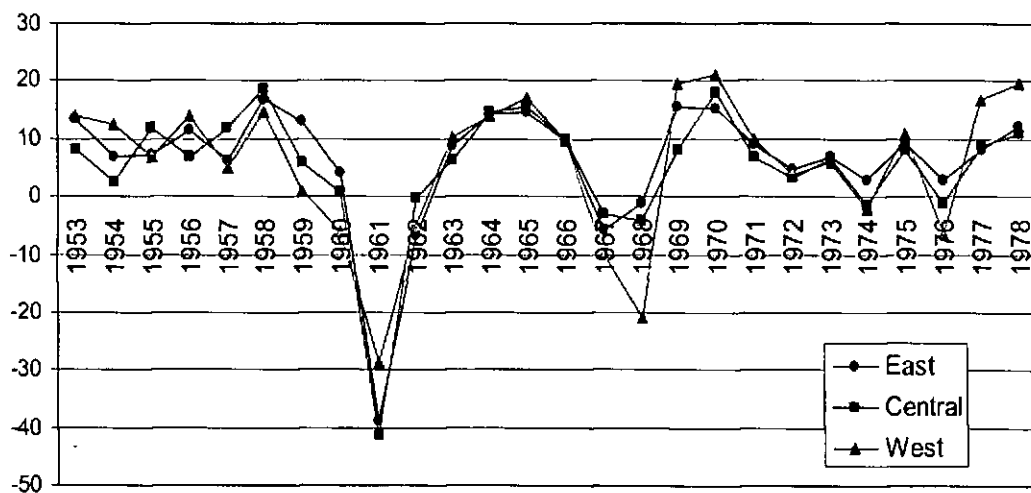
Notes: Growth rate is average annual growth rate of real GDP in 1990 prices.
Sources: *China Statistical Data for 50 Years 1949-98* (NBS, 1999).

Table 3.5 shows that RGDP per capita in the East was higher than in the other two regions and higher in the Central region than in the West throughout the whole period. The average real income per capita ratio of east-central-west was 1.75:1.22:1 over 1952-1978. As indicated by the coefficient of variation (last column in Table 3.5), the disparity of per capita RGDP was unstable before 1967 but increased from 1967. The

per capita income ratio of east-central-west changed from 1.55:1.43:1 in 1952 to 2.04:1.12:1 in 1978. Figure 3.3 presented the logarithm of values taken from Table 3.3. The figures showed increasing trends before 1960, followed by fluctuations over the 1961-67 period, starting to increase with expanding regional gaps.

Table 3.5 Per capita real GDP in comparison, 1952-78 (Yuan, 1990 prices)

Year	East	Central	West	Coefficient of variation(CV)
1952	333.18	306.11	214.71	0.3892
1953	424.70	323.00	230.79	0.5575
1954	423.77	329.88	262.29	0.5099
1955	448.20	344.94	280.01	0.5143
1956	494.42	373.01	316.51	0.5019
1957	526.23	402.93	307.07	0.5377
1958	568.21	485.38	360.35	0.4784
1959	633.95	515.82	390.38	0.5052
1960	681.46	512.89	399.19	0.5865
1961	442.71	337.76	305.07	0.4997
1962	384.88	325.37	272.57	0.4062
1963	407.50	343.02	299.40	0.4207
1964	460.62	381.96	329.41	0.4176
1965	528.67	428.91	369.93	0.4349
1966	571.52	459.64	386.73	0.4577
1967	517.01	425.22	347.11	0.4451
1968	517.11	397.11	296.30	0.5437
1969	618.72	419.14	334.45	0.5898
1970	732.29	488.34	390.36	0.6221
1971	787.10	504.96	417.88	0.6251
1972	792.06	502.31	427.64	0.5953
1973	840.38	524.24	436.93	0.6250
1974	885.89	507.97	437.76	0.6969
1975	943.43	543.50	468.23	0.6864
1976	948.59	524.67	446.90	0.7061
1977	1011.40	564.82	491.00	0.6923
1978	1133.69	621.34	555.86	0.6972
Average 1952-78	631.77	440.53	362.03	0.5460

Notes: Per capita RGDP is measured in 1990s prices.

Sources: *China Statistical Data for 50 Years 1949-98* (NBS, 1999).

Figure 3.3 Log per capita real GDP in comparison, 1952-78
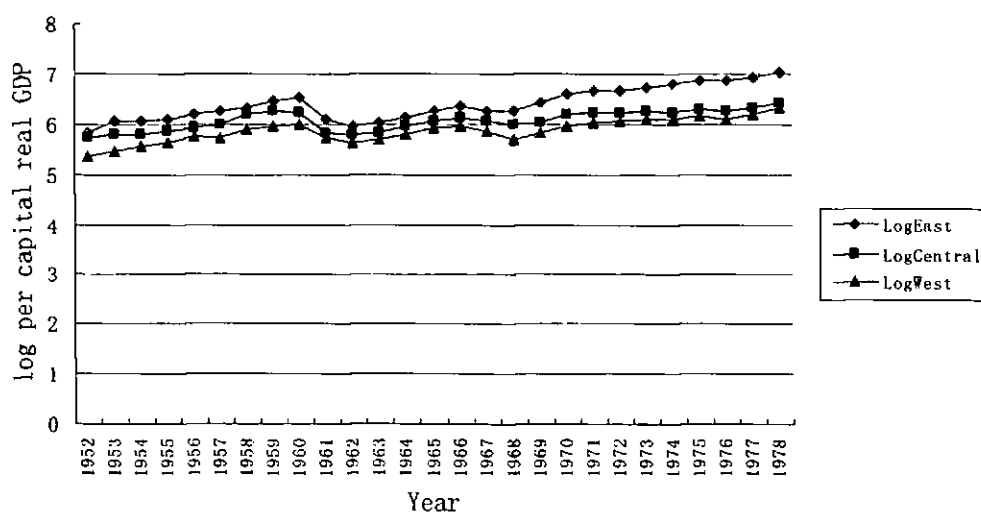
Notes: Log Per Capita RGDP is the logarithm of per capita real GDP is measured in 1990s prices.
Sources: *China Statistical Data for 50 Years 1949-98* (NBS, 1999).

In summary, due to various political and economic movements, the income levels of the Chinese regions were unstable in the pre-reform period. However, the analysis above shows an overall increasing trend in the three regions though it fluctuated in the first several years. This indicates that regional income inequality had been widening before economic reform. The government has been concerned about its regional inequality since 1949. Influenced by the ideology of socialism and egalitarian ideas, Chairman Mao Zedong led the Chinese Communist Party to engage itself with the problems of poverty and the substantial coastal–interior imbalances in China. Mao (1956) stressed the importance of developing the interior without neglecting the coastal region.

Many studies have observed the persistence or widening of regional inequality prior to economic reforms. Compared to the inland areas, the coastal region possesses better physical and human resources for development. In addition, historical reasons such as the penetration of colonial forces after the 1840s worsened the inequalities between China's regions (Bo, 1993; Fan, 1995a; Wei, 1997). The need for urban-centered industrialization and a national defense system limited the resources that were available

for the development of poor areas (Cannon, 1990; Jian *et al.*, 1996; Wei and Ma, 1996; Zhou, 1996; Ma and Wei, 1997). In addition, the inefficiency of investments in the inland areas contributed significantly to the persistence of regional inequality. A large amount of capital that was invested in the interior was for defense purposes under the 'third front' (*san xian*) program, which tied up great amounts of investment and yielded poor economic results (Naughton, 1988; Linge and Forbes, 1990; Wei, 1995b; Ma and Wei, 1997). Decentralization policies in the late 1950s and early 1970s facilitated, to a certain extent, localism and improved the economies of coastal provinces. In the early 1970s, China's development policy was reoriented more toward the coastal region as a consequence of the country's gradual opening up to the outside world. Finally, China, like other socialist countries (Kornai, 1992), was troubled by political turmoil, social unrest and economic mismanagement. The inland provinces lagged behind the coastal regions in terms of resources and infrastructure for economic growth. In short, the legacy of history, an uneven geographic distribution of resources, an emphasis on industrialization and national defense, decentralization and policy changes, as well as political and social unrest, together contributed to the persistence of regional inequality in China even before economic reforms were carried out.

3.3.2 Regional inequality in the post-reform period

Since the economic reforms started, better growth prospects have been found in the whole country, especially for some provinces in the coastal region. During 1979-2005, real per capita GDP increased more than ten-fold, registering an average annual growth of 9.63%, while that of the East, Central and West were 10.33%, 8.98% and 7.99 % respectively (Table 3.6).

Table 3.6 Real GDP per capita and growth by region, 1979-2005 (Yuan, 1990 prices)

provinces	RGDP per capita in 1990 prices			Annual Growth rates (%)		
year	1979	1992	2005	1979-92	1992-05	1979-05
Beijing	2156	5441	16138	7.38	8.72	8.05
Tianjin	1898	4189	17082	6.28	11.42	8.82
Hebei	703	1833	7438	7.65	11.38	9.50
Liaoning	1267	3194	10497	7.37	9.58	8.47
Shanghai	3030	7213	23526	6.90	9.52	8.20
Jiangsu	767	2788	12946	10.44	12.54	11.48
Zhejiang	713	2937	13641	11.51	12.54	12.02
Fujian	600	2340	10355	11.04	12.12	11.58
Shandong	712	2360	11050	9.65	12.61	11.12
Guangdong	780	3467	12436	12.16	10.32	11.24
Guangxi	586	1367	4802	6.73	10.15	8.43
Hainan	617	2459	6495	11.22	7.76	9.48
East China	*877*	*2768*	*11294*	*9.24*	*11.42*	*10.33*
Shanxi	746	1709	5807	6.58	9.87	8.21
Inner Mongolia	618	1727	7492	8.22	11.95	10.07
Jilin	737	2043	6974	8.16	9.90	9.03
Heilongjiang	1056	2263	6943	6.04	9.01	7.51
Anhui	518	1309	5615	7.40	11.85	9.60
Jiangxi	549	1369	5232	7.28	10.86	9.06
Henan	449	1282	5074	8.40	11.16	9.78
Hubei	697	1797	7197	7.55	11.26	9.39
Hunan	637	1454	5202	6.56	10.30	8.41
Central China	*633*	*1573*	*5923*	*7.25*	*10.74*	*8.98*
Sichuan	525	1360	3536	7.60	7.63	7.61
Guizhou	367	914	2597	7.27	8.36	7.82
Yunnan	487	1394	3792	8.43	8.00	8.21
Shaanxi	517	1395	4488	7.93	9.40	8.67
Gansu	505	1229	3842	7.08	9.16	8.12
Qinghai	805	1706	4980	5.94	8.59	7.26
Ningxia	661	1530	4176	6.67	8.03	7.35
Xinjiang	713	2243	5571	9.22	7.25	8.23
West China	*514*	*1364*	*3788*	*7.80*	*8.17*	*7.99*
All China	*711*	*2036*	*7763*	*8.43*	*10.84*	*9.63*

Notes: Per capita GDP is measured in 1990s prices. Growth rate is average annual growth rate of per capita GDP in 1990 prices.

Sources: China Statistical Data for 50 Years 1949-98 (NBS, 1999) and Statistical Yearbook of China (NBS, 1998-2006, various issues).

The provinces with the highest growth are concentrated on the eastern coast, which possesses advantages of geography, endowments, and policies, such as the establishment of Special Economic Zones (SEZs) and Open Coastal Cities, and other incentives to attract foreign investments. At the same time, the industrialization policies for the Central and Western regions were removed. All these factors have allowed the coastal region to grow much faster than the other regions of the country. Consequently, the Chinese economy in the post-reform period has experienced unprecedented rapid and steady growth accompanied by increasing inter-regional disparities, which deteriorated in the 1990s. The ratio of East-Central-West per capita real GDP was 1.71:1.23:1 in 1979, 2.03:1.15:1 in 1992 and 2.98:1.56:1 in 2005.

The regional disparity in China can be attributed to many factors such as different natural resources, geographical location, potential for economic development, economic reforms, different economic structures, coast-oriented regional policy and foreign direct investment. Uneven distribution of resources and preferential policies given to the eastern region are widely regarded as the dominated causes of regional inequality in China.

Figure 3.4 shows that the real GDP per capita gap between the East and the inland regions widened dramatically since 1992. Per capita incomes between the Central and the West used to be very close but started to differ gradually in the following years as well. Interestingly, FDI in China grew like the Chinese saying of "bamboo shoots after a spring rain" after Deng's famous "south tour" ("nan xun") in spring 1992. The year 1992 seemed to be the watersheds of both regional gaps and inward FDI in China. These two phenomena are closely related.

Figure 3.4 Real per capita GDP in comparison, 1979-2005 (yuan)
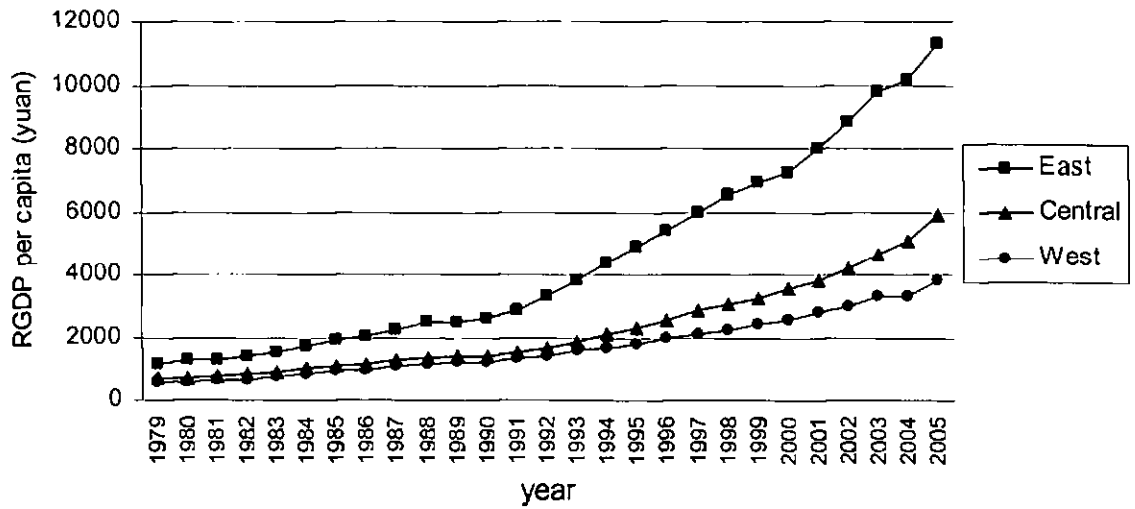
Notes: Per capita GDP is measured in 1990s prices. Growth rate is average annual growth rate of per capita GDP in 1990 prices.

Sources: *China Statistical Data for 50 Years 1949-98* (NBS, 1999) and *Statistical Yearbook of China* (NBS, 1998-2004, various issues).

Figure 3.5 Shares of real GDP by region, 1979-2005
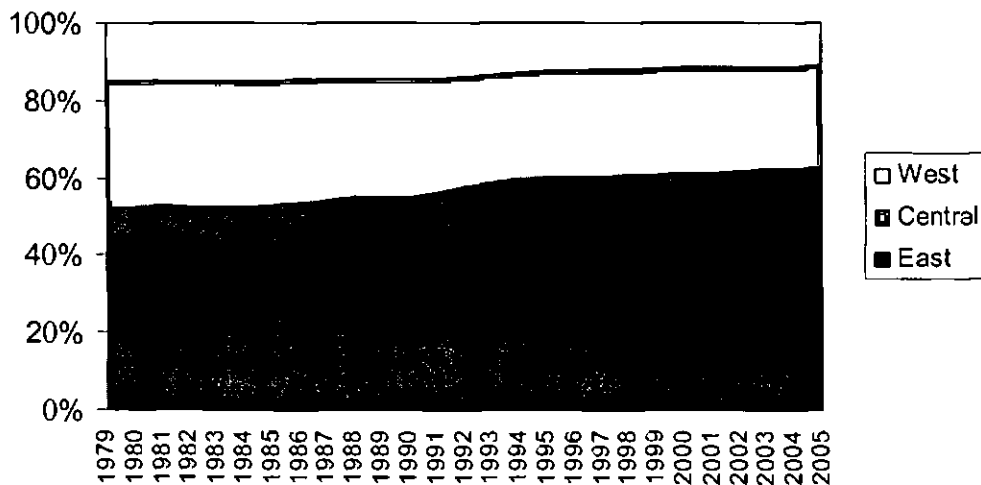
Note: real GDP is measured in 1990s prices

Source: 1.*Comprehensive Statistical Data and Materials on 50 Years of New China*, NBS, 19

2. *China Stotistical Yearbook*, NBS, 2000-2006

GDP is highly concentrated in the eastern region in the reform period (Figures 3.5). The East accounted for over 52% of China's GDP in 1979 and its contribution increased in

the following consecutive 25 years. The West accounted for a small and declining share of China's GDP over the same period.

3.4 FDI in China

3.4.1 Four stages of FDI development

Foreign direct investment in China was authorized in 1979, as part of the economic reform and opening up policy launched in December 1978. In order to accelerate the country's economic modernization, the new policy fostered China's participation in international trade and its access to external sources of capital and technology. FDI was considered as the best way to introduce foreign capital and assimilate modern technology and management skills (Lemoine, 2000). Over the past three decades, FDI inflows into China increased dramatically, jumping from virtually zero in 1979 to an amount of US$69.47 billion in 2006 (Figure 3.6). Its development can be regarded as going through four stages. The first stage began in 1979 when "the law of the People's Republic of China on Joint Ventures Using Chinese and Foreign Investment", was enacted, and ended by 1985. In the late 1970s, four SEZs -- Shenzhen, Zhuhai, Shantou and Xiamen -- were established in the provinces of Guangdong and Fujian, followed by 14 more coastal cities in 1984. Later in 1985, three more economic zones -- the Yangtze River Delta, the Pearl River Delta, and the Zhangzhou-Quanzhou-Xianmen region -- were opened to foreign firms. FDI hence spread from the SEZs to the entire coastal area. In the first stage, only a very small amount of FDI settled in China and was concentrated in small-sized ventures involved in assembling and processing for exports, with most of the investors coming from Hong Kong. In 1985, China received $1.66 billion in FDI, and the accumulative used value of FDI during this period was just $4.7 billion.

The second stage spanned from 1986 to 1991. In April 1986, in response to the decline of FDI in the previous year, for the first time in modern Chinese history, wholly foreign owned enterprises were allowed in China. This marked the beginning of the second stage of FDI development. Moreover, the Chinese central government issued related laws to encourage foreign investments, permitting more freedom of independent operations for FIEs (foreign-invested enterprises) and granting more tax incentives for foreign investment in October 1986. The decision making process for FDI was also decentralised as local governments were allowed to review applications of foreign investment. In addition, in 1988, the entire island province of Hainan was separated from Guangdong to become an independent province and China's largest open economic zone measured in territorial area. The law of joint venture was further amended to include a ban on expropriation, while relaxing restrictions regarding expatriation of profits and dividends, and to permit foreign nationals to be chairmen of the board of directors in FIEs. From a very low level, FDI inflows experienced a double or even triple-digit annual growth from 1979 to 1988. China received a total of $12.05 billion actual FDI during this period. Despite the political event in Tiananmen Square in 1989, FDI in this period still increased significantly. The actually used value of FDI in 1991 was 3 times higher than that of 1985 at $4.37 billion, while the cumulative value for the second stage was $18.61 billion, which was almost four times that of the first stage.

In spring 1992, Deng Xiaoping made his famous tour to South China. This marked the beginning of the third stage of FDI development. Deng encouraged local officials not to be afraid of capitalism, and to open China up more quickly and widely. As a result of his encouragement, FDI inflows into China rocketed. The used value of FDI jumped from $4.37 billion in 1991 to $11 billion in 1992, and further maintained a high growth. In 1994, China received more than three times the FDI of 1992 and became the second largest host of FDI in the world. Thus, FDI inflows into the country experienced a

tremendous growth and reached a spectacular $45.26 billion in 1997. However, the speed of FDI inflows in China slowed during the Asian Financial Crisis in 1997-1998. In 1998, FDI increased by only $0.2 billion per year, and even decreased by around $5 billion in the following two years, 2000-2001. During this stage, despite a slippage in the previous few years, FDI in China still grew rapidly with an average annual growth rate of over 17%. The cumulative used value of FDI was $323.31 billion, which was more than 17 times higher than that of the second stage.

Figure 3.6 FDI inflows in China, 1979-2006
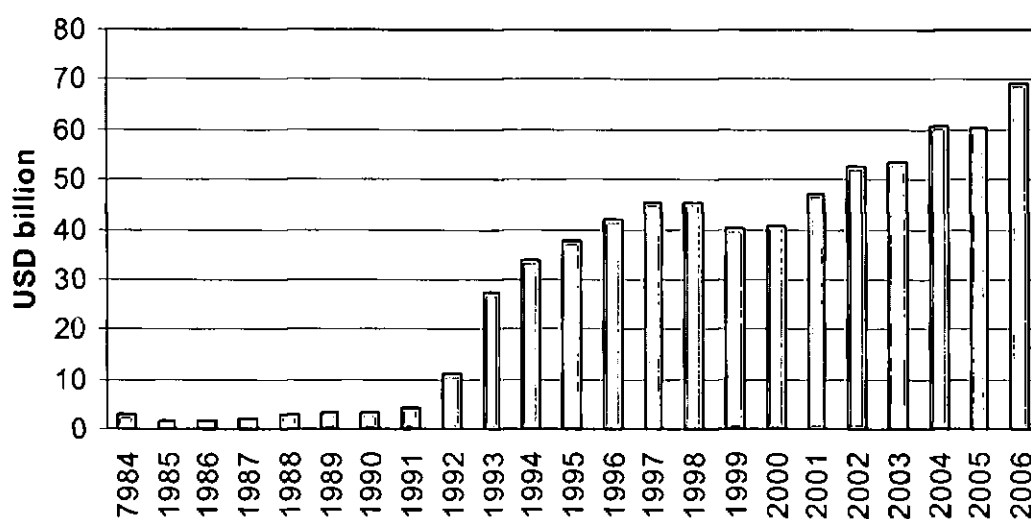
Note: 7984=the cumulative value of FDI during the period 1979-84
Source: The data before 2006 are from China Statistical Yearbook, NBS, and 1987-2006.
    The data of year 2006 is from the website:
    http://news.xinhuanet.com/house/2007-03/27/content_5900091.htm

In 2001, all Asian economies which were China's main investors and trade partners started to recover from the crisis. Most importantly, in November of that year, China finally joined the WTO. Consequently, the fourth stage of FDI development started with a very favorable investment climate in 2001, and FDI continued to maintain a high growth until the present day. In 2003, China received $53.51 billion of used FDI and surpassed the US to become the most popular FDI destination in the world. This figure continued to rise to $60.63 billion in 2004, $60.32 billion in 2005 and $69.47 billion in

2006 (Figure 3.6). The cumulative value of FDI in China was only $4.7 billion in 1985, but rose to $23.31 billion in 1991, $346.62 billion in 2000, and then to $691.9 billion in 2006. The timeline of FDI implied that it was strongly influenced by government policy. In China, as this policy was initiated by Deng Xiaoping himself, most authors have attributed China's economic success to Deng Xiaoping.

3.4.2 China's FDI and GDP growth

Before 1978, China virtually closed its door to foreign investment as a result of the Maoist ideology of "self-sufficiency". Since China's pursuit of the reform and opening-up policy in 1978, FDI has gradually blossomed (Tso, 1998). FDI inflow into China increased sluggishly before 1992 and was mainly concentrated in a few coastal cities. As indicated in Table 3.7, FDI in China was only $0.92 billion in 1983 and it grew slowly to $4.37 billion in 1991. However, FDI inflows expanded dramatically to $11 billion in 1992 and kept rising to $60.32 billion in 2005, making China the largest recipient of FDI in the developing countries since 1994. In 2003, China used to be the biggest destination of FDI in the world. Meanwhile, China's economic growth jumped sharply to RMB2.69 trillion in 1992 from RMB596.27 billion in 1983 and increased further to RMB18.31 trillion in 2005. The patterns of growth of FDI and GDP suggested a strong correlation between them. This can be further confirmed by the ratio of FDI to GDP. Column (4) shows that FDI never exceeded 1% of China's total GDP before 1991. However, the ratio increased to 2.25% in 1992. It indicates that Deng's South China Tour in 1992 indeed spurred the growth momentum of foreign capital inflow. In 1994, this figure reached its peak at 6.93%, and gradually declined thereafter to 2.7% in 2005.

The data on regional level show a similar story. As mentioned above, in the past decades, 52-62% of China's total GDP was concentrated in the east region, while

26-32%, 10-15% in the central and west regions respectively. In contrast to FDI, the lion's share of FDI inflows was concentrated in the east, while the west took the smallest share, and the central areas came in between. In general, FDI has contributed to the high growth of China and it is more attracted to provinces with higher per capita GDP.

Table 3.7   FDI and GDP in China, 1983-2005

Year	FDI ($billion) (1)	FDI (RMB billion) (2)	GDP (RMB billion) (3)	FDI/GDP (%) (4)
1983	0.92	2.69	596.27	0.45
1984	1.42	4.17	720.81	0.58
1985	1.66	4.87	901.6	0.54
1986	1.87	6.47	1027.52	0.63
1987	2.3	8.61	1205.86	0.71
1988	3.19	11.89	1504.28	0.79
1989	3.39	12.77	16992.3	0.08
1990	3.49	16.68	1866.78	0.89
1991	4.37	23.24	2178.15	1.07
1992	11.01	60.7	2692.35	2.25
1993	27.52	158.54	3533.39	4.49
1994	33.77	291.03	4819.79	6.04
1995	37.52	313.33	6079.37	5.15
1996	41.73	346.91	7117.66	4.87
1997	45.26	375.17	7897.30	4.75
1998	45.46	376.39	8440.23	4.46
1999	40.32	333.83	8967.71	3.72
2000	40.72	337.06	9921.46	3.40
2001	46.88	388.01	10965.52	3.54
2002	52.74	436.55	12033.27	3.63
2003	53.51	442.86	13582.28	3.26
2004	60.63	501.82	15987.83	3.14
2005	60.32	494.12	18308.48	2.70

Notes: FDI in Column (1) and GDP in column (3) are measured in current price. Column (2) and (4) are calculated by the authors. Column (1) figures are converted to those in column (2) by using period average exchange rates. Column (4) equates Column (2) divides Column (3).

Sources: China Statistical Data for 50 Years 1949-98 (NBS, 1999) and Statistical Yearbook of China (NBS, 1998-2006, various issues).

3.4.3 The features of FDI in China

The geographic distribution of FDI: coastal region bias

In line with natural and social resources endowments, historical development, and the level of economic development, foreign investors' choice of FDI location is influenced by the different characteristics and conditions present in China's three regions. Due to the initial preferential policies favoring the coastal provinces, FDI in China is characterised by a very uneven geographical distribution. Until 1992, the East received the lion's share of total FDI of more than 90%. Even in the 1993-2005 period, the share of FDI in the eastern region was still over 86% (Figure 3.7). The top five host provinces of FDI -- Guangdong, Jiangsu, Shandong, Shanghai and Zhejiang -- which took up more than 60% of China's total FDI are all located in the eastern region.

Figure 3.7 the share of FDI in three regions, 1979-2005
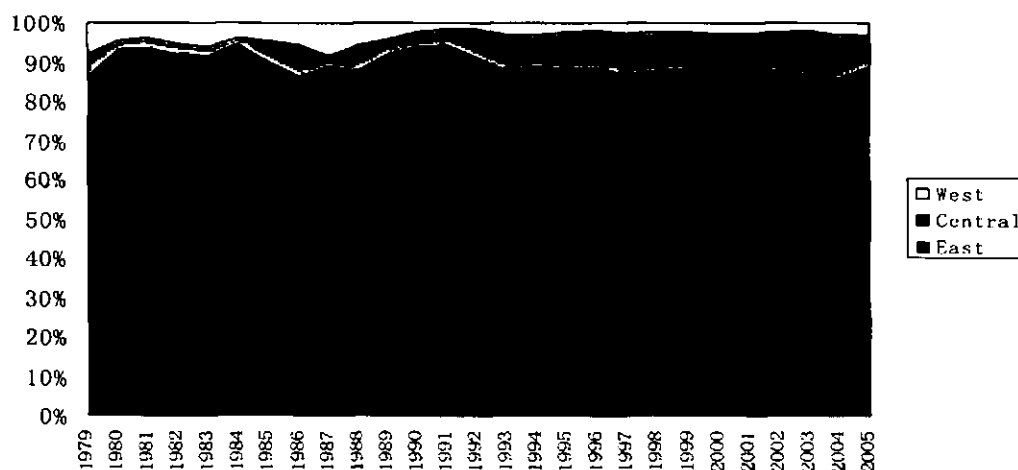
Note: real FDI is actually used FDI measured in 1990s prices
Source: 1.*Comprehensive Statistical Data and Materials on 50 of New China*, NBS, 1999
2. *China Statisticnl Yenrbook*, NBS, 1985-2004 *years*

Cheng and Zhang (1998) consider this as one of the reasons that have led to the fast development of the coastal provinces in the east and the widening of the gap in economic development between coastal and inland provinces since 1979. The

increasing regional differences have created social and political problems. In order to narrow or slow down the widening of the gap, China's central government has adopted a series of measures which include encouraging FDI in the central and western regions. The provinces in these regions are also trying to jump onto the bandwagon to attract FDI. As a result, the volume of FDI in the central and western regions has been slowly increasing since 1989 although their shares of the country's total FDI remain small (Figure 3.8).

Figure 3.8 Used value of FDI by regions, 1985-2005 (USD billion)
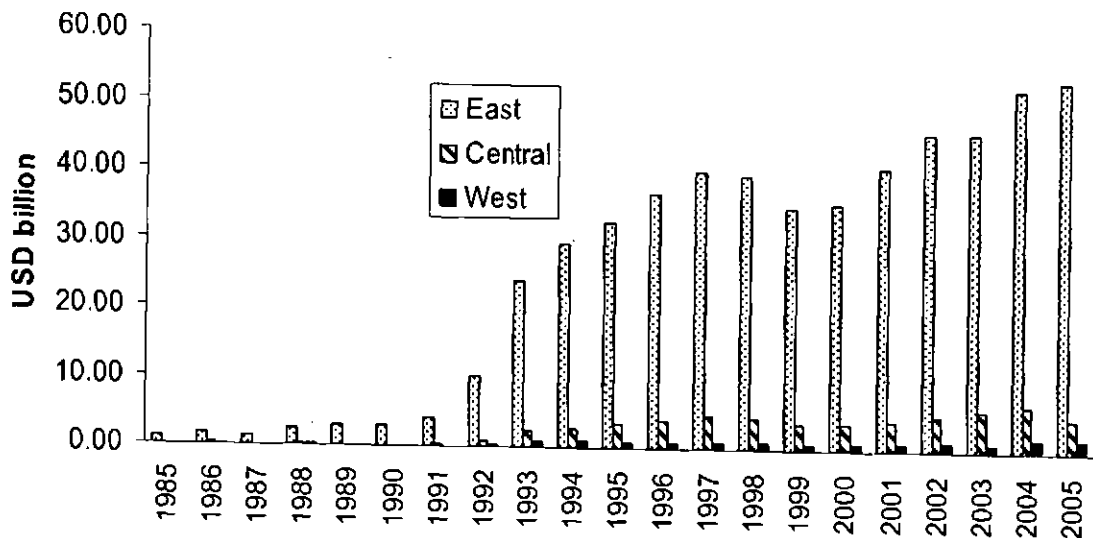
Source: *China Statistical Yearbook*, NBS, 1985-2006

Several reasons explain the geographical polarization of FDI. First of all, the early stage of reform was focused on the eastern provinces. Guangdong, Fujian, 14 coastal cities, Hainan and Pudong were gradually opened to foreign investors in the form of designated Special Economic Zone, Development Zone and Economic and Technology Development Zones after 1980. All of them were given preferential tax policies to attract foreign capital and promote exports. Since the mid-eighties, the opening up policy has been extended northward. At the same time, the authorities adopted a development strategy aimed at accelerating growth and modernization in East based on

export-oriented industries. Only in the early nineties were inland cities and border areas encouraged to open up. In early 2000, the Chinese government announced a programme with the objective of restoring the balance to regional development and decided to implement preferential tax policies in order to attract FDI into the inland areas. In fact, preferential policies have been only one of the advantages that the eastern regions offer to foreign investors. They also have better economic endowments which give them comparative advantages over the central and west regions: geographic proximity to international markets, better transport infrastructures, more skilled labour. Furthermore, many coastal provinces have advanced rapidly during the economic liberalization, developed a dynamic non-state sector, and have thus provided a more favorable environment to foreign investors. Thirdly, as they have recorded higher economic growth, they also provided foreign businesses with larger and rapidly expanding markets. Finally, as Cheng and Zhang (1998) argue, the fact that the coastal region has a high population density but poor natural resources, while inland provinces have a low population density but rich natural resources seems to suggest that the purpose of FDI in China is mainly to tap the potential market and labour abundance and not the natural resources.

The Sectoral Distribution of FDI: Secondary industry (Manufacturing) Bias

FDI has had huge impacts on the three Chinese industries: primary industry (agriculture such as farming, forestry, and husbandry), secondary industry (industrial mining, manufacturing, water supply, and construction, among others) and tertiary industry (transport, wholesale and retail trade, real estate, etc.). Among these three areas, FDI has always mostly concentrated on the secondary industry though the sectoral pattern of FDI in China changed over twenty years (Figure 3.9). In 2005, for example, the secondary industry took up over 68%, 71% and 74% of FDI in terms of projects,

contractual and used value FDI respectively. Only 24-30% of investments were in the tertiary industry and less than 3% in the primary industry (Table 3.8).

Table 3.8 Sector Structure of FDI, 2005 ($billion)

Sector	No.of Projects	Share%	Contractual Value	Share%	Used Value	Share%
Total	44001	100.00	189.06	100.00	60.32	100.00
Primary	1058	2.40	3.84	2.03	0.72	1.19
Secondary	30027	68.24	134.44	71.11	44.69	74.09
Tertiary	12916	29.35	50.78	26.86	14.91	24.72

Source: *China Statistical Yearbook*, 2006

In the case of the secondary industry, the manufacturing sector is a major area of FDI absorption. For example, in 2005, there were 28,928 foreign-invested projects; $127.36 billion and $42.45 billion of contractual and used value FDI inflows respectively in the manufacturing sector. In the manufacturing sector, there was a remarkable growth in foreign investment inflows into the electronics and telecommunication equipment manufacturing industry.

The changes in distributions of FDI by sector are shown in Figure 3.9. The Chinese government has taken several measures to change the sectoral structure of FDI in favor of investment in export-oriented and advanced technology sectors since 1986. It also indicates that in the 1980s, FDI was mainly concentrated in traditional labour-intensive manufacturing industries, especially textiles and garments. The boom in services after 1992 was first driven by a sharp increase in real estate projects which coincided with a "real estate fever" in major Chinese cities. FDI in the secondary industry also increased rapidly and it has accounted for a major part of total FDI inflows of over 60% after 1994. It means that the increase of FDI gradually moved to capital- and technology-intensive sectors, especially chemicals, machinery, transport equipment, electronics and telecommunications.

Figure 3.9 Distribution of FDI by sector, 1979-2005
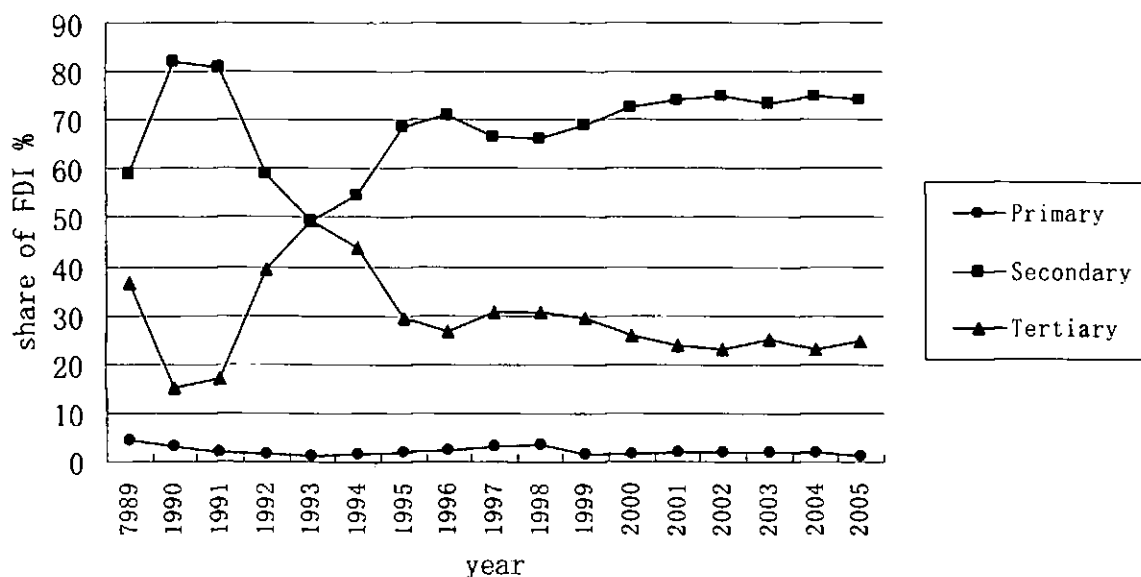
Note: year 7989= cumulative value from the period 1979-89.

Source: *China Statistical Yearbook,* 1982-2006.

The source countries distribution of FDI: Asian (Hong Kong) Bias

Although China has received an impressive amount of FDI since the late 1970s, the sources of FDI inflows are highly dominated by a few countries or regions. As presented in Table 3.9, the 10 biggest source countries or regions of FDI inflows to China in 2005 are: Hong Kong, the Virgin Islands, Japan, South Korea, the US, Singapore, Taiwan, Cayman Islands, Germany and Samoan. The total FDI inflows from these top 10 places are $50.92 billion, accounting for 84.40% of the total actually utilized inward FDI in China. Within these countries, five are from Asia, which is therefore the biggest continent investing in China.

Asian countries have accounted for an overwhelming share of FDI in China in the past decades with their share peaking at 89.71% in 1992. Although the share of Asia has been slightly diminishing, it was still as high as 59.21% in 2005 (Table 3.10). As shown

in Table 3.11, affected by the Asian crisis in 1997-1998, the FDI from Asia reduced from $31.33 billion in 1998 to $25.48 billion in 2000; however, it revived in 2001 with $29.61 billion and kept increasing steadily to $35.72 billion in 2005.

Table 3.9 10 Biggest FDI by countries or regions in China, 2005 ($billion)

Country	Actually Used Value	Share %
Total of FDI inflows in China	60.32	100.00
Hong Kong	17.95	29.75
Virgin Islands	9.02	14.96
Japan	6.53	10.82
South Korea	5.17	8.57
USA	3.06	5.07
Singapore	2.20	3.65
Taiwan	2.15	3.57
Cayman Islands	1.95	3.23
Germany	1.53	2.54
Samoan	1.35	2.24
Total of FDI from top 10	50.92	84.40

Source: *China Statistical Yearbook*, NBS, 2006

To a large extent, this situation is due to Hong Kong, which continued to be the top foreign investors in recent years. However, its share of the aggregate amount has fallen from 62.47% to 50.25% of the total from Asia and from 69.08% to 29.75% of the world total in 2005 (Table 3.10-3.11). Over this period, Taiwan and Macao have increased their investments in mainland China as well. As shown in Table 3.10, these three regions together accounted for 79.37 % of total FDI in 1992. Similarly, although the share of these three regions has been decreasing, it still accounted for more than one third of the world total in 2005. The importance of Hong Kong, Macao and Taiwanese (HMT) investors responded to the initial strategy of the Chinese authorities, which was designed to attract "overseas Chinese" business to the mainland. Guangdong province (Shenzhen and Zhuhai) next to Hong Kong and Macao, Fujian (Xiamen) province, opposite Taiwan, were clearly designed at attracting funds from overseas Chinese. This

policy proved to be a success. Most Hong Kong industries have been relocated to Shenzhen and the Pearl River delta.

Table 3.10 Share of actual FDI by countries or regions, 1985-2005

Year	Asia	HK	HMT	Africa	Europe	LA	N A	US	OPI	Others
1985	66.21	48.86	48.86	0.00	8.88	0.41	18.74	18.26	0.73	5.03
1986	72.10	59.22	59.22	0.00	8.05	0.00	14.65	14.54	3.58	1.62
1987	80.17	69.08	69.08	0.01	3.28	0.00	11.80	11.36	0.43	4.22
1988	83.05	65.60	65.60	0.11	6.13	0.00	7.58	7.39	0.13	3.00
1989	74.72	61.24	61.24	0.00	6.34	0.00	8.88	8.38	1.31	8.76
1990	78.13	54.87	61.25	0.00	4.29	0.19	13.31	13.08	0.97	3.07
1991	81.85	56.96	67.64	0.00	6.11	0.08	7.65	7.40	0.36	3.98
1992	89.71	68.25	79.37	0.03	2.86	0.21	5.13	4.60	0.34	1.73
1993	86.59	62.82	76.24	0.13	2.84	0.21	8.01	7.45	0.44	1.73
1994	84.02	58.40	69.89	0.03	4.89	0.48	8.12	7.34	0.58	1.88
1995	81.33	53.39	62.93	0.04	5.98	0.89	9.13	8.16	0.67	1.97
1996	79.22	49.49	59.19	0.03	7.20	1.54	9.18	8.17	0.70	0.01
1997	67.59	41.14	48.29	0.16	8.70	3.78	7.46	6.61	1.06	0.06
1998	68.92	40.71	48.05	0.35	9.48	10.03	9.52	8.58	1.17	0.52
1999	66.55	40.58	47.80	0.49	11.90	7.95	11.45	10.46	1.26	0.41
2000	62.59	38.07	44.56	0.71	11.70	11.34	11.75	10.77	1.70	0.20
2001	63.17	35.66	42.70	0.70	9.57	13.46	10.87	9.46	2.16	0.06
2002	61.75	33.86	42.28	1.07	7.68	28.36	12.31	10.28	2.69	0.19
2003	63.74	33.08	40.17	1.15	7.98	12.91	9.65	7.85	3.24	1.33
2004	62.05	31.33	37.38	1.28	7.91	14.92	8.21	6.50	3.26	2.38
2005	59.21	29.75	34.32	1.78	9.35	18.72	6.18	5.07	3.31	1.44

Notes: HK=Hong Kong; HMT=Hong Kong, Macao and Taiwan; OPI= Ocean Pacific of Inlands; LA = Latin America, NA = North America including the US, US = the USA.

Source: *China Statistical Yenrbook*, NBS, 1986-2006.

Apart from HMT, other Asian countries such as Japan, Singapore and South Korea, have contributed increasingly to the value and share of direct investment in China (Table 3.11).

Table 3.11 FDI in Asia and shares of its top 5 regions or countries, 1996-2005 ($billion)

year	Asia ($bn)	Hong Kong %	Japan%	Singapore%	South Korean%	Taiwan%
1996	33.38	62.47	11.06	6.73	4.51	10.43
1997	35.41	60.87	12.40	7.36	6.29	9.44
1998	31.33	59.07	10.85	10.86	5.76	9.30
1999	26.83	60.98	11.08	9.85	4.75	9.68
2000	25.48	60.83	11.44	8.52	5.85	9.01
2001	29.61	56.45	14.68	7.24	7.27	10.06
2002	32.57	54.84	12.86	7.18	8.35	12.19
2003	34.10	51.90	14.82	6.04	13.16	9.90
2004	37.62	50.50	14.49	5.34	16.61	8.29
2005	35.72	50.25	18.28	6.17	14.47	6.02

Source: *China Statistical Year book*, NBS, 1997-2006

Besides Asia, Europe and North America (NA) also occupy important shares of FDI in China, while Africa and Pacific Ocean Islands account for a very tiny percentage of investments (Table 3.10). However, their shares of FDI inflows to China have also been increasing steadily, especially since the late 1990s. Figure 3.10 shows the shares of investments from Asia, Europe and North America in the last two decades. Although there were fluctuations of the shares of these regions over time, 1992 was an obvious watershed. Before 1992, the share of Asia, as a whole, kept climbing from 66.21% in 1985 to 89.71% in 1992, while those of Europe and NA lessened from 8.88% to 2.86%, and 18.74 % to 5.13% respectively over this period. However, since then, the share of FDI from Asia started to diminish to 59.21% in 2005. In contrast, those of Europe and NA increased to 9.35% and 6.18% respectively. The amount of increase of these two continents was not as big as the decrease of the Asia, due to the increase from other regions as well since 1992, which are not included in this figure. The very rapid growth of FDI in China accompanied by changes in the geographical pattern of investors reflects the opening up policies of China. As mentioned before, China further opened its door to foreign investors in 1992 by putting in place more favorable policies. As a result, more and more foreigners, apart from "overseas Chinese" in HMT, invested in China. In

short, as confidence of foreign businesses in China's opening up and reform policy gradually improved, the source of investing countries diversified.

Figure 3.10 Share of FDI in China from Asia, Europe and North America, 1985-2005
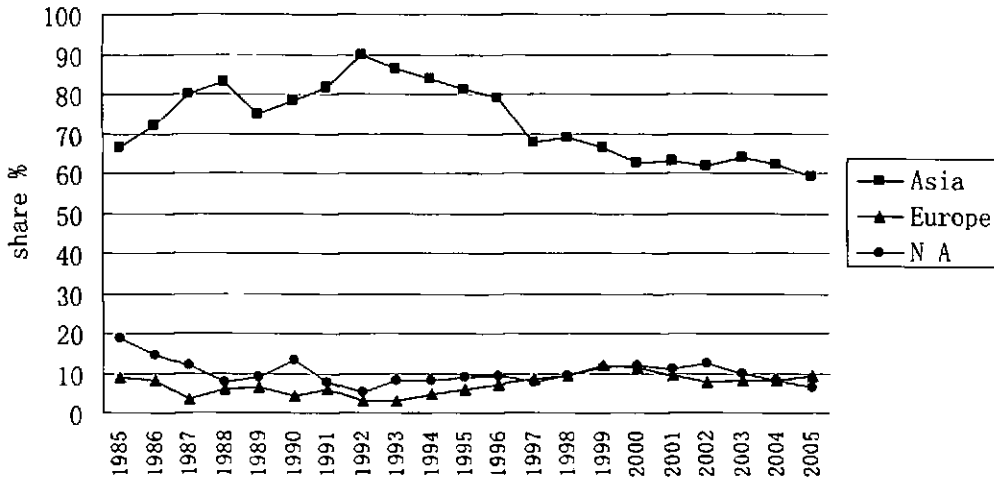
Note: NA=North America

Source: *China Statistical Yearbook,* NBS, 1987-2003

The type distribution of FDI: JEVs and FIEs bias

There are fives major types of FDI in China: Joint Ventures Enterprises (JVEs), Cooperative Operation Enterprises (COEs), Foreign Investment Enterprises (FIEs), Foreign Investment Share Enterprises(FISEs)) and Cooperative Development (CD). FIEs and JVEs are the two dominant modes of FDI, while FISEs and CD played very a very small role over the past decades.

As shown in Table 3.12 and Figure 3.11-12, in 2005, FIEs were the most dominant mode of FDI inflows, with over 70% of total investments and projects. However, the dominant position of FIEs began in 2000. Before 2000, JVEs were much more important than FIEs. JVEs were the first form of foreign-invested enterprises to be authorized by the Joint venture law of July 1979, while FIEs were authorized in 1986.

In the early 1990s, JVEs accounted for the largest amount of FDI but they lost ground in the late 1990s. From 1993 to 2005, their share dropped from 50% to 24% of the total used value amount of FDI. Since 2000, the used value of JVEs did not change much. It fluctuated between £14 billion and $16 billion. On the contrary, in the same period, FIEs rapidly expanded, and mostly in the form of wholly owned foreign enterprises which represented more than 71% of the used value of FDI in 2005, compared with 36% in 1998. Its share in projects had a similar trend. COEs were the third largest mode of FDI inflows. However, its used value declined from $9.72 billion in 1998 to $1.83 billion in 2005. Consequently, its share declined from 21.38% in 1998 to 3% in 2005. The rest of the two types, FISEs and CD, especially CD, accounted for a very small amount of FDI inflows during the post-reform period. Both of them only accounted for less than 2% of the total used value of FDI, representing less than 1% of the total number of FDI projects in the country.

Table 3.12 Utilization of FDI by Type, 1998-2005 ($billion)

year	JVEs		COEs		FIEs		FISEs		CD	
	No. of Projects	Used Value	No. of Projects	Used Value	No. of Projects	Used Value	No. of Projects	Used Value	No. of Projects	Used Value
1998	8107	18.35	2003	9.72	9673	16.47	9	0.71	7	0.18
1999	7050	15.83	1656	8.23	8201	15.54	3	0.29	5	0.38
2000	8378	14.34	1757	6.60	12196	19.26	8	0.13	8	0.38
2001	8893	15.74	1589	6.21	15643	23.87	11	0.53	3	0.51
2002	10380	14.99	1595	5.06	22173	31.73	19	0.70	4	0.27
2003	12521	15.39	1547	3.84	26943	33.38	37	0.33	8	0.03
2004	11570	16.39	1343	3.11	30708	40.22	43	0.78	0	0.11
2005	10480	14.61	1166	1.83	32308	42.96	47	0.92	0	0.00

Notes: JVE =joint ventures, COE = cooperative operating enterprises, FIEs = foreign invested enterprises, FISEs = foreign investment share enterprises, and CD = cooperative development.

Source: *China Statistical Yearbook*, NBS, 1999-2006.

The change in the structure of FDI by different modes reflected in the significant shift in China's foreign investment policy, which changed from a conservative regime (joint

ventures) to a radical and more open investment environment (encouragement of
wholly-owned foreign firms).

Figure 3.11 Share of FDI by projects in China, 1998-2005
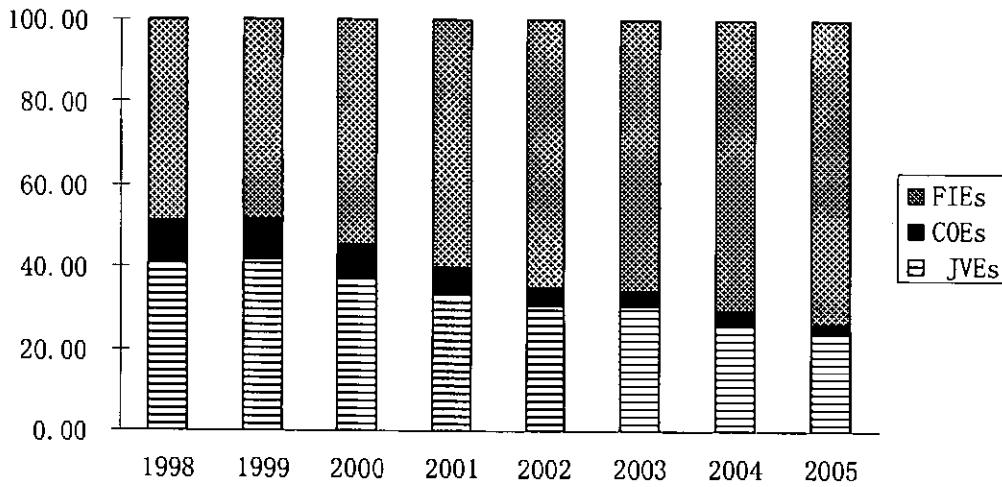
Source: *China Statistical Yearboak,* NBS, 1999-2006

3.12 Share of FDI by used value, 1998-2005
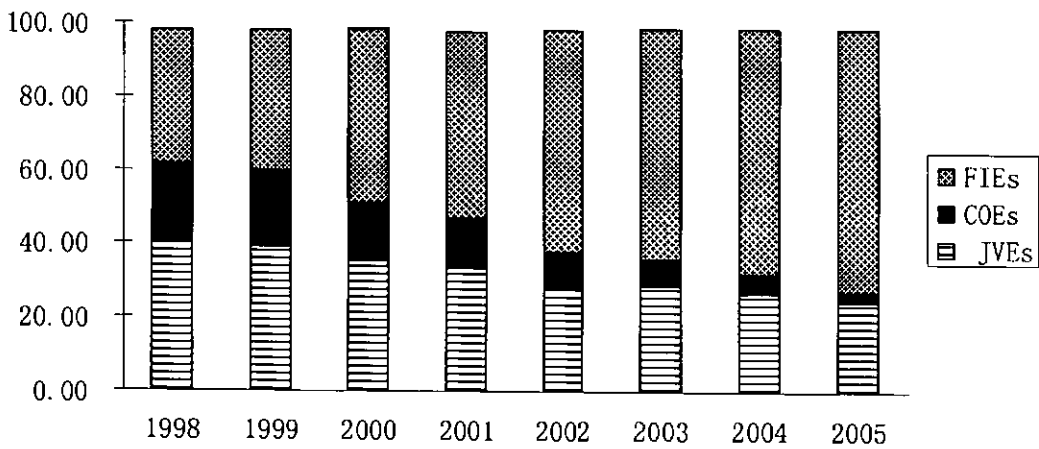
Source: *China Statistical Yearbook,* NBS, 1999-2006

3.5 Chapter summary

The profiles of China's economy and FDI inflows in the post-reform period have been reviewed in this chapter. There is a general consensus that the economic reforms since the late 1970s have brought about revolutionary changes to the country.

China's economic reforms mainly include rural reform, state-owned enterprises reform (SOEs), price policy reform and most importantly, adoption of the open door policy. The household production responsibility system (HPRS) introduced during the rural reform in the late 1970s was a Joint Ventures Enterprises (JVEs), Cooperative Operation Enterprises (COEs), Foreign Investment Enterprises (FIEs), Foreign Investment Share Enterprises(FISEs)) and Cooperative Development (CD) key reform measure to revitalize the rural economy and set a solid foundation for further reforms of the urban economy. Urban reforms focused on the reforms of SOEs and subsequently of the financial sector. The earlier reforms focused on changes in incentives while the subsequent reforms focused on ownership and market competition. Price reforms started with the dual-track system, moving on to a total market price system, which included the foreign exchange market.

All these reforms have been implemented in a gradual manner and·have achieved remarkable results despite the emergence of new problems such as regional growth imbalances and inter-regional inequality.

FDI has been a main feature of China's opening-up policy. FDI inflows in China experienced a number of distinct development periods. Over time, FDI has become a main component of China's economic growth and prosperity. However, the distribution of FDI has been highly skewed towards the coastal provinces. It coincides with the rising trend of inter-regional inequality.

Chapter 4 Economic Growth in the Presence of FDI: The Perspective of Newly Industrialising Economies

Abstract

Although FDI is widely believed to have a positive effect on economic growth, the exact mechanism by which FDI impacts upon the development process of the newly industrializing economies is far from being well understood. This chapter presents and tests two propositions of the role of FDI in economic growth from a newly industrialising economy's perspective. Firstly, FDI is a mover of production efficiency because it helps reduce the gap between the actual level of production and a steady state production frontier. Secondly, FDI, being embedded with advanced technologies and knowledge, is a shifter of the host country's production frontier. Due to its dual role as a mover of production efficiency and a shifter of production frontier, FDI is a powerful driver of economic growth for a newly industrialising economy, helping it to catch up with the world's most advanced countries. China's economic success over the past decades provides an ideal example for testing the hypotheses.

4.1 Introduction

The role of foreign direct investment in economic growth has been extensively studied in the literature, especially in recent years when China and India, two of the world's most populous and fastest growing economies, have been using FDI as a growth stimulus. Different authors have studied the link between FDI and economic growth from different perspectives. Bhagwati (1994) proposes that the volume and efficacy of FDI inflows vary according to whether a country is following an export-push (EP) or an import substitution strategy (IS). Balasubramanyam, *et al.* (1996) prove that FDI plays

a greater role in economic growth in EP countries than in IS economies. Both China and India have adopted an EP strategy, hence, it is possible for them to use FDI effectively to promote growth and reduce their income gap with the industrialised countries.

The endogenous growth theory emphasises the role of science and technology, human capital and externalities in economic development (Romer, 1986, 1987; Lucas, 1988). It differs from the early post-Keynesian growth models which focused on savings and investment, and the neo-classical models which emphasised technical progress (Solow, 1957). This new growth theory coincides with a rising trend of globalisation and integration in the world economy. Exports and FDI play an important role in this process (Kreuger, 1975; Greenaway and Nam, 1988).

Because FDI, export and economic growth have a close relationship, many empirical studies have focused on the link between exports and growth (e.g. Greenaway and Sapsford, 1994), or between FDI and growth (Chuang and Hsu, 2004; Lardy, 1995), or have examined the triangular relationship among FDI, export and growth (Yao, 2006). Existing studies provide useful insights and rich empirical evidence of the role of FDI in economic growth, but the exact mechanism by which FDI contributes to the growth process of a newly industrialising economy has not been well studied.

To understand why FDI is important in the growth process, it is necessary to compare the different roles of FDI and domestic investment (DI). In the post-Keynesian and neo-classical models, DI is a necessary condition for production growth and technical progress, but it may not enable a newly industrialising economy to take advantage of advanced technologies available in the developed world. FDI is different from DI in two important respects although both can be treated as a basic physical input in the production process. Firstly, FDI accelerates the speed of adoption of general purpose

technologies (GPT) in the host countries and, FDI is embedded with new technologies and know-how unavailable in the host countries.

A GPT is a technological invention, or breakthrough, that affects the entire system in the global economy. The most recent examples of GPTs include the computer, Internet and mobile phone. Each GPT is capable of raising the aggregate productivity of labour and capital, but it takes a considerable amount of time for all countries to tap into its potential. Industrial countries tend to be front runners in the adoption of GPTs and their experiences are useful for industrialising economies via FDI.

This difference between FDI and DI is due to the motivation of multinational companies (MNCs) which seek to maximize profit for their investment in the host country. According to Dunning's eclectic approach (Dunning, 1993), MNCs need to have three pre-conditions to invest abroad. First, they must possess certain ownership advantage over indigenous firms. Second, they must have an advantage of internalising business activities. Third, the region of choice must have location-specific advantages. The ability of MNCs to combine these three advantages implies that they should be able to exceed indigenous firms in terms of performance. On the other hand, to be able to compete with MNCs, indigenous firms have to learn from their best practices in organisation and management through learning by watching. Increased competition between foreign and domestic invested firms can lead to more efficient use of resources, reducing the technical efficiency gap between realised output and a steady state production frontier.

The second difference between FDI and DI is that FDI is embedded with advanced technologies that may not be available in the host country. Such advanced technologies will be able to shift the host country's production frontier to a new level, enabling the same amount of material inputs to lead to a higher level of output. Of course, there are

pre-conditions for this effect to take place. Such conditions may include an export-push development strategy, the accumulation of enough human capital, improved infrastructure and the like.

China provides an ideal example to test the propositions because of its fast economic growth and experiences of adopting an EP strategy with significant absorption of FDI for a long period of time.

China has seen extraordinary economic progress due to the economic reforms and the open-door policy that acted as China's gateway to the outside world. The main purpose of this policy was to attract foreign capital, allow foreign direct investment, establish joint ventures or exclusively foreign-owned enterprises and expand exports.

Statistically, over the period 1979-2005, the country's real GDP increased nearly fifteen-fold, from RMB 670.38 billion to RMB 9940.79 billion, registering an average annual growth rate of 10.93 %. By 2005, China became the fourth biggest economy in the world measured in nominal dollars and the second largest measured in PPP dollars.

China's economic growth has been powered by a number of factors: increased inputs of labour and investments, human capital, exports and FDI. Figure 4.1 shows the trends of real GDP, labour, investment, FDI and exports. All the variables are aggregated at the national level and converted into real values in 1990 prices. They are calculated in indexes (1990=100) and taken in natural logarithm.

Labour input increased steadily but significantly less than any other variable. The trends of GDP, exports and investment are similar to each other. Only FDI has grown remarkably more than all the other variables. It appears that exports, investment and

labour are likely to have a log-linear relationship with GDP, but FDI is likely to have more than just a log-linear relationship.

Figure 4.1   Trends of real GDP, investment, export and FDI in 1979-2003
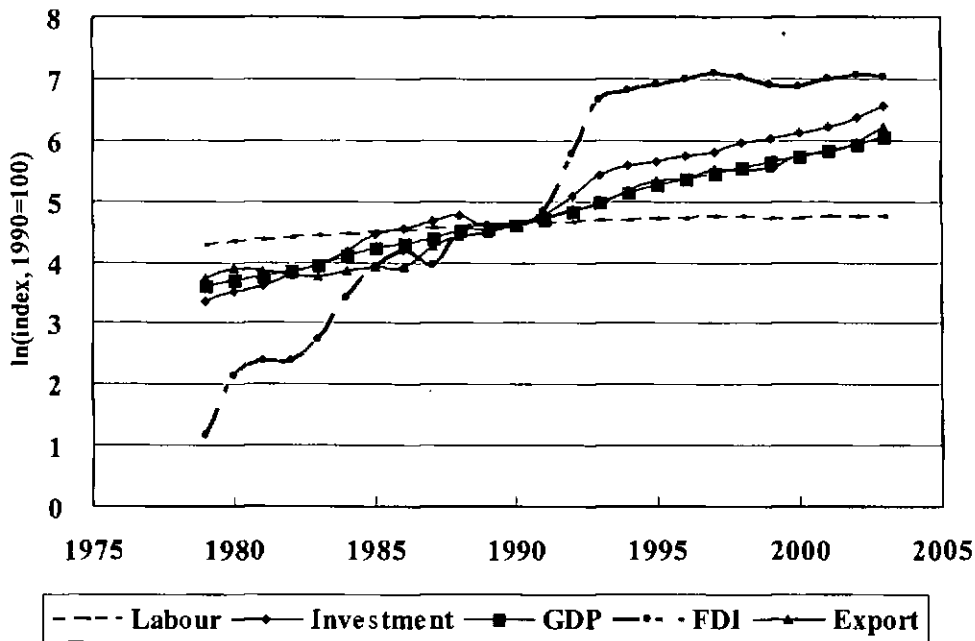
Notes: FDI in this figure and throughout this paper refers to the actual use of FDI, which is different from contracted FDI and excludes foreign loans and portfolio investments.

Sources: *China Statistical Data for 50 Years 1949-98* (NBS, 1999) and *Statistical Yearbook of China* (NBS, 1998-2004, various issues).

In the literature, many studies show that openness, as reflected by rising international trade and FDI, has been an important element of China's economic miracle over the last 29 years of economic reforms (Pomfret, 1997; Yao and Zhang, 2001a; Greenaway, 1998; Fleisher and Chen 1997; Choi, 2004). China's open-door policy was implemented in 1978 in a gradual and pragmatic process along with its effort to transform from a centrally-planned to a market economy. The period 1978-1991 can be regarded as the first phase of openness. During this period, FDI was encouraged but largely concentrated in the special economic zones of Shenzhen, Xiamen, Zhuhai and Shantou, 14 other coastal cities and Hainan Island. During this period, the rate of growth was high but the level of inflow was low.

After Deng Xiaoping made his famous tour to South China in1992, total FDI inflow rose tremendously. In the following years, China quickly became the largest recipient of FDI among all the developing countries and the second largest in the world by 1994, becoming the largest in the world by 2003 with a value of $53.51 billion. FDI inflows into China kept rising to more than $69 billion in 2006 despite a tiny decline in 2005.

China's impressive absorption of FDI attracts plenty of interest from economists. Many hail China's large FDI absorption as a celebrated achievement of its reforms. Zhang (1999a) examines the importance of FDI as a source of savings and as an agent of technology transfer in the Chinese economy. Sun (1999) shows FDI has played an important role in the expansion of Chinese exports, which stimulated strong economic growth. Using an endogenous growth model, Berthelemy and Demurger (2000) argue the transfer of foreign technology by FDI is a key determinant of economic growth in China across 24 provinces over the period 1985-1996. Similar empirical results have been obtained by Lemoine (2000) and Zhang (2001b).

Buckley and Chen (2005) show that FDI inflows into China were directly linked to its export-push development strategy. Right from the beginning of the 1980s, one of the conditions on foreign firms investing in China was that they had to sell a large proportion of their output to the international market. As a result, most of China's FDI have been associated with exports (Sun, 1996; Zhang and Song, 2000). FDI inflows have contributed to the rapid growth of China's merchandise exports. In 1989, foreign-invested firms accounted for less than 9% of China's total exports. This ratio jumped to over 53% and 58% in 2003 and 2005, respectively. In some high-tech sectors in 2000, the share of foreign invested firms in total exports was as high as 91% in electronic circuits and 96% in mobile phones (Buckley and Chen, 2005; UNCTAD, 2003). In 2004, China's total exports and imports were $593 billion and imports $561

billion respectively, both surpassing those of Japan at $565 billion and $455 billion respectively, making China the third largest trading partner in the world in terms of both exports and imports, indicating that China's impressive annual growth in exports at 35% in both 2003 and 2004 was much higher than the world's average of 17% and 21% in nominal dollars (WTO, 2005). The respective value of exports and imports further increased by 28.4% to $761.95 billion and 17.6% to $659.95 billion from 2004 to 2005.

The close link between FDI and export may give a false impression that MNCs only treat China as a manufacturing centre and do not transfer advanced technologies into the country. In reality, different investors have different motivations for investing in China. Child and Faulkner (1998) argue that many overseas Chinese and some Japanese investors look for immediate profits through low-cost unskilled labour and land which are scarce resources in their own countries. Isobe *et al.* (2000) suggest that Japanese FDI in China is often resource seeking, with significant concentration on export and high technology. Zhang (2000a) argues that the dominant motivation of European and American MNCs to invest in China is its huge domestic market which provides good opportunities for long-term profits.

Regardless of their motivation, foreign investors have to consider three important factors in order to succeed in China. These factors include patented technology and know-how, closeness of the supply chain and proximity to clients, corresponding to Dunning's ownership, internalisation and location advantages (OIL). Of these three factors, superior technology and know-how is the most important factor that distinguishes foreign MNCs from domestic firms. Table 4.1 provides data on invention patents granted in China by domestic and foreign sources. During 1995-2005, invention patents granted in China increased over fifteen-fold. The number of invention patents granted to foreigners not only was greater but also increased much faster than that granted to domestic firms. Given that FDI constitutes less than 5% of total investment in

China, foreign invention patents must have played a disproportionately significant and important role in propelling China's technological advance and knowledge creation.

Table 4.1   Invention patents granted in China

Year	Domestic (000)	Foreign (000)
1995	1.53	1.86
1996	1.38	1.59
1997	1.53	1.96
1998	1.66	3.08
1999	3.10	4.54
2000	6.18	6.51
2001	5.40	10.90
2002	5.87	15.61
2003	11.40	25.75
2004	18.24	31.12
2005	20.71	32.60

Source: NBS (2004), *China Science and Technology Statistical Yearbook* and *China Statistical Yearbook*, NBS, 2006.

This chapter is organised as follows. Next section presents a theoretical framework to outline two hypotheses on the role of FDI in the growth process of newly industrialising economies. Section 4.3 presents the empirical models and data definition. Section 4.4 interprets the empirical results at national level. Section 4.5 re-estimates the same models with regional data to see the differences of the impacts of FDI across China's region, while section 4.6 concludes with policy implications and suggestions.

4.2 Propositions on the role of FDI in economic growth

Peter Mandelson, EU's trade commissioner, presented a seminar titled 'Can the EU compete with China?' in Brussels on 15 June 2005. He chose this topic following negotiations with his Chinese counterpart, Bo Xilai, over China's garment and textile exports to the EU, seeing the challenge from China to the EU manufacturing sector.

Twenty or even ten years ago, the world's most powerful and advanced economic blocs, the US, Japan and the EU were not sure of the potential challenge that China could pose to their economies. Today, this uncertainty has become a reality and the international economic order will look very different in another 20 years with China's plans to quadruple its per capita GDP by then.

When the US, Japan and the EU started to feel the competitive pressure from China as they saw their trade deficits accumulate, their political leaders began to blame China for its unwillingness to revalue its currency.[11] The RMB (*ren min bi*) was devalued in the 1980s and 1990s by the Chinese government to remove distortions in the exchange market and increase China's international competitiveness and attractiveness to MNCs. Nonetheless, China's comparative advantage in international trade was not due to its undervalued currency, but its ability to mass produce different industrial products that were sold to the Western countries at low prices.[12] Western consumers have benefited by being able to buy these cheap products but producers may have suffered when they fail to improve their competitiveness by moving to a higher level of the production chain, or reducing their cost of production.

Although the rise of China and India may have threatened the employment of low-skilled labour in the West, the impact of rapid growth in these two countries and

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[11] The People's Bank of China decided to appreciate the value of RMB by 2% against the US dollar in July 2005. Before that, the RMB was closely linked to the dollar although it was not entirely pegged to it. From July 2005, the central bank claimed that the RMB would be adjusted based on a basket of hard currencies, rather than the dollar alone. In reality, RMB has never been officially pegged to any currency or a basket of currencies.

[12] During his visit to Japan in May 2006, Bo Xilai claimed that China's exports of textiles and garments were damaged by the appreciation of RMB against the dollar by over 3% in the past year. Since the profit margin of the Chinese textile industry was low -- about 5% -- even a relatively small appreciation of the RMB would hurt Chinese textile exports. However, Mr Bo did not mention whether the change in the exchange rate had hurt the exports of other industries. In 2005 and in the first five months of 2006, China was still able to produce a large trade surplus.

some other emerging economies on the world economy is widely perceived to be positive. Some economic analysts suggest that one of the reasons why the sharp rise in oil prices since 2004 has not resulted in a global recession or even high inflation in the industrialised world is because the large amount of exports of cheap products from China and India help mitigate inflation pressures in the USA, Japan and Europe.

Regardless of the reason, as long as the industrial economies feel the challenge or threat from the newly industrialising countries such as China or India, it implies that the latter are catching up with the former. In the literature of economic growth, this is the phenomenon of economic convergence between the poor and the rich, or between the developing and the developed economies. Romer (1986, 1987) and others suggest that economic convergence can be explained by the law of diminishing returns to capital. As rich countries have a higher capital/labour ratio than poor countries, and further investments in the former lead to a lower return on capital, MNCs seek to invest in the latter where capital/labour ratio is low and the potential return on capital is high. This process of international capital movement leads to job creation in the developing world and a reduction in the gap in per capita income with the developed countries.

However, not all developing countries have been able to catch up with the developed economies (Islam, 1995; Sala-I-Martin, 1996). Even for countries such as China and India, they failed to catch up with the Western economies before putting in place economic reforms and opening their doors to international trade and foreign investments. In other words, there are pre-conditions for a developing economy to be able to catch up with the industrialised world. According to Gregory Chow (2005), the necessary conditions for catching-up include the following: education and the accumulation of human capital, institutions and market liberalisation, and the ability to create or adopt new technologies.

The new growth theory emphasizes the importance of human capital because education and human capital are the most fundamental conditions that allow a latecomer to industrialisation to imitate the industrial world through 'learning by doing' and 'learning by watching'. Education and human capital are also the most fundamental conditions for innovation and knowledge creation. In contrast to many other developing countries in Africa and Asia, China, India and the Southeast Asian countries have been successful in developing education and building up human capital (World Bank, 1993; Yao and Zhang, 2003).

Institutions such as government policy and market liberalisation are also important conditions for catching-up. Before economic reforms started, China failed to catch up with the West because it adopted a policy of closed door, self-reliance and import substitution although education was reasonably well developed. India did not perform well before 1990 because it stuck to its closed-door and self-reliance policy as did China before 1978. Market liberalisation and policy reforms are key elements for the economic successes of China since 1978 and India since 1991.

The third condition for catching-up is the ability to create and adopt new technologies. For a latecomer to industrialisation, it is neither possible nor necessary to create all technologies required for modernisation. On the contrary, latecomers have a tremendous advantage over developed countries because the former can acquire the same technologies in a much shorter time than the latter. This is particularly true in the information sector. Internet and telecommunication technologies can be easily imitated and adopted, thus having a quick and profound impact on economic growth. China and India are not inventors of many Internet and telecommunication technologies but their people are now enjoying probably the world's most efficient and cheapest services because of their massive market size. Even in Africa, mobile phones and the Internet have become effective tools for transmitting price and marketing information between

townships, which were previously subject to insurmountable communication and transportation barriers.

But how can latecomers acquire technologies that they did not innovate? One way is through direct import of technologies, but a more popular way is through FDI (Ethier and Markusen, 1996; Globerman, 1979). For investors, they have strong incentives to invest because they want to secure a market share for their products in the developing world, to produce their goods cheaply in the host countries in order to boost returns to capital, and to extend their competitive advantage beyond their traditional market (Blomstrom and Sjoholm, 1999; Chen *et al.*, 1995). The incentives of investors constitute the push-factor of FDI. For host countries, FDI is the most direct and efficient way of acquiring technologies created in the most advanced economies, and hence an important mechanism of economic convergence. The incentives of host countries constitute the pull-factor of FDI.[13]

Most researchers consider FDI and exports as two sides of the same coin of openness, and few explain why FDI may be a different factor of openness from exports. Many liberal economists suggest that participation in international trade allow countries to become more specialised in areas where they have a comparative advantage in the international division of labour. As a result, increasing trade activities bring about mutual benefits for all parties. For poor countries, exports and foreign exchange earnings are necessary conditions for importing foreign goods, services and even technologies. In this respect, exports are a pre-condition for raising a country's production and allocative efficiency, but they may not be able to shift the country's

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[13] Some recent studies (e.g. Love, 2003) suggest that some types of FDI outflow are technology sourcing rather than exploitation. In other words, outward investments are used to acquire technology from rather than transfer technology to the host country. Lenovo's acquisition of IBM and Nanjing Automotive's acquisition of MG Rover can be regarded as China's technology sourcing strategy through direct foreign investments.

production frontier. To a great extent, FDI plays a similar role in raising a country's production efficiency because FDI come with the world's most advanced managerial and organisation skills provided by MNCs. For countries where the lack of domestic capital is a key constraint on job creation and economic growth, FDI effectively makes up the shortfall in domestic investments. Hence, FDI can be regarded as a mover of economic growth.

What makes FDI different from export is its role as a shifter of economic growth because it is embedded with advanced technologies which are not available in the host country. Although many studies find that export plays an important role in economic development, it is not a substitute of FDI, especially in the context of a newly industrialising country. This is easily comprehensible if one considers the following situation. Suppose China is able to export a lot of cheap and labour-intensive products such as garments and textiles to the US and then it uses the foreign exchange earnings to import aircrafts and automobiles. As textiles and garments can be produced using indigenous technologies, the bilateral trade activities may not be able to change the level of technologies and know-how in China. However, if US carmakers, e.g. GM, Ford, or even aircraft manufacturers, e.g. Boeing, invest in China to produce and sell their vehicles and planes locally, domestic firms will be able to improve their technologies through learning by watching, or through supplying spare parts to foreign invested firms.

A typical example is the development of the automobile industry. Before 1978, China's motor industry was dominated by Russian technology imported in the 1950s. The First Auto Work in Changchun was set up with help from the former USSR to produce the Jiefang Truck. From the 1950s up to 1978, the same truck model was produced for almost three decades. Since economic reforms began, foreign vehicle makers have been allowed to set up joint ventures in China. The first western carmaker to enter China was

VW, which dominated the local market for more than a decade before other world class makers realized the huge market potential. Today, almost all large foreign carmakers have established joint ventures in different parts of the country. Even Mercedes and BMW are now setting up production lines there. Through joint ventures, local firms have been able to imitate foreign technologies and to start producing their own models or to supply parts to foreign carmakers. There is no doubt that FDI has not only helped improve the production efficiency of domestic firms but also helped push China's production frontier towards the world's most advanced levels.

Let us assume that there are only two countries in the world: one is an industrialised economy (A) and the other is a newly industrialising economy (B), and both countries follow a Cobb-Douglas production technology.

$$Y_{jt} = A_{jt} f(K_{jt}, L_{jt}) e^{g(z)} \tag{4.1}$$

Where Y, K, L are respectively GDP, capital and labour; j and t denote country (A, B) and time; g(z) a function of various factors affecting production efficiency and the production frontier, including exports, human capital, FDI, institutions and others. As country A is richer and has a higher K/L ratio than country B, country A tends to make investments in B in order to maximize returns to capital, as long as $\dfrac{\partial Y_{Bt}}{\partial K_{Bt}} > \dfrac{\partial Y_{At}}{\partial K_{At}}$ holds true.

In this scenario, both countries must gain mutual benefits for cross-border movement of capital to take place. The benefit for A is that it can maximize returns to its capital and has access to B's market. The benefit for B is that it can have access to A's technology and improve per capita income so that the income gap between A and B declines over time.

Another assumption is that both countries invest in science and technology to create knowledge and innovation. However, because A is better endowed with both physical and human capital, it is more able to innovate and hence produce a higher level of output given the same level of inputs in comparison with B. The dominant way for B to reduce this technological gap is by importing A's technology embedded through FDI. Consequently, the role of FDI can be suggested by the following two propositions.

Proposition I: Given the same steady state of B's technology, FDI can improve B's production efficiency because foreign invested firms are front runners in the adoption of GPTs due to their superior human capital, management and organizational structure. Domestic firms can learn from foreign invested firms through learning by watching. They also have incentives to become more efficient and competitive because they fear losing out to foreign invested firms.

The moving effect of FDI on production efficiency of B can be illustrated in Figure 4.2. PF_B denotes the production frontier of B. At a steady state when input is fixed at X_0, the actual level of domestic production is Y_{d0} without the effect of FDI. If FDI has a positive impact on production efficiency at this steady state, or $\dfrac{\partial Y_B}{\partial FDI_B} > 0$, the actual level of production will rise to Y_{f0}. The net moving effect of FDI on country B's production is $(Y_{f0}-Y_{d0})$.

Proposition II: FDI is a shifter of the domestic production frontier. If FDI does not have a shifting effect, the maximum output of B can never go above PF_B. If FDI has a shifting effect, country B's maximum potential output can be as high as those located on PF_A, which is the production frontier of A (Figure 4.2).

Figure 4.2 Production frontiers of A and B, and the role of FDI in B
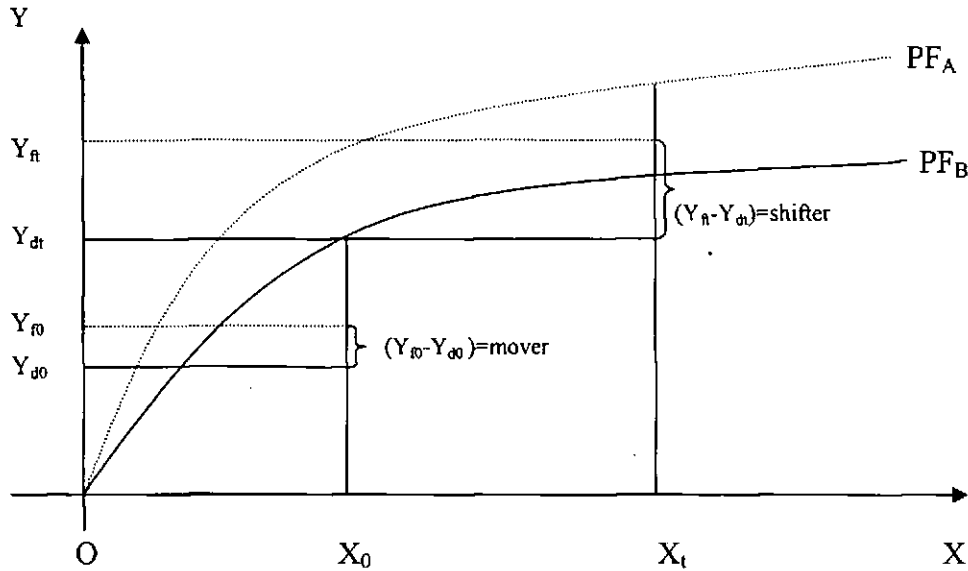
For instance, without a shifting effect, the actual level of production may move from Y_{f0} at the initial steady state to Y_{dt} at the new steady state with a new input mix X_t. The maximum possible output of B at the new level of input will be on PF_B or below. If FDI has a shifting effect, the actual level of output can go above PF_B, with a maximum potential output to be on PF_A. In Figure 4.2, if the new actual output is Y_{ft}, which is situated between the two frontiers, it means that the production frontier of B has been shifted towards PF_A from PF_B. This positive shifting effect can be expressed as $\dfrac{\partial Y_B}{\partial FDI} = f(t) > 0$, implying that the marginal product of FDI is an increasing function of time.

With propositions I and II, country B's production function can be re-written as

$$Y_{Bt} = A(FDI, Z_1)_{Bt} f(K_{Bt}, L_{Bt}) e^{g(t^* FDI, t, Z_2)}$$
\hfill (4.2)

FDI is part of the multiplier A_{Bt} along with a set of other variables Z_1 which can also improve production efficiency. Besides, FDI enters the residual term to be a shifter of the production frontier along with other variables, including a time trend t, which captures the Hick's neutral technological progress in B in the absence of FDI or foreign technologies, t*FDI captures the additional technological progress that is attributed only to FDI.

The total effect of FDI on economic growth in country B can be expressed as

$$\frac{\partial Y_B}{\partial FDI} = \frac{\partial A(FDI, Z_1)}{\partial FDI} + e^{g(t*FDI, t, Z_2)}\left(\frac{\partial g(t*FDI, t, Z_2)}{\partial FDI}\right) \qquad (4.3)^{14}$$

The first part on the right hand side of (4.3) measures the moving effect, and the second part the shifting effect of FDI on Y_B. If both effects are positive and significant, the above two propositions hold true. This is a task to be done below.

4.3 Empirical models and Data

4.3.1 Model specifications and panel cointegration tests

Previous empirical studies have proved that GDP can be determined by the following variables: labour and capital as basic physical inputs; export, FDI and foreign exchange rate policy as variables of openness; human capital and transportation as internal environmental variables. The following empirical model will include all these variables.

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[14] Equation (4.3) is a simplified form of the derivation of equation (4.2) with respect to FDI. The exact form and the detailed derivative procedure are not provided here for simplicity. However, the principal point of the derivative is to show that the increased value of output caused by FDI can be broken down into two components: a rise in the multiplier of the production function, and an enhanced effect on technological progress.

Equation (4.2) is expanded and variables are all taken in natural logarithm as shown in equation (4.4).

$$y_{it} = \beta_0 + \beta_1 k_{it} + \beta_2 n_{it} + \beta_3 h_{it} + \beta_4 fdi_{it} + \beta_5 \exp_{it} + \beta_6 exc_t + \beta_7 tran_{it} + \beta_8 t + \beta_9 (t * fdi)_{it} + \beta_{10} East + \beta_{11} Central + v_{it} \quad (4.4)$$

Where i ($i = 1,2, \ldots, 29$) and t ($t = 1979, \ldots, 2003$) denote province i and year t, k and n capital stock and labour in natural logarithm, human capital $h = \ln$ (number of students enrolled in higher education/population), $fdi = \ln(\text{FDI}/(\text{DI}+\text{FDI}))$, $exp = \ln(\text{Export/GDP})$, $exc = \ln(\text{real exchange rate})$, $tran = \ln(\text{equivalent highway mileage per } 1000 \text{ km}^2 \text{ of land area})$, $East$ takes the value of 1 for an eastern region and 0 otherwise, $Central$ takes the value of 1 for a central region and 0 otherwise.

The definition of FDI in the production model needs careful consideration. Because capital stock is the accumulation of fixed asset investment, which includes both domestic and foreign investments, the production function would be specified wrongly if FDI, either measured as a flow or stock, were added as another explanatory variable along with capital stock. To avoid multi-collinearity and double accounting, FDI is defined as the ratio FDI/(DI+FDI). This definition has a clear advantage in discerning whether the role of FDI is different from DI. If they had exactly the same role in the growth process, this ratio would not have any significant effect in the production function. If FDI has a more important impact on production than DI, this ratio will have a positive and significant effect.

In the literature, export, human capital, exchange rate and transportation also have been found to be relevant variables in the production function. Like FDI, export is defined as the ratio export/GDP instead of the absolute value of export to avoid the problem of multi-collinearity and crowding out the effect of labour and capital on output. Human

capital can be defined in different ways, the ratio of the number of students enrolled in higher education over population, the ratio of the number of students enrolled in secondary education over population, or the ratio of the number of students enrolled in higher education to the number of students enrolled in secondary education. This chapter chooses the ratio of the number of students enrolled to higher education over population for the reason explained below.

It is expected that all the explanatory variables in (4.4) will have a positive effect on the dependent variable. In particular, if both (*fdi*) and (*t*fdi*) are tested to have a positive and significant effect on y, the proposition that FDI is a mover of production efficiency, tested by the coefficient on *fdi*, and a shifter of the domestic production frontier, tested by the coefficient on *t*fdi*, will be supported.

4.3.2 Data

The data is based on a survey of 29 provinces and municipalities for the period 1979-2003. China has 31 provinces and municipalities, but Tibet is excluded because it did not attract any significant FDI throughout the period. Chongqing became a central municipality separated from Sichuan province in 1996. To maintain consistency, the data for Chongqing and Sichuan are merged. Two principal data sources are available: *China Statistical Data 50 Years 1949-98* (NBS, 1999) and *China Statistical Yearbook* (NBS, various years, 1999-2004).

Data for GDP and capital are calibrated below based on investment in fixed assets. All the variables are calculated, based on 1990 constant prices. GDP is derived from real GDP annual indexes by province. Labour refers to the total labour force in each province. Human capital is the number of students enrolled in higher education in each province divided by its population. Some previous studies use the data of the enrolment

rate of secondary schools (Mankiw et al., 1992), specialised secondary schools (Zheng, et al, 2006), years of schooling or education (Xu, 2000; Rizov, 2005 and Rizov and Swinnen, 2004) and expenditures on education, science, health care and culture activities (Yao and Zhang, 2001b). Amongst these indices, higher education is regarded as one of three major sources of technological innovation in China. It also has most significantly developed since 1978, for example, the students enrolment in high education in 2006 were more than 12 folds of those in 1978. Therefore it could be the most appropriate proxy of human capital in the case of our study. This is consistent with Yao and Zhang (2001b), in which proved that variations in higher education have a more important impact on economic growth than the enrolment rate of secondary schools. FDI is actually used FDI. Export is the total value of exports.

The values of exports and FDI are provided in US dollars in the official statistics. Since they are measured in US dollars, most economic analysts do not bother to deflate the values in current prices into values in constant prices (e.g. Liu, et al., 1997; Liu, 2000). It is important to conduct an appropriate deflation. One relevant deflator is the US consumer price index. The values of trade and FDI in nominal dollars are deflated by this index. The deflated values are converted into equivalent values in RMB by multiplying the value with the official exchange rate in 1990 ($1 = RMB 4.784). Since all the other variables in the model are measured in RMB, it is useful to change these two variables in RMB as well.

Exchange rate is real exchange rate, which is time-variant but location-invariant as all the provinces faced the same foreign exchange rate. Ideally, the real exchange rate should be derived from the exchange rates and price indexes of China's main trading partners. However, since the RMB follows the US dollar very closely, though it is not pegged to the dollar, only the dollar exchange rate and the US price index are used to calculate the real exchange rate. The real exchange rate is expected to have a positive

effect on economic growth because it represents China's trade competitiveness and the extent of market liberalisation in the foreign exchange market (Yao and Zhang, 2001b; Ding, 1998).

Transportation is measured as the equivalent mileage of railways, highways and waterways per 1000 square kilometres. Highways are the dominant means of transportation in terms of mileage. The national ratio of the lengths of railways, highways and waterways is 1.00/16.84/1.90. The simplest way to measure transportation is to add the total lengths of these three different means of transportation (e.g. Liu, et. al., 1997; Fleisher and Chen, 1997). However, the tansportation capacity of one mile of railway is different from that of one mile of highway or waterway. As a result, it is necessary to convert railways and waterways into equivalent highways. The conversion ratios are derived from the volumes of transport per mile by each of the three means of transportation. Taking the national average, the conversion ratios are 4.27/1.00/1.06. In other words, railways are multiplied by 4.27 and waterways by 1.06 to derive their equivalent lengths of highways. This method of conversion may not be perfect as the relative capacity of different transportation means may not be the same in different provinces. However, any possible conversion errors may be small because highways account for a predominant proportion of the total transportation volume.

The most difficult task is the calculation of capital stock as official publications do not provide any data on this variable. Most authors have tried various ways to measure capital stock. This chapter follows Yao and Zhang (2001a) by assuming the following equation.

$$K_{it} = (1-\delta)K_{it-1} + \lambda I_{it} \tag{4.5}$$

Where δ is the depreciation rate of capital stock, which is assumed to be 7.5%, and λ is the rate of capital formation from investment in fixed assets I_{it}. λ is assumed to be 95%,

meaning a 5% wastage in the capital formation process.[15] Following Yao and Zhang (2001a), the initial capital stock K_{i0} is calculated as two times the level of real GDP in the first year of the data period, 1979 in this case, implying a capital elasticity of 0.5 in that year. Given that the initial value of capital stock is relatively small for such a long time period, any other reasonable estimation of the initial level of capital will not have a significant effect on regression results.

Investment includes both domestic investment (DI) and FDI. It is calculated in terms of 1990 prices using provincial price deflators. As price deflators for capital goods are not available, investment can be deflated either by an imputed GDP deflator, or a general consumer price index. As China has a high savings ratio of about 40% of GDP, the GDP deflator is considered to be a better proxy of deflator for investment.

One important data issue is about the consistency of two different official publications, *China Statistical Yearbook (Yearbook)*, which is published every year, and *China Statistical Data of 50 Years 1949-98 (50 Years Book)*. Although the *Yearbook* provides more consistent data than the *50 Years Book*, the former does not provide the complete data for the earlier years of the sample period. To deal with the inconsistency problem, the following procedure is followed. Firstly, whenever there is a difference between the two publications, data from the *Yearbook* will be used. Secondly, when data have to be taken from the *50 Years Book*, a check for consistency is conducted. If abnormal changes in values between years are found, an artificial but reasonable smoothing or

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[15] It is simplistic and somewhat naïve to assume constant depreciation and capital wastage rates throughout the data period and across all regions. An ideal solution would be to calibrate various rates for different years and regions but available data do not permit such exercises. An alternative approach is to do some sensitivity analyses to see whether various depreciation and wastage rates may affect regression results. Such analyses were conducted and the results were robust, say if we change the depreciation rate from 7.5% to 5%, and the wastage rate from 5% to 10%. The main explanation for the robustness is probably due to the large scale of investments in China, making any small proportional changes in depreciation or wastage not significantly sensitive to regression results.

adjustment has to be applied.[16] Another problem is the unavailability of FDI data in the earlier years of the data period for some provinces which had little FDI. To avoid the problem of zero values in logarithm, some artificial small values are used to replace zero values. This may not be the best way to deal with such a data problem, but it should have little effect on the final results and have the benefit of keeping many observations in the regressions.[17] Table 4.2 gives the summary statistics of all the relevant variables to be used for the empirical models.

Table 4.2 Summary statistics of data (25 years, 29 provinces, 1979-2003)

Symbols	Definition	Minimum	Maximum	Mean	S.D.
y	Ln(GDP)	7.863	13.661	11.003	1.090
k	Ln(capital)	8.525	14.204	11.545	1.039
n	Ln(labour)	0.382	4.020	2.645	0.853
fdi	Ln(FDI/(DI+FDI))	-5.108	3.810	0.182	1.961
exp	Ln(Export/GDP)	-0.746	4.467	1.981	0.908

[16] In the *China Statistical Data of 50 Years 1949-1998 (NBS, 1999)*, there are a few places where figures look spurious. This is obviously due to the compilation errors in the book. If we encounter such errors, we will examine the data in the neighbouring years or regions to derive reasonable estimates consistent within the relevant time series. Similarly, there are missing values in some places and we have to examine neighbouring figures so that reasonable estimates are made to fill in the gaps of the missing data points. For instance, if one data point on variable Y is missing in 1985 in province X, but we have data of variable Y for all the other years before and after 1985 in province X, we will take the average value of the figures three years before and three years after 1985 to represent the value in 1985. The number of missing and spurious values is very small (less than 2%) in the entire data set, but without correcting such data errors, some regression results could be ridiculous.

[17] It was suggested that we drop data in those years which do not have FDI for all individual provinces. This is a very valuable suggestion but it implies that we have to exclude 7 years of data from the sample. To test whether the results are significantly changed, we used two different data samples, one covering all the years as presented in this chapter and the other only for 1986-2003. The results derived from these two samples using the same models are not much different, especially with the effects of the key variables (FDI and other environmental variables) remaining essentially unchanged. This implies that the way we have treated FDI in this chapter is acceptable with an obvious advantage that it gains many more data points which are useful in different model specifications, especially for the regional models where the sample size would be too small if we eliminated many years from the data set.

h	Ln(human capital)	-3.110	1.138	-1.469	0.814
exc	Ln(Real exchange)	0.616	1.832	1.466	0.314
$tran$	Ln(Transport)	2.699	7.357	5.572	0.877
$t*fdi$	$time*fdi$	-56.990	66.930	10.092	23.968
$t*exp$	$time*exp$	-1.312	97.488	24.950	18.265

Notes: S.D. = standard deviation. All the values are measured in 1990 prices in million RMB (GDP, capital, FDI, DI, export); in percentage (FDI/(DI+FDI)), Export/GDP, human capital (higher education enrollment/population); in million people (labour); in $km/1000KM^2$ (transport); and in yuan/$ (real exchange rate).

Sources: *China Statistical Years Book* (NBS, 1999-04, various issues), and *China Statistical Data of 50 Years 1949-1998* (NBS, 1999).

4.4 Regression results for national level

Equation (4.4) is estimated in four different models. Three models are estimated with OLS. The first OLS regression is run with a random effect where no provincial and regional dummy variables are included. In this model, provincial variations in production and production efficiency are left to be entirely explained by the explanatory variables, but the results are not satisfactory because the model does not pass Hausman's test. The preferred model is the second model where two regional dummy variables, East and Central, are included. The third model is to include all the provincial dummy variables using the first province, Beijing, as a benchmark province. As much of the variations in the dependent variable is explained by the provincial dummies, some important explanatory variables (export/GDP and FDI/(DI+FDI) become insignificant (Table 4.5).

A number of empirical studies on China using similar datasets have found that all the variables included in equation (4.4) are non-stationary and integrated of degree 1, or I(1). Using a panel unit root test, Yao (2006) confirms that GDP, FDI, domestic investment, transportation, human capital, international trade are all I(1). The same finding is confirmed by Ljungwall (2006). As a result, a direct OLS estimation of

equation (4.4) may lead to spurious results if the variables in their levels are not cointegrated.

An alternative estimation is by use of the GMM approach through the dynamic panel data estimation technique proposed by Arellano and Bond (1998). One advantage of the GMM approach is that it helps reduce the problems of multicollinearity among the explanatory variables and endogeneity between the dependent and explanatory variables. In the literature, some studies have pointed out that export and FDI may be seriously correlated. In addition, GDP and FDI (as well as exports) may have a reverse causal relationship. In equation (4.4), export is defined as a ratio of export over GDP and FDI as a ratio of FDI over total investments. Although such definitions are intended to reduce the problems of multicollinearity and endogeneity, it is still useful to compare regression results of the GMM approach with those of the OLS regressions. If the results are not fundamentally different, we can be confident that the OLS regressions are not spurious.

A more reliable way to make sure that OLS regressions are not spurious is to test for panel unit roots of all the variables and panel cointegration between the dependent and explanatory variables. Both tests can follow the procedure proposed by Petroni (1999).

The common regression model for panel cointegration test is given in equation (4.6).

$$y_{it} = \alpha + \delta t + \sum_{j=1}^{M} \beta_j x_{jit} + e_{it}$$

$$\text{for } t = 1, ..., T; i = 1, ..., N; j = 1, ..., M$$

(4.6)

. where the left-hand side variable represents that of equation (4.4) and the right hand side variables represent all the right hand side variables in equation (4.4). T is the number of years and M is the number of provinces. Testing whether there is a cointegration vector is the same as testing whether the estimated error term e_{it} is

stationary. This is done through testing whether $\hat{\gamma} < 1$, from an auxiliary regression of equation (4.7).

$$\hat{e}_{it} = \hat{\gamma}\,\hat{e}_{it-1} + v_{it} \tag{4.7}$$

Equation (4.7) can be used to test for the existence of a unit root in any variable if the left-hand side variable in equation (4.6) is replaced by any variable and the third term in that equation is dropped. Hence, the same programme can be used for both panel unit root and panel cointegration tests. More details of the test procedure are in Petroni (1999).

Pedroni provides four standardised and normally distributed statistics for left tailed tests. This means that a negative value less than -1.96 will reject the null hypothesis of a unit root for a single variable. The results for all the variables involved in equation (4.4) are presented in Table 4.3.

Table 4.3   Panel unit root tests for individual variables (29 provinces, 1979-2003)

	Levin-Lin ρ	Levin-Lin t-ρ	Levin-Lin ADF	IPS ADF
Capital assets	2.21	6.15	3.65	5.66
Human capital	-3.12	-5.10	-0.88	-0.65
Employment	2.55	2.01	2.78	4.11
Exports/GDP	2.13	1.49	2.11	2.32
FDI/(DI+FDI)	-0.61	1.11	2.09	-1.00
GDP	3.22	4.33	7.16	9.02
Transportation	4.16	4.04	5.22	5.92
Exchange rate	0.80	3.12	3.03	2.23

Notes: Human capital = enrolment rate of higher education students as a proportion of secondary school graduates. The critical value is -1.96 to reject the null hypothesis of a unit root at the 5% significance level as all the statistics are left-tailed tests.

All the variables except human capital are found to be non-stationary. The first differences of all the variables are stationary, the results are not reported here to save space. This means that they are all I (1). A cointegration test is conducted for equation (4.4) and the test results are given in Table 4.4. All the test statistics except group-ρ show strong evidence of cointegration.

Table 4.4 Cointegration tests for the empirical model, equation (4.4)

Panel-pp	-1.14
Panel-ADF	-1.28
Group-ρ	-2.03
Group-pp	0.61
Group-ADF	-0.32

Notes: The critical value is −1.96 to reject the null hypothesis of no cointegration at the 5% significance level as all the statistics are left-tailed tests.

Because equation (4.4) has passed the panel cointegration test, the long-run static models will not be spurious even although all the explanatory variables are found to be non-stationary. Following Johansen's (1988) testing procedure, a further cointegration test based on the λ_{max} and λ_{trace} statistics indicates that GDP, labour, capital, FDI/(FDI+DI), export/GDP, and human capital form at least one cointegration vector, providing further evidence for a meaningful long-run relationship in the regressions to be presented below.

Table 4.5 shows the regression results of the four models mentioned above. Most of the estimated coefficients are expected for their sign, size and significance. In particular, let us pay attention to three parameters of great interest: the coefficients on Time, ln(FDI/(DI+FDI)) and time*ln(FDI/(DI+FDI)). In all models, these coefficients are positive and statistically significant except for the time trend in the random effect model and ln(FDI/(DI+FDI)) in the fixed effect model. These results strongly support the two propositions presented at the beginning of this chapter. Firstly, FDI plays a more

important role than DI in stimulating production efficiency, which is now supported by the positive and significant coefficient on ln(FDI/(DI+FDI)) in all models. Secondly, FDI is also a shifter of the domestic production frontier, which is now supported by the positive and significant coefficient on the product term of a time trend and the FDI variable. It means that over time, FDI helps the domestic economy to move continuously onto a higher steady state of technology. This change in the domestic production frontier caused by FDI is an additional enforcement of the Hick's neutral technological progress represented by the coefficient on a time trend, which is positive and significant in all models except the random effect one.

The second and the fourth models show that the rate of technological progress, without the effect of FDI, is about 3% per annum. With the effect of FDI, the total rate of technological progress is about 3.5-4.3%. This implies that up to 30% of the total technological progress in China could have been due to the effect of FDI. Given that FDI constitutes only 5% of total investment, its contribution to technological progress is highly important for China's economic success over the data period.

Apart from FDI, other variables are also important for China's economic growth. These variables include export, human capital and the real exchange rate. The estimated coefficient on ln(Export/GDP) is significant and positive in all but the fixed effect model. This means that export is a province specific variable. Once all the provincial dummy variables are included, the effect of export is reflected in the dummy variables. It also implies that export is an important factor explaining regional variations in production efficiency. Unlike FDI, the product term of time with export does not have a significant effect (results are not reported). This suggests that export can be used to stimulate production efficiency but it cannot become a shifter of the domestic production frontier. This result is easily apprehensible. Export is a dynamic force in improving the competitiveness of domestic firms but not embedded with advanced technologies from MNCs.

Table 4.5 Panel data Regression results (29 provinces, 1979-2003)

	Random effect model		Controlled random		Fixed effect model		Controlled GMM	
	Beta	t-values	Beta	t-values	Beta	t-values	Beta	t-values
Constant	1.084*	6.5	1.868*	10.7	3.460*	11.4	1.995*	3.6
ln(labour)	0.258*	22.2	0.298*	25.6	0.208*	5.9	0.310*	4.6
ln(capital)	0.726*	47.4	0.657*	41.2	0.512*	23.1	0.652*	11.9
ln(real exchange rate)	0.049*	7.4	0.039*	6.2	0.041*	7.4	0.039*	4.5
ln(human capital)	0.034*	4.5	0.055*	7.3	0.050*	4.9	0.021	1.2
ln(FDI/(DI+FDI))	*0.015**	*2.2*	*0.019**	*2.8*	*0.010*	*1.6*	*0.026**	*2.6*
time trend	*0.002*	*0.3*	*0.030**	*3.1*	*0.022**	*8.6*	*0.031**	*3.1*
*time*ln(FDI/(DI+FDI))*	*0.058**	*8.0*	*0.043**	*6.2*	*0.053**	*8.9*	*0.021**	*2.0*
ln(export/GDP)	0.036*	6.2	0.026*	4.3	0.004	0.7	0.031*	2.5
ln(transport)	0.003	1.6	0.024	0.5	0.015	0.6	0.038	1.7
East	No		0.057	8.1	No		0.223	2.2
Central	No		0.049	10.6	No		0.072	1.5
Provincial dummies	No		No		Yes		No	
Diagnosis	Adj-R^2=0.992		Adj-R^2=0.993		Adj-R^2=0.996		Wald test (p=0.00) Sargan test (p=0.00) First-order (p=0.17) Second-order (p=0.98)	

Notes: (1) Dependent variable = ln(GDP), '*' signifies significance at 5% critical level or below. (2) DI = domestic investment, FDI = foreign direct investment. (3) The first three models are run in OLS and the last model is run in DPD, using the following instruments, labour (2,3), capital (2,3), labour(-1), capital(-1), ln(FDI/(DI+FDI)), ln(human capital) and ln(transport). (4) East and Central are dummy variables for the east and Central provinces of China, regional definitions are in Table 1. (5) All the variables are measured in constant 1990 prices.

Sources: NBS (1999) *China Statistical Data 50 Years*; and NBS (1999-2004) *China Statistical Yearbook* (various issues).

Human capital is another important variable. The estimated coefficient is positive and significant in all but the GMM model. If the ratio of higher education enrollment to population rises by 1%, the level of production will increase by 0.034-0.055%. Given that higher education has developed dramatically in China, human capital must have played a critical role in its economic progress. The real exchange rate reflects the extent of openness in the foreign exchange market. The RMB used to be overvalued in the earlier years of economic reforms, and hence was an important disincentive for foreign investors and exporters in China. The gradual devaluation of the RMB improved China's international competitiveness. As a result, it is expected to have a positive effect on economic growth. The regression results in Table 4.5 confirm this expectation. A similar result was also found in Yao and Zhang (2001a).

Transportation is expected to have a positive effect on economic growth but the coefficient on transportation is not significant in Models 2 and 3, and only significant at the 10% level in Models 1 and 4 in Table 4.5. There are two possible explanations for the unexpected results on transportation. First, the government has invested heavily from 1998 in transportation and much of the investments have been allocated to the less developed regions. Consequently, the development of transportation may not have been related to the level of economic development at the provincial level. Second, the effect of transportation on economic growth may be dominated by the effects of export, FDI, human capital and real exchange rate. Some auxiliary regressions are conducted to include only the variables of labour, capital and transportation and it is found that transportation is significant and positive.

However, when transportation is included with all these variables, it becomes insignificant. A reasonable explanation is that transportation may not be a variable as important as FDI, export, human capital and foreign exchange in the production model. This is likely to be explained by the 'equalizing effect' of government policy on investment in transportation across regions.

Lastly, it is interesting to examine the values of labour and capital elasticities. Apart from the fixed effect model, the sum of these two values is close to unity, implying a constant return to scale economy. In the fixed effect model, the sum of these two elasticities is significantly less than unity, meaning a decreasing return to scale if all the provincial fixed effects are taken into account. The value of labour elasticity is less than half that of capital elasticity, suggesting that capital is a more important variable than labour.

4.5 Regional differences

The increasing regional inequality in terms of income and growth between the coastal and inland areas has been an important economic and policy issue in China. It is also a topic of intensive research in the literature with regard to its determination and consequence on further economic development. Fu (2004) suggests that exports and FDI are largely concentrated in coastal areas and have limited spillovers to the inland provinces due to the following reasons. Firstly, exports and FDI may function as engines of growth for the coastal regions but not for the inland regions. Secondly, exports and FDI may have limited forward and backward linkages because a significant proportion of export and FDI activities are concentrated in the export processing zones which have limited linkage to domestic firms. Moreover, high technology levels are 'enclaved' in wholly foreign owned enterprises or join ventures in which foreign partners hold majority equity shares. Advanced core technologies are often controlled by foreign investors in these firms (Huang 2001; Wang, 2000). Nolan (2002) argues that after more than a decade as a joint venture partner to VW, Shanghai Auto is not at all capable of competing as an independent carmaker. In some extreme cases, Hu and Jefferson (2002) find significant productivity depression rather than positive spillover effects of FDI on domestic firms.

To test whether the above case studies and arguments can be supported, the long-run models are estimated using regional data. Following the tradition of regional division as

defined in Figure 3.1(p106), equation (4.4) is re-estimated in four different versions by region. The first version is for the East, the second for the Central and the third for the West. The last model combines the Central and the West together to form the so-called Inland Region as opposed to the Coastal (East) region. The first three models are estimated with random effects and the last model with controlled random effects using a dummy variable for the Central provinces.

Table 4.6 reports the regression results. The results for the East (Coastal region) are consistent with those of the controlled random effect model in Table 4.5. All the variables have the expected sign and are statistically significant. One important difference is the values of estimated labour and capital elasticities. At the national level, labour elasticity is less than half of capital elasticity. In the East region model, there is no significant difference between the two, implying that the marginal product of labour in the East is substantially more than that in the rest of the country. Another difference is the estimated coefficient on transportation. At the national level, this coefficient is found to be statistically insignificant, but in the East, it is significant.

It is worth stressing that apart from labour and capital, all the environmental variables, including real exchange rate, human capital, FDI/(DI+FDI) and its product term with time, export/GDP and transportation are all significant at the 5% level or below. As the coefficients on the two FDI-related variables are significant and positive, the results confirm the two propositions presented at the beginning of this chapter.

Results of the Central region and the Inland region, which combines both the Central and the West, also show that all the key variables are statistically significant and have the right sign. The only exception is that both export/GDP and transportation are not significant, implying that export/GDP may not be a strong driver of economic growth in the Central provinces. However, two FDI-related variables are found to have the same positive and significant effects in the Central region as in the East and the whole country.

Table 4.6 Panel data regression results by region, random and controlled effect models

	East region		Central region		West Region		Central&West Regions	
	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value
Constant	2.355*	9.5	1.953*	6.3	1.328*	3.9	1.722*	6.9
ln(labour)	0.548*	20.2	0.339*	10.4	0.365*	12.9	0.357*	16.7
ln(capital)	0.515*	17.4	0.695*	24.1	0.732*	22.2	0.705*	29.4
ln(real exchange rate)	0.112*	3.5	0.147*	3.9	0.166*	4.5	0.164*	5.6
ln(human capital)	0.084*	6.3	0.108*	4.8	0.010	0.6	0.068*	4.5
ln(FDI/(DI+FDI))	*0.013**	*2.4*	*0.040**	*2.5*	*-0.001*	*-0.1*	*0.019**	*2.2*
time trend	*0.028**	*5.1*	*0.011**	*2.1*	*0.001*	*0.3*	*0.010**	*2.9*
time*ln(FDI/(DI+FDI))	*0.051**	*3.5*	*0.043**	*3.4*	*0.011**	*1.9*	*0.035**	*4.8*
ln(export/GDP)	0.048*	5.3	0.013	0.8	0.028*	3.7	0.015*	2.5
ln(transport)	0.057*	5.2	0.001	0.1	-0.033	-1.5	-0.028	-1.1
Central	----	----	----	----	----	----	0.059*	9.4
Diagnosis	Adj-R^2=0.994 T=24 n=288		Adj-R^2=0.990 t=24 n=216		Adj-R^2=0.995 t=24 n=192		Adj-R^2=0.993 t=24 n=408	

Notes: (1) Dependent variable = ln(GDP), '*' signifies significance at 5% critical level or below. (2) DI = domestic investment, FDI = foreign direct investment. (3) All models are estimated with random effect, or controlled random effect (for the Central & West regions combined). Central is a dummy variable for the Central provinces of China, regional definitions are in Table 1. (5) All the variables are measured in constant 1990 prices.

Sources: NBS (1999) *China Statistical Data 50 Years*; and NBS (1999-2004) *China Statistical Yearbook* (various issues).

Results of the West region are significantly different from the rest of the country. Most environmental variables are found to be insignificant except for the real exchange rate, export/GDP and the cross term of time with FDI/(Dl+FDI). The coefficients on human capital, FDI/(DI+FDI), time, and transportation are all insignificant, implying that there is little domestic technological progress, that human capital and transportation are still two important constraints on economic growth, and that the effects of FDI and exports on economic growth are not as strong in the West as in the rest of the country.

The significant differences in regression results between the Central and West regions suggest that they are not a homogeneous group of provinces. Consequently, earlier studies which treat both regions as one homogeneous group may lead to misleading conclusions about the effects of FDI and export on economic growth. Nonetheless, despite the significant differences in the estimated coefficients of the explanatory variables among regions, it is important to stress that even in the West, export and FDI are found to have a significant impact on economic growth. This finding is different from the conclusion drawn by Fu (2004) who suggests that FDI and exports have little effect on economic growth in the inland region. The difference in findings in this chapter and that of Fu may be due to the use of different data and models. This chapter emphasises the role of FDI as a mover of production efficiency and a shifter of the host country's production frontier. The regional level regressions suggest that the propositions are supported in both the East and the Central regions, and provide evidence that FDI is also a shifter of the local production frontier although it may not be a mover of production efficiency in the West region. One possible explanation is that the volume of FDI in the West is still small and it may take time for FDI to become an important and integrated part of local production. This finding has important policy implications for regional economic development.

The effects of explanatory variables on output are different across regions. The key differences can be summarised as follows. First, as two basic physical inputs, labour and capital play a rather different role in production. In the East, output is less elastic with respect to capital than in the rest of the country, implying that labour may be a constraint on economic growth. In the Central and West regions, output is twice as responsive to capital as to labour, implying that they have a relative abundant supply of labour and scarcity of capital. The significant difference in labour and capital elasticities

between regions implies that there exist barriers to free factor mobility in China among regions although there is evidence of a large-scale labour migration from the inland to the coastal region. Second, human capital plays a more important role in the East and Central regions than in the West, suggesting that economic growth in the latter was hampered by the lack of human resources due either to emigration, or to the fundamental deficiency of education caused by poor economic conditions. Third, technological progress caused by domestic innovation and knowledge is much faster in the East than in the Central, and faster in the Central than in the West. On an annual basis, the Hick's neutral technological progress was 2.8% in the East, 1.1% in the Central and 0.1% in the West. FDI-induced technological progress was about 1% in the East, 0.7% in the Central, and 0.2% in the West. Fourth, FDI helped the East and Central regions to improve their production efficiency but not the West. Exports helped improve production efficiency in the East and West but not in the Central. It is worth noting that unlike FDI, export did not help shift the production frontier in all regions, confirming the theoretical discussion outlined in Section 4.2. Finally, transportation plays an important role in the East but not in the other two regions. This implies that transportation is a key factor of production in the advanced region but still underdeveloped in the poor areas, pointing out the importance of infrastructure development in the inland provinces.

4.6 Conclusions

This Chapter presents a theoretical framework to study the role of FDI in economic growth from the perspective of a newly industrialising economy. It presents two important propositions which have not been considered in the economic literature. Firstly, FDI is a mover of production efficiency in the host economy. Secondly, FDI is a shifter of the steady state of the host country's production frontier.

As the largest and fastest-growing industrialising economy in the world, China has maintained a long period of rapid economic growth. China's economic miracle over the past decades has been due to its open policy characterised by large inflows of FDI and exports. As a result, China provides an ideal example for testing the hypotheses.

The empirical models are based on an augmented Cobb-Douglas production function, which includes two basic input variables, labour and capital, and a set of environmental variables. FDI is calibrated into the production function along with export, human capital, transportation and the real exchange rate.

All explanatory variables are found to produce the expected results and output is positively influenced by labour, capital, export, FDI, human capital and real foreign exchange rate. At the national level, FDI as a proportion of total investment and its cross term with a time trend are found to have a significant and positive effect on production. In particular, it is important to note that technological progress played an important part in China's economic growth, contributing 3.5-4.3% of aggregate economic growth on an annual basis. FDI contributes up to 30% of total technological progress. Given that FDI constitutes about 5% of total investment; its contribution to gross technological progress in China is a potent support of the second proposition that FDI is a shifter of China's production frontier over time.

The models are also estimated using regional-level data to see whether there are different effects of FDI and other environmental variables on economic performance across regions. Although the regression results disprove that FDI and export have little impact on economic growth in the inland regions, there are strong evidences that the impact of FDI, export, transportation, human capital, technological progress on economic performance was asymmetric across regions. Most environmental variables (human capital, transportation, export and FDI) are found to have limited impact on production in the West region although FDI is found to have some effect on its technological progress.

The regional difference in technological progress deserves attention for both policy making and academic research. There exists a two-step 'water-fall' picture of technological progress in China: the level is highest in the East, plummets by more than half in the Central and almost grounds to a halt in the West. The annual growth of technological progress, including both domestic and FDI-induced, was as high as 4% in the East, but less than 2% in the Central and less than 0.3% in the West. The real problem is not because FDI causes the widening gap between the East and the Inland areas, but because FDI has played a much less significant role in the latter than in the

former. As a result, policy should not discourage export and FDI to move away from the Inland area, especially the West. Instead, inland provinces should be encouraged and supported to attract more FDI and stimulate exports. To achieve the full potential of FDI, conditions have to be created. Conditions such as education and transportation are essential, but other policies such as inter-regional migration and cross-regional investments are also important in reducing inter-regional disparity in income and production in China.

Chapter 5 The Impact of Foreign Direct Investment on Regional Inequality in China

Abstract

China's economic miracle over the past three decades has been characterised by its open-door policy, especially the absorption of foreign capital. One downside of economic reform has been the ever rising inter-regional inequality. As FDI is highly unevenly distributed across regions, many scholars and policy makers have blamed the inflows of FDI as a main factor driving the Chinese regions apart. If this reasoning were to hold true, controlling the scale of FDI would then provide a solution for reducing regional inequality. However, it is difficult to reconcile the positive effect of FDI on economic growth with its potential 'negative' effect on regional inequality. This is a controversial and provocative issue in the literature of economic development. Using the largest panel dataset covering all the Chinese regions over the entire period of 1979-2003 and employing an augmented Cobb-Douglas production function, this chapter proves that FDI has been an important factor responsible for regional growth differences in China. However, it suggests that FDI cannot be blamed for causing regional inequality; it is the uneven distribution of FDI instead of FDI per se that has caused regional growth differences. The key policy implication is that FDI should be directed to the inland areas through preferential policies in order to improve the spatial allocation of investments as a way of reducing the regional inequality.

5.1 Introduction

Since economic reform and the open-door policy began in the late 1970s, China has achieved impressive economic growth, expanding at an annual rate of 9.6% during 1978-2006. By 2005, China became the fourth biggest economy in the world measured in nominal dollars and the second largest measured in PPP dollars. However, China's economic integration with the world has been accompanied by growing regional inequalities. Different regions have not enjoyed the fruits of economic reform equally. The disparity between China's urban and rural citizens has increased significantly, while

inequalities between different regions and industries are also widening. Statistics show that the Gini Coefficient measuring China's household income inequality was 0.424 in 1996, 0.456 in 1998, 0.457 in 1999 and 0.458 in 2000, continuing to rise in the 21st century. According to international standards, China has stepped into the stage of "absolute disparity" and the gap seems to be widening still (Chang, 2002).

The high economic growth and widening disparities in China's regions are attracting serious attention. Researchers debate over whether regional inequality has intensified and the factors contributing to the inequality in post-reform China. Many studies suggest that government policies favoring the coastal region have worsened regional income inequality and conflicts, particularly in the late 1980s and 1990s. Researchers have argued for more resources to be allocated to the disadvantaged interior regions to reduce regional inequality (Lakshmanan and Hua, 1987; Kueh, 1989; Cannon, 1990; Yang, 1990 and 1991; Kato, 1992; Chai, 1996; Yao, 1999; Yao and Zhang, 2001a and 2001b; Fu, 2004; Chen and Wu, 2005).

However, not all studies agree with the view that regional inequality has widened in the post-reform period. They argue instead that regional inequality has actually narrowed since the adoption of economic reforms, mainly as a result of diffusion, convergence, inter-regional resource transfer and rural industrialization. Hsueh (1994) argues that national economic policies tended to redistribute capital from rich to poor regions in the 1980s, thereby generating a process of convergence. Gundlach (1997) found absolute convergence in regional output per worker across Chinese regions in 1978-89. Raiser (1998) also found similar evidence of absolute convergence using regional data in 1978-92. Huo (1994) and Chen and Fleisher (1996) saw similar results.

Some other studies show two opposite trends of regional inequality in China at different periods. For example, Lyons (1991) and Tsui (1991) show a slight decline in inequality during 1978-87 and an increase in inequality by comparing the early 1980s with the 1950s. Sachs and Warner (1996) find evidence of convergence from 1952 to 1965 and divergence from 1965 to 1978. Since the late 1980s, however, Sachs and Warner observed a widened income gap between coastal and non-coastal regions. Furthermore, they found that intra-regional disparities declined during the reform period but inter-region inequality experienced little improvement. Jian et al. (1996) argue that real

income convergence of Chinese provinces was a relatively recent phenomenon, emerging strongly only since the reform period began in 1978. After 1990, however, regional incomes diverged again. Tsui (1996) shows that inequality across different provinces in China declined in the first half of the 1980s, but deteriorated again from the second half of the 1980s.

The controversial arguments above may be due to different approaches and data period samplings. As for the reasons for the large disparity in China, the popular explanations include: distribution of resources and the government's preferential policy towards coastal zones (Yang, 2002; Lu, 2002; Fang et al., 2002). Many studies have examined the factors behind China's widening regional gap, such as factor productivity, institutional bias, and development strategies (e.g., Tsui, 1991; Jian, et al., 1996; Fleisher and Chen, 1997; Kanbur and Zhang, 1999). Chang (2002) finds that China's large income gap is caused by its urban–rural differential, rather than the regional disparity, or the gap between the poor mass and the emerging rich class. More recently, Kanbur and Zhang (2005) construct and analyse a long-run time-series for regional inequality in China from the Communist Revolution to the present. They find that the regional inequality is explained in different phases by three key policy variables: the ratio of heavy industry to gross output value, the degree of decentralization and the degree of openness.

Compared to other empirical studies of FDI issues in China, relatively few studies have provided a detailed assessment of FDI and regional economic inequality. However, there are some scholars who have attempted to do so. Most of the arguments in earlier studies claim that FDI leads to more poverty, isolation, a neglect of local capabilities and larger inequality (Mazur, 2000). Sun and Chai (1998) examine the effects of FDI on economic growth in the eastern and western regions of China by using panel data of 16 provinces over 1986-1992. They found that the effect of FDI on economic growth was stronger in the eastern region and very weak in the western region, which reinforced inter-regional economic inequality. Bao et al., (2002) investigate the effect of geography on regional economic growth in China during 1978-97. They claim that the coastal regions had spatial and topographic advantages characterised by possessing more FDI and mobilization of rural surplus labour plus lower costs of transportation and communication, which produced the disparity from coastal to inland regions. Zhang and

Zhang (2003) develop an empirical method for decomposing the contributions of two major driving forces of globalization, foreign trade and FDI on regional inequality and apply it to China in 1986-98. Globalization is found to be an important factor contributing to the widening regional inequality. More recently, Fu (2004) investigates the spillover and migration effects of exports and FDI, estimates their impact on regional income inequalities in China and finds that exports and FDI played an important role in raising regional disparities. In contrast, some studies have opposite evaluations about FDI. Dollar and Kraay (2002) argue that the current wave of FDI from the 1980s promoted equality and reduced poverty. Zhang (2001c) investigates the role of trade and FDI in a cross-country convergence analysis, indicating that export and FDI tend to accelerate the convergence process in the Asian newly industrialised economies and Japan.

The controversial empirical studies on the linkage between FDI and regional inequality require further research. Yao and Wei (2007) claim that FDI has played a dual role on economic growth as a mover of production efficiency and a shifter of production frontier. FDI is hence regarded as a powerful driver of economic growth for China to catch up with the most advanced countries in the world. Consequently, it is expected that the less developed regions of China such as the West and Central provinces might be able to catch up with their rich east counterparts with more FDI. This chapter estimates quantitatively the linkage of FDI inflow and economic inequality in China's regions using more recent data, and examines whether and how FDI has contributed to the process of convergence or divergence of income across the Chinese regions.

In relation to the per capita income gap within China, a series of studies have contributed to the evolution of income distribution in China during the pre- and post-reform periods. One group of articles has decomposed the Gini coefficient of mainland China in order to explain the causes of income inequality, and has found that rural-urban inequality and spatial inequality are the causes of such inequality (Tsui, 1996; Yao, 1999; Yao and Zhang, 2001a; Gustafsson and Li, 2002). Some articles employ the classical approach and the concepts of β- and σ-convergence to address the spatial pattern of China's economic growth and income inequality (Jian, Sachs and Warner, 1996; Gundlach, 1997; Raiser, 1998; Demurger, 2001; Zhang, 2001b; Yao and

Zhang, 2001b). In this study, the σ- and β-convergence tests in absolute and conditional convergence with respect to per capita real GDP will be applied.

The next section provides empirical models and estimation results of σ- convergence for both national and regional levels. Section 5.3 presents empirical models of absolute and conditional β-convergence at national, regional and regional group levels. Section 5.4 interprets the empirical results of β-convergence tests, and section 5.5 concludes with policy implications.

5.2 σ-convergence

Will the West/Central regions of China remain poor for the next century? Will the East still be the rich region in the following decades? Is the degree of economic disparity between China's regions increasing or falling over time? The concepts of σ-convergence, absolute and conditional β-convergence are discussed respectively in this and next sub-section to answer these important questions.

The concept of σ-convergence can be defined as *"a group of economies are converging in the sense of σ if the dispersion of their real per capita GDP levels tends to decrease over time"* (Sala-i-Martin, 1996, p1020). It is used to reflect the static disparities in per capita income. It can be regarded as evidence of σ-convergence between China's regions if regional income disparity declines over time. Commonly, it is measured by the coefficient of variation (CV) which is the ratio of standard deviation to the mean[18].

$$CV = \frac{\sqrt{\dfrac{\sum (y_i - \bar{y})^2}{n}}}{\bar{y}} \qquad (5.1)$$

where y_i is real GDP per capita in region i and $\bar{y}$ is the mean value.

Given a contraction in CV, we can say that the economies in consideration have experienced σ-convergence with reduced difference in their income levels. A higher

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[18] Yao and Zhang (2001b) measure σ-convergence by the inter-provincial Gini coefficient and the time standard deviation of log (GDP per capita).

value of CV indicates a more serious income disparity, and *vice versa*. The CV not only quantifies the income inequality problem but also measures the development of income gap between different economies. It has been widely used in the literature, such as Lyons (1991), Tsui (1996), Chen and Fleisher (1996), Raiser (1998), Zheng, Xu and Tang (2000), Xu and Zou (2000), Wu (2002) and Chang (2002). The CV index in these studies is calculated by the net material product, national income or per capita GDP in nominal or real value to assess the evolution of regional income inequality in the pre- and post-reform periods.

Table 5.1 and Figure 5.1 present the indices of CV at national and regional levels based on real per capita GDP. The CVs in the whole country, at the first decades of reform period, 1979-1989, showed a trend of declining, from 0.6924 to 0.6028 (except for 0.7015 in1980), this finding is consistent with Zheng, Xu and Tang (2000). Since 1990, however, the values then increased to 0.6680 in 1998; and similar conclusion can also be found in Chang (2002). Since 1999, a declining trend of the CV values was found again to 0.6180 in 2003 (the smallest value 0.5983 appeared in 2000). This pattern reflects the process of economic reform and policies adopted during the past decades. At the beginning, the whole country benefited from economic reform, achieving impressive economic development. Some initially poorer economies took advantage of their backwardness and performed more rapidly than some initially richer ones, leading to a contraction of income gap for the country. In the second stage, the coastal provinces benefited greatly from the preferential policies granted by the central government. For instance, the Eastern region was allowed to adopt a market system and to open its door to foreign investors before the rest of the country. Consequently, FDI largely flowed into the coastal cities, greatly accelerating export activities and local development. As a result, income disparity between the Coastal and Inland regions began to deteriorate in this period. In the third stage, the income gap appeared to have declined thanks to the government's Western Development Programme and the Rebuilding Programme of the Northeast Region. However, the reduction in the CV in the third phase may be too little to be statistically significant and whether the income inequality among the Chinese regions really declined has to be tested using a more robust parametric approach as will be discussed later in this chapter.

At the regional level, three macro-geographical regions (East, Central and West) are found to have different CVs in terms of their values and trends. The East had the highest value of CV and the Central the lowest, meaning that income gaps were highest within the East and lowest within the Central. Regarding the trends of CVs, the East and the Central regions experienced three phases of changes over the data period. In the East, the CV declined from 0.6868 in 1979 to 0.4652 in 1994, followed by an increase 0.4995 in 1998, and then declined again to 0.4247 in 2003. Similarly, a contraction of CV was found in the Central from 0.2647 in 1979 to 0.2000 in 1986, and followed by a rise to 0.2268 in 1991, and then declined to 0.1558 in 2003. Compared to the other two regions, the West had a relatively stable value of CV. Despite some fluctuations, the trends of CVs have a clear and declining tendency in all regions, especially in the East. In addition, the reduction in regional CVs was much more profound than that observed at the national level. Oscillation in regional CVs implies that intra-regional inequality declined, especially among the Eastern provinces. The sluggishness of the national CV and the reduced regional CVs indicate that inter-regional inequality must have risen. This is consistent with the conclusion drawn by Yao and Zhang (2001b) on the formation of three geo-economic clubs in China under economic reforms.

Figure 5.1 Coefficient of variation in comparison
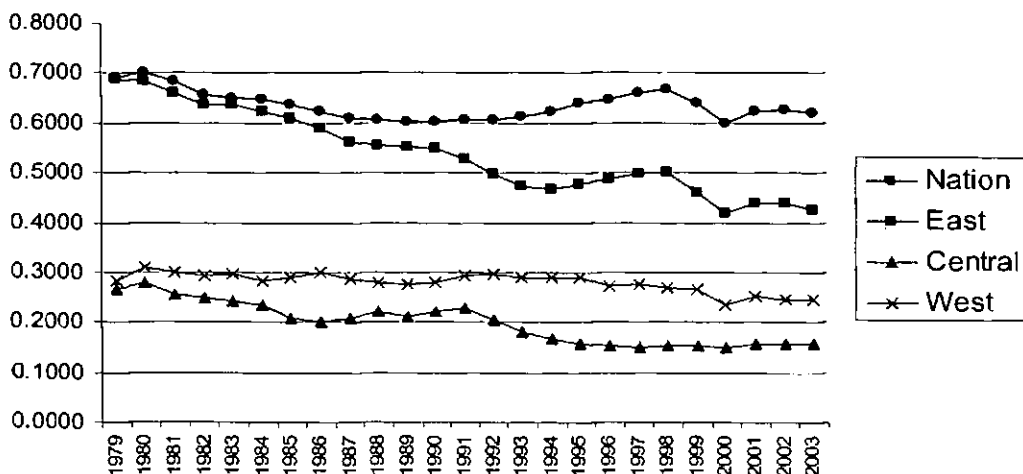
Note: CV is calculated according to equation 5.1.
Source: 1.*Comprehensive Statistical Data and Materials on 50 years of New China*, NBS, 1999
        2. *China Statistical Yearbook*, NBS, 1985-2004

Table 5.1 Coefficient of variation in comparison

Year	Nation	East	Central	West
1979	0.6924	0.6868	0.2647	0.2831
1980	0.7015	0.6826	0.2790	0.3089
1981	0.6850	0.6608	0.2566	0.3006
1982	0.6580	0.6349	0.2482	0.2918
1983	0.6509	0.6371	0.2422	0.2962
1984	0.6456	0.6239	0.2362	0.2840
1985	0.6351	0.6093	0.2080	0.2906
1986	0.6221	0.5904	0.2000	0.2985
1987	0.6079	0.5630	0.2068	0.2873
1988	0.6065	0.5545	0.2200	0.2781
1989	0.6028	0.5515	0.2127	0.2741
1990	0.6036	0.5490	0.2203	0.2789
1991	0.6046	0.5264	0.2268	0.2918
1992	0.6076	0.4966	0.2050	0.2961
1993	0.6115	0.4724	0.1813	0.2897
1994	0.6227	0.4652	0.1682	0.2902
1995	0.6393	0.4763	0.1568	0.2886
1996	0.6480	0.4861	0.1524	0.2735
1997	0.6593	0.4958	0.1507	0.2766
1998	0.6680	0.4995	0.1542	0.2689
1999	0.6391	0.4592	0.1543	0.2660
2000	0.5983	0.4194	0.1485	0.2358
2001	0.6226	0.4404	0.1579	0.2503
2002	0.6266	0.4407	0.1582	0.2460
2003	0.6180	0.4247	0.1558	0.2459

Note: CV is calculated according to equation 5.1.
Source: 1.*Comprehensive Statistical Data and Materials on 50 years of New China*, NBS, 1999
       2. *China Statistical Yearbook*, NBS, 1985-2004

In summary, the degree of income gap in the whole country during 1979-2003 experienced three phases: reduction in the first decade, expanding at the second decade, then declining again from the third decade. This pattern reflects the process of economic reform and policies inclined during the past decades in China. At the beginning, the whole country benefited from economic reform and then achieved impressive economic development. Some initially poorer economies took advantage of their backwardness and performed more rapidly than some initially richer ones, leading a contraction of income gap for the country. In the second stage, the Coastal provinces possessed disproportionate benefits from the central government with more favourable policies. FDI largely flowed into the coastal cities, greatly accelerating the local development. Consequently, income disparity between the Coastal and Inland regions deteriorated

during this period. Since the central government implemented its western development policies from the late 1990s, there is evidence that the growth in regional inequality has slowed down. Many previous studies only found two phases of CV in China in the post-reform period due to the lack of the latest data.

In view of the income disparity at the regional level, three regions were found to have different CVs in terms of their values and trends. The East had the highest value of CV and the Central the lowest one, meaning that income gaps were the most significant within the East and the smallest in the Central. Furthermore, the trends of CV in these two regions presented similar patterns to the whole country. However, the West, unlike the others, showed relatively stable values and trend, which declined slightly after 1995. The differences in the values and trends of CV revealed dissimilar backgrounds, endowments and economic conditions between these regions.

5.3 β-convergence

The classical literature defines convergence in two different ways. One is σ-convergence and the other is β-convergence. The studies of σ-convergence on the variation coefficient with respect to per capita RGDP have been investigated on both national and regional levels above. This section is going to estimate β-convergence in order to further measure the speed at which the income gap is declining or increasing at both the national and regional levels.

According to Sala-i-Martin (1996b, p1020), the definition of absolute β-convergence can be described as *"we say that there is absolute β-convergence if poor economies tend to grow faster than rich ones"*. In other words, this is to test if an initially lower income group has higher speed of income growth, and convergence is a process in which the poorer economies catch up with the richer ones. This argument is based on the neoclassical model, which predicts that initially poor countries will grow faster than initially rich ones if the only difference across countries lies in their initial levels of capital (Solow, 1956; Sala-i-Martin, 1996). However, in the real world, economies may differ in other respects such as technological progress, population growth, investment, infrastructure and political stability. If these differences are considered, the neoclassical

models will predict that the growth of an economy will be positively related to the distance that separates it from its own steady state. This is the concept known in the classical literature as conditional β-convergence (Sala-i-Martin, 1990, 1996; Yao and Zhang, 2001b).

In absolute β-convergence, initial income level is the only factor of concern and the catching-up process will take place if the initially poorer economies have higher growth than the initially richer ones. To examine absolute β-convergence, the simple regression that was suggested in Baumol (1986) and applied in Chen and Fleisher (1996), Jian, Sachs and Warner (1996), Gundlach (1997), Raiser (1998) and Yao and Zhang (2001b) will be adopted in this research, to regress the growth rate of real GDP (RGDP) per capita against the beginning period's level of RGDP per capita. The regression function is specified as:

$$Ln(y_{it}) - Ln(y_{i0}) = \alpha + \beta Ln(y_{i0}) + \varepsilon_{it} \text{[19]} \qquad (5.2)$$

and $\beta = -(1 - e^{-\lambda t})$

Where y_{it}, y_{i0} denote respectively per capita RGDP of the ending and beginning periods respectively in the ith economy, t is the time span. A statistically significant and negative β suggests absolute income convergence. It implies that an initially poorer economy, such as the remote provinces in western China, can take advantages of its backwardness to achieve a higher growth rate so as to catch up with the initially richer provinces such as the east region. On the contrary, if $\beta \geq 0$, the data exhibits no absolute β-convergence. It may even show an absolute β-divergence since an economy with higher initial income tends to grow faster; then the initially richer economies will become even richer, while the initially poorer economies will become even poorer in the group. The value of λ is the pace of income convergence (or divergence).

As for conditional convergence, income convergence and the catching-up process can only be initiated given the presence of additional control factors, such as investment ratio, population growth, openness, FDI ratio, human capital and infrastructure, etc. If absolute β-convergence is observed, then conditional β-convergence is also implied. In

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[19] Raiser (1998), P.3; Yao and Zhang (2001b), p.171.

conditional β-convergence, the above-mentioned growth related factors determine the steady state income level of an economy and if an economy is far from its steady state income level, and it will tend to have a higher speed of economic growth until it arrives at its steady state. However, in the process of conditional β-convergence, the initially poorer economies will have a tendency to move just towards its own steady state income level.

Taking into account the investment ratio and the effective population growth rate, the estimation equation of conditional convergence can be written as:

$$Ln(y(t)) - Ln(y(0)) = (1 - e^{-\lambda t})\frac{\alpha}{1 - \alpha - \beta} Ln(s) - (1 - e^{-\lambda t})\frac{\alpha + \beta}{1 - \alpha - \beta} Ln(n + g + \delta)_{20}$$
$$- (1 - e^{-\lambda t})Ln(y(0))$$

$$(5.3)$$

which was derived from:

$$Ln(y(t)) - Ln(y(0)) = (1 - e^{-\lambda t})Ln(y^*) - (1 - e^{-\lambda t})Ln(y(0)) \qquad (5.4)$$

and the steady state level of income per capital, y^*, was defined as:

$$\frac{dLn(y(t))}{dt} = \lambda[Ln(y^*) - Ln(y(t))], \text{ where } \lambda = (n + g + \delta)(1 - \alpha - \beta) \quad (5.5)$$

where y_t denotes real income per capita and y_0 the value in the initial period, n population growth, g a rate of technological progress, δ rate of capital depreciation. α is the capital share in income and β is the labour share. s is the investment in physical capital as a share in GDP, λ is the rate of convergence. According to Mankiw, Romer and Weil (1992), this augmented Solow growth model specifies that the growth of income is a function of the determinants of the ultimate steady state and the initial level of income[21].

This model argues that the income per capita in an economy will converge to the economy's own steady-state level, which is determined by its own endowments, such as

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[20] Mankiw, Romer and Weil (1992), p.423. Yao and Zhang, 2001b, p173
[21] Mankiw, Romer and Weil (1992), p.423.

capital accumulation, population growth and depreciation, etc. The income levels between different economies, however, may not necessarily approach to a similar level over time. Specifications similar to the above-mentioned model could also be found in Gundlach (1997), Raiser (1998)[22] and Yao and Zhang (2001a, 2001b). In assessing the growth pattern of China, Yao and Zhang (2001b) has incorporated some additional factors, such as the international trade to GDP ratio, transportation measured by the equivalent length of highways and regional dummies in their estimation.

Since FDI is considered to be one of the engines to economic growth in China (Yao and Wei, 2007), this research will apply similar specification by adding FDI to examine conditional β-convergence at national and regional levels. Regressions will be run on both cross-sectional and pooled basis to estimate the pace of unconditional or conditional β-convergence, which is the speed at which different economies return to their respective steady state output levels. The estimations also aim at addressing the growth discipline of these economies, as well as the contributions of different factors, such as investment ratio, population growth, openness ratio, FDI ratio, human capital and transportation[23], to the growth pace and speed of income convergence. The functional form of the estimation equation is specified as:

$$LnY_{it} - LnY_{i0} = Cons\tan t + (1 - e^{-\lambda t})LnY_{i0} + \gamma_1 Ln(s)_i + \gamma_2 Ln(n + g + \delta)_i + \gamma_3 Ln(FDI)_i$$
$$+ \gamma_4 Ln(Export)_i + \gamma_5 Ln(HEP)_i + Ln(Tran)_i + \varepsilon_i$$

(5.6)

This specification is derived from the Solow growth model with a Cobb-Douglas production function as the basis. Where y_{it}, y_{i0} denote respectively per capita RGDP of the ending and beginning periods respectively in the ith economy, the investment ratio s is calculated as the share of investment as a proportion of GDP. The population growth n is calculated as the annual growth rate of the year-end population. We set $(g+\delta)$ equal to 0.05 and assume this value to be the same for all provinces and all years.[24] FDI is

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[22] In Raiser (1998), the ratio of non-state enterprises output to industrial production and light industry output to industrial production have been inserted into the estimation of conditional convergence to show how the Open Door Policy, the market liberalization and the structural change have contributed to the growth and income convergence of Mainland China.

[23] Yao and Wei (2007) find that the factors of FDI ratio, export ratio, human capital and transportation have been proved to present significant impact on the GDP growth in China at both national and regional levels.

[24] Yao and Zhang, 2001b, p174.

defined as the ratio of actually used FDI to total investment to avoid multi-collinearity and double accounting. Export is also defined as the ratio of total value of exports to GDP instead of the absolute value of export to avoid the problem of multi-collinearity. HEP, or human capital, can be defined in different ways, the ratio of the number of students enrolled in higher education over population, the ratio of the number of students enrolled in secondary education over population, the ratio of the number of students enrolled in higher education to the number of students enrolled in secondary education, or investments in education, science, health care and cultural activities. This chapter, same to chapter 4, chooses the ratio of the number of students enrolled to higher education over population. Data for GDP is gross domestic product. All the variables are calculated in 1990 constant prices.

As in chapter 4, the data is based on a panel of 29 provinces and municipalities (Tibet is excluded and Chongqing is merged with Sichuan) for the period 1979-2003. Two principal data sources are available: *China Statistical Data 50 Years 1949-98* (NBS, 1999) and *China Statistical Yearbook* (NBS, various years, 1999-2004). And all the data definitions are identical with chapter 4 and Yao and Wei (2007).

The above-mentioned β-convergence test will be employed to examine whether and at what speed the per capita income level of China and its regions are converging after controlling their growth potential, or if the initially poorer inland China is able to grow at a higher speed than the initially richer coastal east. To address the issue of absolute β-convergence among regions, a simple estimation will be employed on the growth rate of per capita RGDP at the beginning year's per capita RGDP. The intention is to assess if the growth rate of these economies is negatively related to its initial income level. Given a negative and statistically significant estimated coefficient for the initial income level, it is possible to conclude that the initially poorer economy is able to have a higher growth rate which enables it to catch up with the initially richer economy, and β-convergence is taking place in an absolute manner.

Both cross-section and panel data approaches are employed in this sector for comparison. In the panel regression, the sampling period (1979-2003) can be divided into several shorter time spans. The question is what is the appropriate length for each time span? The shortest time period is one year. However, annual time length is too

short to be appropriate for studying growth convergence. Shorter disturbances may emerge large in such short spans (Yao and Zhang, 2001b). To conquer this problem, the data period in this research is divided into six time spans: 1979-83, 1983-87, 1987-91, 1991-95, 1995-99, 1999-03. When t =1983, for example, t-1 =1978, all the related variables to each province are the averages over 1978-83. Data for the other periods are derived in the same way.

5.4 Estimation results of β-convergence tests

In the estimations, the Chinese provinces will be divided into three regions: East (Coastal), Central and West. Income convergence will be analyzed for each region and for the whole country. In addition, a pair-wise analysis is also conducted to examine the convergence or divergence tendency for the following pairs of regions: East-Central (EC), East-West (EW) and Central-West (CW).

5.4.1 Estimation results of β-convergence at national level

Absolute Income Convergence

Based on equation (5.2), only $\ln(y_0)$ is included on the right-hand side to test for absolute convergence. As reported in the upper panel of column 2 in Table 5.2, there is no evidence of absolute β-convergence. The estimated coefficient of initial income during 1979-2003 is statistically insignificant, implying that the initially poorer Chinese provinces do not have higher growth than the initially richer ones and thus fail to catch up. The initially poorer provinces could be benefited by the reforms to grow faster than before. However, the coastal provinces might be able to continuously derive disproportionately greater benefits from the reforms after 1992 as the central government encouraged them to speed up the pace of reform and development with more open policies in terms of FDI and exports. Their speed of growth might then out-perform the others. Hence, the process of absolute convergence has not been found in the entire post-reform period. This finding is rather similar to those offered by Chen and Fleisher (1996) and Jian, Sachs and Warner (1996) in which the former did not

show any absolute β-convergence in both the pre- and post-reform periods, while the latter suggested a mixed result with no clear absolute β-convergence.

An East dummy is introduced in the analysis to capture the impact of the preferential policies favoring the east region. As shown in the second panel of column 2 in Table 5.2, income convergence is observed and the adjusted R^2 increases significantly compared with that in the upper panel. It shows that economic reform and the resulting higher growth have brought about conditional β-convergence, particularly to the eastern region. The speed of convergence is 1.67% in the cross-section regression. This may imply that some of the initially poorer economies in the East, such as Guangdong and Fujian, have experienced a rapid growth after economic reform which enabled them to catch up with the other initially richer economies in the country. Furthermore, the east dummy is strongly significant. It shows that the east region has its own income growth pattern which is different from the other regions of the country. This specific growth discipline could very much be explained by the open door policies and the preferential treatment which were firstly introduced in the coastal region with an intention to promote trade and to attract foreign investment.

Table 5.2 Basic convergence regressions analysis for national level, 1979-2003

Method	Cross Section Analysis	Panel Data Analysis
Constant	2.000 (28.372)**	0.328 (32.751)**
Ln Y_{io}	-0.069 (-0.557)	0.018 (1.582)
Implied λ	*0.0029*	*-0.0007*
Adjusted R^2	0.025	0.009
With east dummy		
Constant	1.704 (21.853)**	0.313 (28.296)**
Ln Y_{0i}	-0.342 (-3.258)**	0.003 (0.239)
East dummy	0.507 (5.032)**	0.054 (2.969)**
Implied λ	*0.0167*	*-0.0001*
AdjusUSted R^2	0.461	0.052

Notes: Estimated equation: $LnY_{it} - LnY_{i0} = Cons\tan t + (1 - e^{-\lambda t})LnY_{i0} + \varepsilon_i$.   t statistics in parenthesis. ** and * indicate statistical significance at 1% and 5% level   respectively. Yit and Yi0 are real GDP per capita in the *i*th province in 2003 and 1979 respectively in cross –section analysis. In panel data analysis, they are real GDP per capita in each ending year and beginning year of six time spans. Real GDP is calculated at constant 1990 prices. East dummy is that taking the value of 1 for an eastern region and 0 for otherwise. Source: NBS (1999) *Comprehensive Statistical Data and Materials on 50 years of New China*, NBS, 1999; NBS (1985-04, various issues), *China Statistical Yearbook*.

Apart from the cross-sectional analysis, the panel data approach has also been advocated to address the issue of absolute β-convergence. Such pooled analysis may

help to resolve the possible significance problem which is caused by the shortening of observations. As indicated in the first half of column 3 in Table 5.2, like its cross-section counterpart, no evidence of absolute β-convergence can be found. The estimated coefficient on the initial income level is even positive although it is insignificant. The adjusted R^2 is very small. It means that Chinese provinces were not able to move their income levels towards the national mean, and the initially poorer regions failed to have a higher growth rate after economic reform. In other words, the West or/and Central regions failed to catch up with the East. Dissimilar to the cross section regression, the introduction of an east dummy could neither revise nor improve the estimation results as the estimated coefficient of the initial income level is still insignificant. However, the east dummy is statistically significant and raises the adjusted R^2 although it is still small. This finding indicates that the initial income level and east dummy are far away from explaining the dependent variable.

Table 5.3 Speed of convergence and divergence (λ) for different data sets

Data set	Cross-section regression		
	λ	t value	R^2
Our estimates			
China 29 Provinces (1979-2003) (cross-section data)	0.0029	0.557	0.025
China 29 Provinces (1979-2003) (panel data)	-0.0007	1.582	0.009
Yao and Zhang (2001b)			
China 30 Provinces (1978-1995) (cross-section data)	0.009	1.10	0.040
China 30 Provinces (1979-1995) (panel data)	-0.0025	1.89	0.029
Chen and Fleisher (1996: Table 1)			
China 25 Provinces (1952-1992) (cross-section data)	-0.005	1.47	0.046
China 25 Provinces (1978-1993) (cross-section data)	0.009	1.54	0.054
Raiser (1998: Table 2)			
China 28 Provinces (1978-1992) (cross-section data)	0.0255	2.74	0.287
Gundlach (1997:p426)			
China 29 Provinces (1978-1989) (cross-section data)	0.0220	3.14	0.280
Sala-l-Martin (1996a)			
World 110 countries (1960-1990)	-0.004	2.00	0.4
OECD countries (1960-1990)	0.014	4.33	0.48
UAS 48 states (1980-1990)	0.021	70.0	0.89
Germany 11 regions (1950-1990)	0.014	2.33	0.56
UK 11 regions (1950-1990)	0.020	2.50	0.62

Notes: (1) The values in column 3 are asymptotic t-value for the convergence speed parameter λ. If the value λ is positive, it indicates convergence, or *vice versa*.   Apart from the second and fourth row for China, all the data sets are long-run cross-section data.(2) Yao and Zhang (2001b) use real GDP per working-age person instead of real per capita GDP. Furthermore, they had data for 30 provinces. And their results are most similar to ours. (3)Chen and Fleisber (1996) use real per capita national income, instead of real per capita GDP in 1952-92 and real per capita GDP in 1978-93. At the time of their writing, GDP data was not available before 1988 from official statistics. In addition, they did not have data for five provinces, Guangxi, Jilin, Hainan, Qinghai and Tibet. Despite the obvious caveats in the data sets, their results are not fundamentally different from ours. (4) Raiser (1998) takes data from a number of different sources, including his personal calculations.

Table 5.3 compares our estimated results with those in the literature for different data sets. Our cross-section regression for the period 1979-2003, like the regression by Yao and Zhang (2001b) for cross-section analysis as well as Chen and Fleisher (1996) for 1978-93, shows evidence of convergence, but the test statistics are not significant. In contrast, like the cross-section regression by Chen and Fleisher for a longer time period 1952-92, our panel data regression shows evidence of divergence, although it is also insignificant. The panel data regression by Yao and Zhang (2001b), however, shows a clear evidence of divergence because the value of λ is negative and significant. This evidence contrasts sharply with that presented by Gundlach (1997) and Raiser (1998).

According to the neo-classical model, the initially poor countries will grow faster than the initial rich ones if the only difference across countries lies in their initial level of capital (Solow, 1956; Swan, 1956). However, in the literature, many studies find no evidence of absolute convergence for countries with different institutions, preferences and production technologies. Sala-I-Martin (1996) shows significant divergence rather than convergence by estimating the data for 110 countries during 1960-90 and the speed of divergence was 0.4% per annum. This finding implies that economies may differ in other respects in the real world, such as population growth, saving behavior, technology and political stability. If these differences are considered, the neoclassical model will predict that the growth of an economy will be positively related to the distance that separates it from its own steady state. This is the concept of conditional convergence and focus of analysis in the next section.

Conditional Income Convergence

If the initially poorer economies cannot grow faster than the initially richer ones, then they should have failed to catch up and reduce their income gap with the initially richer economies. Nevertheless, they may still be able to move their income levels to their respective steady states, which are determined by some growth related factors. Based on this belief, the conditional income convergence test will be performed to estimate if the catching-up and convergence process will take place after imposing controls on the growth potential of these economies, despite no tendency of absolute income convergence.

To observe the difference that each additional variable makes to the conditional β-convergence models, four different regressions are run step by step. The first regression adds only two basic variables: Ln(s) and Ln(n+g+δ). The second regression adds Ln(s) and Ln(n+g+δ) and Ln(FDI). The third regression further adds Ln(Export) to the second. And the last regression includes all the variables by additionally adopting Ln(Human capital) and Ln (Transportation).

Table 5.4 Conditional convergence regressions at national level, 1979-2003:
by adding ln(s) and ln ($n+g+\delta$)

Method	Cross section analysis	Panel data Analysis
Constant	3.788 (0.974)	**-0.472 (-2.022)***
Ln Y_{io}	0.031 (0.216)	-0.010 (-0.687)
ln(s)	-0.065 (-1.337)	**0.072(2.090)***
ln ($n+g+\delta$)	0.919 (0.596)	-0.325 (-0.325)
Implied λ	*-0.0012*	*0.0004*
Adjusted R^2	-0.022	0.086
With east dummy		
Constant	2.035 (0.696)	**-0.641 (-2.870)****
Ln Y_{0i}	**-0.289 (-2.278)***	**-0.046 (-2.989)****
ln(s)	-0.262 (-0.708)	**0.120 (3.501)****
ln ($n+g+\delta$)	0.227 (0.196)	**-0.401 (-4.862)****
East dummy	**0.487 (4.588)****	**0.083 (4.644)****
Implied λ	*0.0136*	*0.0019*
Adjusted R^2	0.433	0.185

Notes: Estimated equation: $LnY_{it} - LnY_{i0} = Cons\tan t + (1 - e^{-\lambda})LnY_{i0} + \gamma_1 Ln(s)_i + \gamma_2 Ln(n + g + \delta)_i + \varepsilon_i$. t statistics in parenthesis. ** and * indicate statistical significance at 1% and 5% level respectively. All the values are measured in 1990 prices. Yit and Yi0 are real GDP per capita in *i*th province in 2003 and 1979 respectively in cross –section analysis. In panel data analysis, they are real GDP per capita in each ending year and beginning year of six time spans. Investment ratio s equal investment/ real GDP, population growth rate n is the annual growth rate of the year-end population. (g+δ) equal 0.05 all the time. East dummy is that taking the value of 1 for an eastern region and 0 for otherwise.
Sources: NBS (1999) *Comprehensive Statistical Data and Materials on 50 years of New China*, NBS, 1999; NBS (1985-04, various issues) *China Statistical Yearbook*.

In the first batch of estimations, according to equation (5.3), only two basic factors, investment ratio and effective population growth rate, plus the initial income are added to the right hand side of regression. As indicated in Table 5.4, in the cross-section estimations, these two factors appeared to be statistically insignificant with wrong signs and they are able to neither improve nor revise the results of its absolute manner in Table 5.2. There is no evidence of conditional convergence and the estimated coefficient of the initial income level is insignificantly positive. Furthermore, the

adjusted R^2 is still small, implying poor goodness-of-fit in the regression. This result matches some of the findings in Gundlach (1997), Yao and Zhang (2001a) and Jones, Li and Owen (2003). When the east dummy is adopted in the estimations, the explanatory power of these two additional variables is still poor. But the east dummy is statistically significant and has contributed to bring about negative significance at 5% level on the initial income. In addition, the adjusted R^2 increases to 0.433, and the speed of convergence rises to 1.36%. This result reveals that the process of conditional convergence is almost independent of the investment ratio and effective population growth.

The results of panel data regressions are presented in the last column of Table 5.4. In general, the significance of estimation results on convergence has obviously improved compared with either its absolute manner or cross-sectional counterpart. The two explanatory variables now have right signs and the investment ratio is significant at 5% level. Besides, they have contributed to change the estimated coefficient of the initial income to be negative although it is insignificant. After the east dummy addressing, the estimation results are striking. There is strong evidence of conditional income convergence in 1979-2003 and all the explanatory variables become strongly significant in proper signs. The estimated values of adjusted R^2 and speed of convergence have also improved. This confirms that the region-specific effects must be correlated with the included variables. As explained above, investment ratio and effective population growth rate are just two of the factors that may affect growth. A high investment ratio and a low effective population growth rate may be necessary but not sufficient for achieving higher growth. Therefore, they are not satisfactory explanatory variables and have failed to explain the growth discipline of the Chinese provinces. This suggests that some important explanatory variables other than the investment ratio and population growth are missing from the regressions.

The second estimation differs from the first one by adding ln(FDIR) on the right-hand side of the equation. The regression results are reported in Table 5.5. This explanatory variable is found in Demurger (2001) with statistical significance. With the new variable in cross-sectional regression model, reported in the first half of column 2, no conditional income convergence is observed but its negative significance on initial income has greatly improved. The FDI ratio is statistically significant, improving the

value of adjusted R^2 and accelerating the pace of convergence. Both the adjusted R^2 and the speed of convergence become positive, rising to 0.322 and 1.4% respectively. Their values increase after the east dummy is added. The east dummy is significantly positive, helping to bring about conditional income convergence between the Chinese provinces. However, the significance of the FDI ratio is reduced and become insignificant when it is together with the east dummy. This may be due to the fact that its explanatory power is diluted by the East dummy variable. Similar to the previous finding from the cross-section analysis in Table 5.4, investment ratio and population growth rate still fail to explain the growth pattern of the Chinese provinces.

Table 5.5 Conditional convergence regressions at national level, 1979-2003:

by adding ln(s), ln($n+g+\delta$) and FDI

Method	Cross section analysis	Panel data Analysis
Constant	-1.322 (-0.383)	-0.328 (-1.597)
Ln Y_{io}	-0.295 (-2.030)	-0.085 (-5.296)**
ln(s)	0.261 (0.561)	0.109 (3.540)**
ln ($n+g+\delta$)	-1.277 (-0.920)	-0.301 (-4.022)**
Ln(FDIR)	0.193 (3.703)**	0.039 (7.264)**
Implied λ	*0.0140*	*0.0036*
Adjusted R^2	0.322	0.299
With east dummy		
Constant	0.355 (0.111)	-0.455 (-2.235)*
Ln Y_{0i}	-0.343 (-2.580)*	-0.099 (-6.108)**
ln(s)	0.018 (0.041)	0.135 (4.357)**
ln ($n+g+\delta$)	-0.510 (-0.395)	-0.354 (-4.731)**
Ln(FDIR)	0.080 (1.229)	0.034 (6.284)**
East dummy	0.364 (2.506)*	0.054 (3.209)**
Implied λ	*0.0168*	*0.0042*
Adjusted R^2	0.445	0.336

Notes: Estimated equation: $LnY_{ii} - LnY_{i0} = Constant + (1 - e^{-\lambda t})LnY_{i0} + \gamma_1 Ln(s)_i + \gamma_2 Ln(n + g + \delta)_i + \gamma_3 Ln(FDI)_i + \varepsilon_i$. t statistics in parenthesis. '**' and '*' indicate statistical significance at 1% and 5% level respectively. All the values are measured in 1990 prices. Yit and Yi0 are real GDP per capita in the ith province in 2003 and 1979 respectively in cross –section analysis. In panel data analysis, they are real GDP per capita in each ending year and beginning year of six time spans. Investment ratio s equal investment/ real GDP, population growth rate n is the annual growth rate of the year-end population. ($g+\delta$) equal 0.05 all the time. FDIR equals real actually used FDI/ real total investment. East dummy is that taking the value of 1 for an eastern region and 0 for otherwise.
Source: NBS (1999) *Comprehensive Statistical Data and Materials on 50 years of New China*; NBS (1985-04, various issues) *China Statistical Yearbook*.

In the panel data estimation, the regression results are greatly improved after adding the FDI ratio. As reported in the final column of Table 5.5, the estimated coefficient on the FDI ratio is significant and positive, helping to bring about conditional β-convergence

over the data period. Furthermore, in the presence of the FDI ratio, the estimated coefficient on the investment ratio rises sharply with a much higher significance level. It implies that FDI must have improved the productivity of domestic capital. In addition, population growth has now become significantly negative. This remarkable result suggests that FDI must have played a pivotal role in promoting regional economic growth. Similar to the previous regression results, the East dummy not only improves the estimation significance but also further increases the values of adjusted R^2 and the pace of convergence. The findings from the second regression in both cross-section and pooled data analyses suggest that there should be some more important regional specified explanatory variables other than investment, population growth and FDI considered in the estimation.

The third regression further adds export ratio as a measurement of openness based on the second regression, summarized in Tables 5.6. Given the new variable ln(EXPR), more significance is observed in the regression results compared with Table 5.5. In the cross-sectional analysis, the export ratio is statistically significant and has contributed to bring about conditional income convergence which is not found in Table 5.5. Furthermore, the significant level of the investment ratio and population growth is improved although they are still insignificant. In addition, the speed of convergence jumps from 1.40% to 4.03% and the R^2 increases to 0.550. This means that export is a very powerful factor accelerating the speed of income growth. Unlike the previous results, the east dummy adopted in this regression is not significant and even dilutes the estimation significance of other variables. The findings in the cross-section analysis are all observed in its panel data counterpart. However, the estimation of the latter shows significant improvement in the level of significance. All the explanatory variables are significant with expected signs. Besides, both estimated coefficient and significant level of investment and population growth have improved. However, it reduces the explanatory power of FDI and the East dummy. The FDI ratio becomes insignificant in the cross-section regression and the East dummy becomes insignificant in both the cross-section and panel data regressions. It is likely that export, the East dummy and FDI are correlated. The explanatory power of these three factors tends to deteriorate when they are used simultaneously. The results indicate that the importance of export to the growth and development of the country since international trade creates new job opportunities, stimulates efficiency and quality improvements, suggesting that the

Chinese provinces that have been conducting more export relative to their output are likely to have a higher income growth rate, and were thus able to approach its own steady state of income level.

Table 5.6 Conditional convergence regressions at national level, 1979-2003:
        by adding ln(s), ln($n+g+\delta$),   FDI and Export

Method	Cross section analysis	Panel data Analysis
Constant	-3.727 (-1.289)	-0.716 (-3.192)**
Ln Y_{io}	-0.635 (-4.204)**	-0.119 (-6.603)**
ln(s)	0.317 (0.836)	0.150 (4.736)**
ln ($n+g+\delta$)	-1.867 (-1.635)	-0.438 (-5.395)**
Ln(FDIR)	0.048 (0.819)	0.036 (6.938)**
Ln(ExpR)	0.375 (3.627)**	0.038 (3.691)**
Implied λ	*0.0403*	*0.0051*
Adjusted R^2	0.550	0.348
With east dummy		
Constant	-2.941 (-0.908)	-0.673 (-2.952)**
Ln Y_{0i}	-0.602 (-3.679)**	-0.116 (-6.424)**
ln(s)	0.243 (0.598)	0.151 (4.766)**
ln ($n+g+\delta$)	-1.576 (-1.247)	-0.426 (-5.194)**
Ln(FDIR)	0.037 (0.586)	0.035 (6.464)**
Ln(ExpR)	0.324 (2.361)*	0.028 (2.054)*
East dummy	0.100 (0.575)	0.023 (1.039)
Implied λ	*0.0369*	*0.0049*
Adjusted R^2	0.537	0.348

Notes: Estimated equation:

$LnY_{it} - LnY_{i0} = Cons\tan t + (1 - e^{-\lambda})LnY_{i0} + \gamma_1 Ln(s)_i + \gamma_2 Ln(n+g+\delta)_i + \gamma_3 Ln(FDI)_i + \gamma_4 Ln(Export)_i + \varepsilon_i$

t statistics in parenthesis. ** and * indicate statistical significance at 1% and 5% level   respectively. All the values are measured in 1990 prices. Yit and Yi0 are real GDP per capita in the *i*th province in 2003 and 1979 respectively in cross –section analysis. In panel data analysis, they are real GDP per capita in each ending year and beginning year of six time spans. Investment ratio *s* equal investment/ real GDP, population growth rate *n* is the annual growth rate of the year-end population. (g+δ) equal 0.05 all the time. FDIR equals real actually used FDI/ real total investment, ExpR is the ratio of real total value of export to real GDP, East dummy is that taking the value of 1 for an eastern region and 0 for otherwise.
Source: NBS (1999) *Comprehensive Statistical Data and Materials on 50 years of New China*; NBS (1985-04, various issues) *Chino Statistical Yearbook*.

Table 5.7 Conditional convergence regressions at national level, 1979-2003: by adding ln(s), ln($n+g+\delta$),   FDI, Export, Human Capital and Transportation

Method	Cross section analysis	Panel data Analysis
Constant	-4.190 (-1.309)	-0.783 (-3.393)**
Ln Y_{io}	-0.780 (-2.829)**	-0.098 (-3.867)**
ln(s)	0.380 (0.832)	0.160 (4.638)**
ln ($n+g+\delta$)	-2.034 (-1.648)	-0.438 (-5.380)**
Ln(FDIR)	0.029 (0.425)	0.034 (5.885)**
Ln(ExpR)	0.401 (3.376)**	0.036 (3.298)**
Ln(HEP)	0.091 (0.566)	-0.023 (-1.257)
Ln(Tran)	0.021 (0.259)	0.007 (0.636)
Implied λ	*0.0606*	*0.0041*

Adjusted R^2	0.518	0.347
With east dummy		
Constant	-2.732 (-0.746)	-0.740 (-3.091)**
Ln Y_{0i}	-0.804 (-2.881)**	-0.099 (-3.896)**
ln(s)	0.204 (0.404)	0.158 (4.554)**
ln ($n+g+\delta$)	-1.523 (-1.099)	-0.430 (-5.218)**
Ln(FDIR)	0.005 (0.069)	0.033 (5.767)**
Ln(ExpR)	0.337 (2.377)*	0.030 (2.115)*
Ln(HEP)	0.157 (0.872)	-0.020 (-1.036)
Ln(Tran)	0.003 (0.035)	0.005 (0.426)
East dummy	0.169 (0.838)	0.016 (0.692)
Implied λ	*0.0652*	*0.0042*
Adjusted R^2	0.511	0.345

Notes: Estimated equation: $LnY_{it} - LnY_{i0} = Cons \tan t + (1 - e^{-\lambda t})LnY_{i0} + \gamma_1 Ln(s)_i + \gamma_2 Ln(n+g+\delta)_i + \gamma_3 Ln(FDI)_i$
$+ \gamma_4 Ln(Export)_i + \gamma_5 Ln(HEP)_i + Ln(Tran)_i + \varepsilon_i$

t statistics in parenthesis. ** and * indicate statistical significance at 1% and 5% level respectively. All the values are measured in 1990 prices. Yit and Yi0 are real GDP per capita in the ith province in 2003 and 1979 respectively in cross –section analysis. In panel data analysis, they are real GDP per capita in each ending year and beginning year of six time spans. Investment ratio s equal investment/ real GDP, population growth rate n is the annual growth rate of the year-end population. (g+δ) equal 0.05 all the time. FDIR equals real actually used FDI/ real total investment, ExpR is the ratio of real total value of export to real GDP, HEP human capital is the percentage of higher education enrolment /population. Tran transportation is measured by equivalent highway mileage per 1000km2 of land area. East dummy is that taking the value of 1 for an eastern region and 0 for otherwise.

Sources: NBS (1999) *Comprehensive Statistical Data and Materials on 50 years of New China*; NBS (1985-04) *China Statistical Yearbook*.

Apart from the variables mentioned above, human capital and transportation are added to the final regression. Table 5.7 summaries the results of conditional convergence tests including all explanatory variables. Both the final additional factors are statistically insignificant and fail to improve or revise the previous findings. Human capital even has a wrong sign in the panel data regression. However, they contribute to improve the speed of convergence in the cross-sectional regression model by over 2 percentage points per year. To test whether human capital and transportation can impact on regional economic growth, an auxiliary regression is run excluding some other factors. When only human capital, the east dummy and initial income are included in the regression, strong evidence of conditional convergence is detected at the 1% level and human capital is significantly positive at the 5% level. When only transportation, investment ratio, population growth and initial income are included in the regression, there is also strong evidence of conditional convergence and all the aforementioned variables are statistically significant with correct signs. These re-estimations imply that human capital and transportation have a significant impact on regional convergence, but their influences are not as important as other factors. Their explanatory power might be partly diluted when they go with the other more important factors such as FDI and export. This

result reflects that the difference in investment, population growth rate, exports and FDI development could be the main causes of heterogeneous economic performance of the country. Only after controlling these factors, different regions are able to push their income levels towards their own steady states.

To conclude, both cross-sectional and panel data regressions have generated similar results although the latter shows more significant statistics than the former. There is no evidence of absolute convergence in the post-reform period in either analysis. After inserting an east dummy into the specification, the estimation results reveal conditional β-convergence in the cross section regression although there is no absolute convergence. The initially poorer provinces could be benefited by the reforms to grow faster than before. However, the coastal provinces might be able to continuously derive disproportionately greater benefits from the reforms after 1992 as the central government encouraged them to speed up the pace of reform and development with more open policies in terms of FDI and exports. Their speed of growth might then out-perform the others. Hence, the process of absolute convergence has not been found in the entire post-reform period.

Six additional growth determinants, including investment ratio, effective population growth rate, FDI/total investment ratio, export/GDP ratio, human capital and transportation are inserted with the purposes of estimating the contribution of these factors to the convergence process. The estimation results show that there is no evidence of conditional convergence between China's regions when just the first two factors are considered. Adding FDI ratio brings about conditional β-convergence and export ratio further improves the significance of the estimation. FDI and export also increase the significance on the first two variables (investment ratio and population growth) and make them significant with right signs in the panel data regressions. The last two variables human capital and transportation are not observed with any significance. However, they have been proved to have effects on economic growth through some sensitivity or auxiliary analyses which isolate the effects of other important factors such as FDI and export. It indicates that they may not have as much importance as factors such as FDI and export and their explanatory power may have been diluted by other factors because of multi-collinearity which is not easy to control in the regression model. This result reflects that the difference in investment, population

growth rate, export and FDI development could be the main causes of diversified economic performance of the country. Only after controlling these factors, different provinces or regions of China are able to converge their income levels towards their own steady states.

5.4.2 Estimation results of β-convergence at regional level

As discussed before, China can be divided into three macro-regions: East (coast), Central and West due to different conditions, such as geography, history, endowments and economic development. To get an in-depth study on the issue of income disparity in China, it is necessary to estimate the process of convergence within each region apart from the estimation at the national level. Besides, it is well known that among the three regions, the East region is the richest and the West is the poorest. In other words, per capita income descends from the East to the Central, and then to the West, forming a clear three-tiered geographical pattern. Yao and Zhang (2001a) claim that the regional divergence is due to the spillover from the growth centers, which are highly concentrated in the East, and declines as provinces are further away from the centers. They found that the distance from the growth centre has a significant and negative effect on regional economic growth. Based on Yao and Zhang's finding, some related questions hence come into being. Will the West narrow its income disparity with the Central and the East over time? Can the Central catch up with the East over time? And how different is the pace of catching up with the East between the West and the Central? Three groups combined with each pair regions are then re-estimated with the same models to answer these questions. Namely, three groups of economies, the East and the Central (EC), the East and the West (EW) and the Central and the West (CW) are reconsidered related to the issue of convergence or divergence.

Since the panel data analysis has generated better results than the cross-section regression in the previous section, the following analysis will only use the panel data approach.

Absolute Income convergence

Table 5.8: Basic convergence regressions in panel data analysis at regional level, 1979-2003

Region	single region data			group regions data		
	East	Central	West	EC	EW	CW
Constant	0.376**	0.319**	0.299**	0.345**	0.333**	0.310**
	(16.82)	(19.29)	(29.44)	(24.58)	(26.33)	(32.25)
Ln Y_{io}	-0.008	0.025	-0.002	0.0109	0.0147	0.0169
	(-0.398)	(1.024)	(-0.104)	(0.776)	(1.149)	(1.104)
Implied λ	0.0003	0.0003	0.0001	-0.0004	-0.0006	-0.0007
Adjusted R^2	0.012	0.001	0.021	0.003	0.003	0.002

Notes: Estimated equation: $LnY_{it} - LnY_{i0} = Cons \tan t + (1 - e^{-\lambda t})LnY_{i0} + \varepsilon_i$, t statistics in parenthesis. ** and
* indicate statistical significance at 1% and 5% level respectively. The definitions of each variable are the same to those in Table 5.6. EC=all provinces in the East and Central regions; EW = all provinces in the east and west regions; CW = all provinces in the central and west regions.
Sources: NBS (1999) *Comprehensive Statistical Data and Materials on 50 years of New China.* NBS (1985-04, various issues) *China Statistical Yearbook.*

Table 5.8 shows the estimation results of absolute convergence for the three regional groups. No clear evidence of absolute income convergence can be found in any of the regions and groups for the entire period 1979-2003. It means that the richer provinces in each region and the richer region in each group could manage to sustain their higher pace of economic growth and keep out-performing their counterpart economies. In other words, the income of the poor economies in each region or group fails to catch up with the rich ones. In all the regressions, the R^2 values are very small, showing little goodness-of-fit in the fitted models. This finding is consistent with the results presented in the previous section using national level data.

Conditional income convergence

Like the conditional convergence analyses for the whole country, four steps of regressions are also conducted here to see the different effects of explanatory variables on the convergence process. In the first model by only adding investment ratio and effective population growth rate, as reported in columns 2-4 of Table 5.9, the results are arresting. Unlike the results for the whole country in Table 5.4, these two factors appeared to be statistically significant with correct signs in all the three regions and have contributed to conditional income convergence in each region. Compared with Table 5.8, the adjusted R^2 values increase remarkably. These results imply that given a similar background in the region, more investment induces higher growth while a higher population growth prohibits growth. The speed of convergence shows remarkable

improvement, rising to 0.32%, 0.33% and 0.24% in the East, Central and West respectively. The East and Central have similar values and the West has the smallest rate of convergence. It indicates that the provinces in the West will take a longer time to reach their own steady state.

Table 5.9 Conditional convergence regressions in panel data analysis at regional level, 1979-2003: by adding ln(s) and ln ($n+g+\delta$)

	single region data			group regions data		
Region	East	Central	West	EC	EW	CW
Constant	-0.145	-1.284	**-0.760***	-0.218	-0.482	**-1.17****
	(-0.433)	(-1.976)	**(-2.042)**	(-0.804)	(-1.754)	**(-3.450)**
Ln Y_{io}	**-0.076****	**-0.078***	**-0.059***	**-0.048***	-0.0007	**-0.048***
	(-2.878)	**(-2.064)**	**(-2.148)**	**(-2.498)**	(-0.044)	**(-2.271)**
ln(s)	**0.231****	**0.158***	**0.111***	**0.194****	0.041	**0.087***
	(3.231)	**(2.261)**	**(2.294)**	**(3.729)**	(0.995)	**(2.424)**
ln ($n+g+\delta$)	**-0.310***	**-0.659****	**-0.432****	**-0.304****	**-0.315****	**-0.576****
	(-2.617)	**(-2.800)**	**(-3.126)**	**(-3.127)**	**(-3.145)**	**(-4.502)**
Implied λ	*0.0032*	*0.0033*	*0.0024*	*0.0020*	*0.0000*	*0.0020*
Adjusted R²	0.154	0.158	0.167	0.132	0.068	0.161

Notes: Estimated   equation: $LnY_{it} - LnY_{i0} = Cons\tan t + (1-e^{-\lambda t})LnY_{i0} + \gamma_1 Ln(s)_t + \gamma_2 Ln(n+g+\delta)_t + \varepsilon_t$ t statistics in parenthesis. ** and * indicate statistical significance at 1% and 5% level   respectively. The definitions of each variable are the same to those in Table 5.8. EC=all provinces in the East and Central regions; EW = all provinces in the east and west regions; CW = all provinces in the central and west regions

Sources: NBS (1999) *Comprehensive Statistical Data and Materials on 50 years of New China.* NBS (1985-04) *China Statistical Yearbook.*

The results of regional group analysis are exhibited in columns 5-7 in Table 5.9. The effective population growth rate is statistically significant for all groups and the investment ratio is significant for the east-central and central-west groups but not east-west. Correspondingly, conditional convergence is detected within these two groups. It implies investment only can contribute on the provinces within the two groups of West-Central and Central-East to converge to their own steady states. Investment is found to be able to enhance the speed of achieving the steady states for the western provinces, but it fails to accelerate the convergence to the steady state of the group of east-west. Furthermore, like the left panel, the implied λ and the adjusted R² have higher values. In short, the Chinese regions which have received relatively more investment with lower effective population growth rate have achieved higher income growth and will be able to shorten the time to reach their own steady states. In the east-west group, these two factors did not seem to help the provinces converge to the

group's steady state. It might be probably explained by some other factors such as skill, knowledge, production experience, etc. that can affect economic performance. Without any improvement in these areas, the poorer provinces could still fail to exercise their full potential to grow at a higher speed.

Table 5.10 Conditional convergence regressions in panel data analysis at regional level, 1979-2003: by adding ln(s), ln($n+g+\delta$) and FDI

	Single region data			Group regions data		
Region	East	Central	West	EC	EW	CW
Constant	-0.271	-1.503**	-0.346	-0.285	-0.311	-0.718*
	(-0.869)	(-3.255)	(-0.786)	(-1.215)	(-1.262)	(-2.178)
Ln Y_{io}	-0.107**	-0.274**	-0.080*	-0.124**	-0.065**	-0.096**
	(-4.117)	(-7.119)	(2.689)	(-6.127)	(-3.579)	(-4.284)
ln(s)	0.162*	0.261**	0.138**	0.176**	0.081*	0.125**
	(2.346)	(5.060)	(2.757)	(3.923)	(2.158)	(3.648)
ln ($n+g+\delta$)	-0.321**	-0.822**	-0.300	-0.330**	-0.279**	-0.442**
	(-2.922)	(-4.879)	(-1.908)	(-3.933)	(-3.121)	(-3.625)
Ln(FDIR)	0.034**	0.067**	0.016	0.043**	0.036**	0.030**
	(3.529)	(7.106)	(1.674)	(6.556)	(5.574)	(4.292)
Implied λ	*0.0045*	*0.0128*	*0.0033*	*0.0053*	*0.0027*	*0.0041*
Adjusted R^2	0.276	0.577	0.200	0.354	0.260	0.287

Notes: Estimated equation: $LnY_{it} - LnY_{io} = Cons \tan t + (1 - e^{-\lambda t})LnY_{io} + \gamma_1 Ln(s)_t + \gamma_2 Ln(n+g+\delta)_t + \gamma_3 Ln(FDI)_t + \varepsilon_t$. t statistics in parenthesis. ** and * indicate statistical significance at 1% and 5% level respectively. The definitions of each variable are the same to those in Table 5.9. EC= all provinces in the East and Central regions; EW = all provinces in the east and west regions; CW = all provinces in the central and west regions.
Sources: NBS (1999) *Comprehensive Statistical Data and Materials on 50 years of New China.* NBS (1985-4) *China Statistical Yearbook.*

The FDI ratio is then added to the second regression of conditional convergence analyses for regions and groups. As indicated in the left half of Table 5.10, like the first regression, conditional income convergence is observed for all the regions. The FDI ratio is statistically significant for the east and central regions and has contributed to improve not only the estimated coefficient but the level of significance of the initial income as well as those of the previous two explanatory variables in all regions particularly in the Central. Furthermore, similar to Table 5.9, the investment ratio is statistically significant with correct sign for all the regions. However, like FDI ratio, the effective population growth rate is only significant for the east and the central. The results indicate that the higher stock of investment (including FDI) and lower effective population growth rate can urge both east and central region to reach their steady states. However, FDI and population growth did not show significant impact on the process of

conditional convergence in the west region. However, like the east and the central regions, the speed of income convergence and the adjusted R^2 for the west has also experienced a significant growth when FDI is inserted into the estimation. Noticeably, the central region is found to be the biggest beneficiary with biggest improvement on the speed of convergence and R^2, sharply from 0.33% to 1.28% and 0.158 to 0.577 respectively. This can explain why the central region is found to have the most equal income levels among its provinces from the estimation of σ-convergence. This can be probably explained by the reform policies which are rather selective even for the east provinces and therefore, different coastal provinces could have different growth patterns and it would take a relatively longer period of time before they can achieve their own steady states.

Similar regressions are applied to the three regional groups, with results reported in the right half of Table 5.10. In general, the additional explanatory variable FDI ratio has greatly improved the estimation significance compared with Table 5.9. It is found statistically significant for all groups and has contributed to further bring about conditional income convergence for the east-west group which was not found in the previous regression. Besides, FDI has improved the explanatory power of investment for the east-west group. Furthermore, comparing with previous results, both speed of convergence and adjusted R^2 measured in Table 5.10 have experienced remarkable increases. Take the east-west group for an example, the pace of convergence rise from zero to 0.27%, and the adjusted R^2 from 0.068 to 0.260. This finding indicates that FDI has accelerated the process of conditional convergence between each pair of regions and improve the explanation power of the regression model; in particular, it is a powerful engine for the group of east-west to achieve its conditional convergence. Similar to the study at the national and regional level above, the importance of FDI to growth and development is confirmed at the group level. It indicates that FDI is a key determinant of regional growth differences and its effect is particularly strong among the provinces in the Central region. This effect is insignificant among the West provinces, implying that there is little difference of growth that can be explained by FDI in western China.

With the help of the export ratio in the third regression, the issue of conditional convergence between the regions and groups is examined by panel data analyses and the results are shown in Table 5.11. In general, the findings are rather similar to those in

Table 5.10, and conditional income convergence is found in all the regions and groups. At the regional level, the additional new factor export ratio does not have any significance, but it has contributed to improve the explanatory power of population growth in the west region which is not significant in Table 5.10. Besides, it has improved both the speed of convergence and the adjusted R^2 for the east and the west regions. As mentioned earlier in the above section using national level data, the explanatory power of export ratio is diluted somewhat by FDI when they are estimated together, however, it is still found to have impact on growth, even stronger in the West region. To find out if this phenomenon happens at the regional level, the model is re-estimated by omitting FDI from the model. In this scenario, export is found to be statistically significant only in the west region. It indicates that export can explain more difference of growth in the west than in the rest two regions

At the group level, as reported in the right part of Table 5.11, the expanded model has displayed a higher degree of significance for initial income which is statistically significant for all three groups. Dissimilar to the regional analyses, export is significant in the two groups of east-central and east-west. It implies that export can be one of factors explaining the growth difference of the coastal and inland areas. Moreover, it has contributed to better explanatory power of investment and population growth for all groups since their t values have improved. However, the significance of FDI is reduced somewhat although it is still statistically significant in all estimations. Like the analysis at the regional level, the regression model is re-estimated without FDI. This leads to a more significant effect of export in all three groups although it is still insignificant for the central-west group. This finding is consistent with those at the national level. It indicates that export and FDI may be co-related in the regression models. Furthermore, in the contrast model, the adjusted R^2 has shrunk by 40-50% for three groups and the pace of convergence slow down by 66% for the east-central, 46% for the central-west group. This finding reveals that export and FDI are both important in speeding up the process of conditional convergence even in the central-west group. This confirms that export might not be the factor of explaining the income difference between the central and the west regions.

Table 5.11 Conditional convergence regressions in panel data analysis at regional level, 1979-2003: by adding ln(s), ln($n+g+\delta$),   FDI and Export

Region	Single region data			Group regions data		
	East	Central	West	EC	EW	CW
Constant	-0.541	-1.512**	-1.001	-0.574*	-0.677**	-0.994*
	(-1.533)	(-3.044)	(-1.804)	(-2.189)	(-2.690)	(-2.568)
Ln Y_{io}	-0.126**	-0.275**	-0.116**	-0.142**	-0.117**	-0.114**
	(-4.430)	(-6.853)	(-3.330)	(-6.643)	(-5.365)	(-4.390)
ln(s)	0.180*	0.262**	0.168**	0.195**	0.160**	0.140**
	(2.596)	(4.883)	(3.267)	(4.336)	(3.915)	(3.901)
ln ($n+g+\delta$)	-0.397**	-0.824**	-0.528*	-0.425**	-0.416**	-0.537**
	(-3.337)	(-4.603)	(-2.692)	(-4.609)	(-4.538)	(-3.822)
Ln(FDIR)	0.036**	0.067**	0.011	0.041**	0.034**	0.030**
	(3.698)	(7.030)	(1.130)	(6.328)	(5.406)	(4.279)
Ln(ExpR)	0.034	0.001	0.044	0.027*	0.051**	0.025
	(1.569)	(0.051)	(1.856)	(2.302)	(3.865)	(1.345)
Implied λ	*0.0054*	*0.0129*	*0.0049*	0.0061	0.0050	0.0048
Adjusted R^2	0.292	0.568	0.243	0.376	0.340	0.293

Notes: Estimated equation:

$LnY_{it} - LnY_{io} = Constant + (1 - e^{-\lambda})LnY_{io} + \gamma_1 Ln(s)_i + \gamma_2 Ln(n + g + \delta)_i + \gamma_3 Ln(FDI)_i + \gamma_4 Ln(Export)_i + \varepsilon_i$

t statistics in parenthesis. ** and * indicate statistical significance at 1% and 5% level respectively. The definitions of each variable are the same to those in Table 5.10. EC= all provinces in the East and Central regions; EW = all provinces in the east and west regions; CW = all provinces in the central and west regions.

Sources: 1.NBS (1999), *Comprehensive Statistical Data and Materials on 50 years of New China.*
2. NBS (1985-2004), *China Statistical Yearbook.*

In the final regression, we include all explanatory variables by adding another two factors human capital and transportation. As presented in Table 5.12, these two new factors, like the results using national data, are not significant in any region or group. However, compared with the regression without these two variables, they have contributed to improve the explanatory power of export in the West region. Furthermore, they also help the Central and West regions to speed up the process of convergence from 1.29% to 1.51% and 0.49% to 0.56% respectively. This result indicates that better human capital and transportation are necessary factors of growth and like what other factors do they have more influence on the process of catching-up for the Central region although they are not as powerful as other explanatory variables. This finding is consistent with those found in the national analyses. The models are re-estimated without some other factors and transportation is observed to be significant in some regions and groups but human capital is always insignificant. The different contributions to the catching-up process of six variables reveal that China's economic growth in the past has been greatly dependent on intensive material inputs and capital investments. Human capital and technology have played a relatively minor role. This

implies that human capital has not been fully exploited in the production process, or the distribution of human capital across regions may not be as uneven as that of other variables, especially FDI and exports.

Table 5.12 Conditional convergence regressions in panel data analysis at regional level, 1979-2003: by adding ln(s), ln($n+g+\delta$),   FDI, Export, Human Capital and Transportation

	Single region data			Group regional data		
Region	East	Central	West	EC	EW	CW
Constant	-1.348*	-1.183*	-1.065	-0.740*	-0.728**	-1.046*
	(-2.404)	(-2.053)	(-1.869)	(-2.482)	(-2.859)	(-2.439)
Ln Y_{io}	-0.098*	-0.315**	-0.130**	-0.130**	-0.087**	-0.112**
	(-2.295)	(-5.743)	(-3.502)	(3.868)	(-3.007)	(-3.594)
ln(s)	0.173*	0.246**	0.164**	0.203**	0.168**	0.134**
	(2.525)	(4.221)	(2.948)	(4.448)	(3.856)	(3.322)
ln ($n+g+\delta$)	-0.427**	-0.763**	-0.579**	-0.434**	-0.409**	-0.561**
	(-3.571)	(-4.017)	(-2.875)	(-4.667)	(-4.459)	(-3.727)
Ln(FDIR)	0.032**	0.072**	0.017	0.038**	0.031**	0.031**
	(3.223)	(6.830)	(1.612)	(5.390)	(4.488)	(4.209)
Ln(ExpR)	0.027	-0.007	0.053*	0.023*	0.050** ·	0.027
	(1.229)	(-0.310)	(2.127)	(1.801)	(3.568)	(1.408)
Ln(HEP)	-0.062	0.044	0.001	-0.018	-0.032	-0.005
	(-1.833)	(1.065)	(0.044)	(-0.759)	(-1.565)	(-0.190)
Ln(Tran)	0.103	-0.015	-0.018	0.022	0.003	-0.007
	(1.756)	(-0.750)	(-1.510)	(1.092)	(0.212)	(-0.583)
Implied λ	*0.0041*	*0.0151*	*0.0056*	*0.0056*	*0.0037*	*0.0048*
Adjusted R^2	0.315	0.563	0.248	0.373	0.343	0.281

Notes: Estimated equation: $LnY_{it} - LnY_{i0} = Cons\tan t + (1 - e^{-\lambda t})LnY_{i0} + \gamma_1 Ln(s)_i + \gamma_2 Ln(n+g+\delta)_i + \gamma_3 Ln(FDI)_i$
$+ \gamma_4 Ln(Export)_i + \gamma_5 Ln(HEP)_i + Ln(Tran)_i + \varepsilon_i$

t statistics in parenthesis. ** and * indicate statistical significance at 1% and 5% level respectively. The definitions of each variable are the same to those in Table 5.10. EC= all provinces in the East and Central regions; EW = all provinces in the east and west regions; CW = all provinces in the central and west regions.
Sources: NBS (1999) *Comprehensive Statistical Data and Materials on 50 years of New China.* NBS (1985-4)   *China Statistical Yearbook.*

To summarize, the issue of β-convergence is estimated by panel data approach at both region and regional group level for the period 1979-2003 in this section.   Similar to the results at the national level, there is no evidence of absolute β-convergence in all regions and groups. This confirms that rich provinces in China have been keeping their faster growth and out-performed the poor ones after economic reform.   Four conditional β-convergences are also employed step by step to examine the different role of explanatory variables playing on the process of convergence. Dissimilar to the findings at the national level, more investment and less population growth are found to

have contributed to conditional convergence within all the regions and groups except for the east-west group. Given FDI in the regression, the estimated results have noticeable improvements. The central region is found to be the biggest beneficiary with biggest improvement on the speed of convergence and R^2. And this can explain why the central region is found to have the most equal income levels among its provinces from the estimation of σ-convergence. Furthermore, FDI has contributed to accelerate every pair of difference income level regions to contract to the group's steady states, including biggest different level of the east-west group although the effect of FDI on growth is relatively weaker in the west. Similar to the national estimation, the explanatory power of export ratio is diluted somewhat by FDI when they are estimated together, however, it is still found to have impact on growth, even stronger in the west region. These findings contrast sharply with Fu (2004) who claim that FDI and export played an important role in increasing regional disparities in China. As for the last two variables, human capital and transportation, the latter plays slight role in the process of conditional convergence, this is consistent with the findings of Yao and Wei (2007), however, human capital does not have a significant effect on narrowing income disparity. The different contributions to the catching-up process of six variables reveal that China's economic growth in the past has been greatly dependent on intensive material inputs and capital investments. Human capital and technology have played a relatively minor role. This implies that human capital has not been fully exploited in the production process.

5. 5 Chapter summary

Compared with previous studies, this chapter makes some new contributions to the understanding of the impact of FDI on regional growth and inequality in China after economic reform. It uses a more recent dataset for all the Chinese regions during 1979-2003. It employs both cross-sectional and panel data approaches to study the same question. It examines regional inequality from three different perspectives: inter-province, intra-region and inter-group (each pair of two regions). It employs more determinants of income growth such as FDI and transportation into the β-convergence estimation, with special attention on FDI and its role in the economic convergence process across the country and within each geo-economic region as well as regional

groups. The purpose of examining the same issue of FDI on spatial growth differences and income inequality with various model specifications and estimations is to provide a comprehensive anatomy on whether FDI has caused regional income inequality, which is a controversial issue in the literature with significant policy implications on economic growth and development of China and any other similar less developed economy in the world.

Apart from β-convergence, σ-convergence with the coefficient of variation (CV) is used to assess whether there is σ-convergence between China's regions. The results show that the country has experienced three phases of the process of income inequality over 1979-2003, declining in the first decade, expanding in the second and then started to decline again from the third decade. However, this slight decline in CV may not be statistically significant as CV is a non-parametric approach which is not subject to statistical testing. Furthermore, a declining CV does not necessarily imply economic convergence if a reduced CV is not caused by the poorest regions catching up with the richest regions, but by the catching up of the medium income regions with high income regions, or by the convergence among the medium income regions. As a result, CV is not an ideal measurement for income convergence for all regions within a country although it can be used to indicate the trend of overall inequality. The last disadvantage of CV is that it cannot show why regions are converging or diverging in per capita incomes.

In contrast, β-convergence is a more useful tool to measure income convergence as it can testify whether poor regions are catching up with rich ones. It can also explain why regions are converging or diverging in per capita incomes. In this chapter, the β-convergence test indicates no evidence of absolute convergence in different estimations with both the cross-sectional and pooled analyses. This implies that the initially poorer regions have failed to grow faster than the initially richer ones due to their diversified economic backgrounds and the biased policies faced by these economies. It implies that neither the poor provinces nor poor regions have managed to grow faster than their rich counterparts. As a result, it can be concluded that regional inequality rises rather than declines during the data period.

But what have explained the rising inequality? This question can be answered through the analysis on conditional convergence. The analysis in this chapter provides some salient findings on income inequality. First of all, apart from investment ratio and effective population growth rate, FDI and export are found to have significant and positive effects on regional growth differences. In addition, the effect of FDI on economic growth is weak among the western provinces. These two findings could easily lead to a conclusion that FDI is an important cause of regional inequality, especially if one considers that the skewed distribution of FDI among the three large geo-economic regions in China is coincided with a similar spatial pattern of real per capita GDP. If such a conclusion were the correct interpretation of the results and logical as many previous studies have argued and suggested, then reducing FDI inflows into China would be able to restrain the rising trend of regional income inequality. Such a policy implication would also make it difficult to reconcile the positive effect of FDI on economic growth and its 'negative' effect on income distribution. As such a conclusion and its potential policy implications are obviously controversial, it needs a better understanding and a more accurate interpretation on the econometric results which show a positive and significant relationship between FDI and economic growth in all kinds of model specifications presented in this chapter.

If we summarize the results presented in this chapter, we have the following findings: (1) regional income inequality rises in the data period; (2) regions can converge to their own steady states only after controlling for the differences in saving rate, population growth, human capital endowment, transportation, and above all FDI and exports; (3) the same factors that have a significant effect with national level data have similar effect with regional (or groups of regions) level data; (4) FDI is singled out to have played a consistent and positive effect on growth differences in all specifications except for the West region and the combined West/Central regions; and (5) FDI is highly unevenly distributed among the regions, with a very small share in the West region. All these findings should point to the following conclusion which is very different from that drawn by many other authors: FDI is an important factor of economic growth but it is unevenly distributed across regions, as a result, it is the uneven distribution of FDI, rather than FDI itself, that has been a cause of regional income inequality. This conclusion should be followed with the following policy implication: to reduce regional inequality, FDI should be encouraged, rather than discouraged, but FDI has to be

directed towards to the West and Central regions through preferential policies and government intervention to create a better environment for absorbing FDI in these relatively backward areas.

Chapter 6 Determinants of Foreign Direct Investment in China's Regions

Abstract

FDI inflow in China has dramatically increased due to the economic reform and open door policy. However, compared to the 'average' of host countries, especially the developed countries, China still appears to host 'too little' FDI, especially in the west region. With policy regimes becoming increasingly open and similar, many countries feel more competitions and challenges to attract FDI. This chapter timely tests a set of locational factors of FDI in China. It differs from previous studies by considering the changes of importance of FDI determinants through time and across regions, aiming to find out and then exert the particular advantages of inland area to successfully attract FDI. Using the largest dataset over the post-reform period and employing an augmented Cobb-Douglas production function with long-run static and short-run dynamic models with ECM, this chapter estimate the determinants of FDI into China for the full data period 1979-2003. Besides, the same models are re-estimated on two sub-periods 1979-1991 and 1992-2003 and also on each separate region. Almost all the determinant factors are found to have changed in their importance to affect FDI inflows in China through time and cross regions, which provides helpful knowledge and information for China's FDI policy, especially the policy in the inland region.

6.1 Introduction

In the previous two chapters, it was concluded that FDI has played a positive role in economic growth for China and its uneven share across regions was responsible for rising income disparity between China's regions. FDI has so far played a minor role in economic growth in the West due to the low level of inflows. This implies that further economic development of inland regions depends on a large extent on continuous FDI and policy-making that should facilitate inward investment to the non-coastal area. As a result, with the help of FDI, the poorer region's economy will grow faster and then might be able to narrow the income distance from the richer ones.

Since China adopted the reform and opening-up policy in the late 1970s, FDI inflows to China has increased dramatically, especially after Deng Xiaoping's tour to the south in 1992. The accumulative value of FDI in China was only £4.1 billion in 1984, and then jumped to £691.9 billion in 2006. China became the second largest host of FDI in the world since 1994. In 2003, it surpassed the USA and became the most popular destination with $53.51 billion of its actually used FDI. This figure continued to rise to $60.63 billion in 2004, slightly reduced to $60.32 billion in 2005 and then increased again to $69.47 billion in 2006. In China, 28% of industrial added value, 20% of taxation, 57% of total exports, 11% of local employment are contributed by MNEs (Yunshi and Jing, 2005). Despite the rising inflows of FDI into China, the share of China's total FDI as a proportion of the world's total declined from 9.59% in 2003, to 8.53% in 2004, 6.58% in 2005 and 6% in 2006. Furthermore, despite the large amount of FDI China has received in recent years, the country still appears to host too little FDI compared to an 'average' host country, especially the developed countries. For example, in 2006, the total FDI inflow was $800 billion in the developed countries and $177.3 billion in the USA alone. Besides, China's per capita FDI inflow is only $53, less than one third of the world's average, and one twelfth of the developed countries. Meanwhile, FDI in China is rather unevenly distributed, being highly concentrated in the east coastal region. In 2006, the actually used FDI in the east, central and west regions was $56.92 billion, $3.92 billion and $2.18 billion and their shares to the country was 90.32%, 6.22% and 3.91% respectively[25]. The above figures suggest that FDI inflow in China still needs to be largely enhanced, especially in the west and central regions.

Not surprisingly, an increasing attention has been paid on the likely determinants of FDI in China. Using the data period 1978–92, Wang and Swain (1995) find that GDP, GDP growth, wages, and trade barriers have a positive relationship, while interest rate and exchange rate have a negative linkage to FDI in China's manufacturing sector. Heid and Ries (1996) study 931 joint ventures in 54 cities during 1984-91 excluding investments by overseas Chinese (Hong Kong, Macau, Singapore), They find that the foreign investors are more lured to the cities with good infrastructure, established industrial base and foreign investment presence. More recently, Coughin and Segev (2000) test

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[25] The Data before 2006 is taken from *China's Statistical Year book 2006.* Data in 2006 is from http://news.xinhuanet.com/house/2007-03/27/content_5900091.htm

the 29 provinces in the period 1990-1997, and argue that economic size, labour productivity and coastal location attract FDI, while higher wages and illiteracy rates deter it. Originally, Sun et al. (2002) find that the cumulative FDI relative to cumulative domestic investment has a negative impact on new FDI, and MNCs may consider investing in provinces not yet flooded with FDI. Using primary data with responses from 22 foreign firms operating in China, Ali and Guo (2005) find that China's huge potential market size, large population, fast growth, membership of the WTO, government incentive policies, labour costs, and high investment return are all significant factors for FDI inflow in China. Moreover, they find that global integration is one of the key factors for some foreign firms investing in China. This indicates that China is a very important market and investing in China is part of MNCs' global strategy.

The related previous studies provide comprehensive contributions on the determinants of FDI in China by using secondary or primary data, provincial or city level data, source country or industry data. China's preferential foreign investment policies, cheap labour, increasing purchasing power and improving investment environment, especially after entry into the WTO in 2001, have made the country a favourite destination for global investment (Yunshi and Jing, 2005). However, do the likely determinants of FDI in China vary amongst regions? Moreover, being a member of the WTO suggests that trade will play a more important role in the country's economic development. So under this new international environment do MNCs go to China to still exploit some conventional advantages such as low labour costs, or do they have other motives to meet challenges of the new international competition? These two questions are rarely examined in the literature. This chapter thus attempts to enrich the literature by estimating changes in the importance of FDI determinants through time and across China's regions.

Accordingly, this chapter extends previous research in the following dimensions. Firstly, it uses more recent panel data over 1979-2003. It combines long-run static models and short-run dynamic models with ECM (error-correction mechanism), as well as subsequently comparing the results from the two methods. Moreover, apart from the estimation on the full sample period 1979-2003, two sub-sample periods 1979-1991 and

1992-2003 will be split and re-estimated to see if FDI determinants change through time[26]. Finally, it estimates the models on both national and regional data in order to see if three regions have different attributes attracting FDI.

The next section briefly reviews the previous studies on the determinants of FDI. It is followed by a discussion of the data and empirical methodology in section 6.3. The interpretation of empirical results is reported in section 6.4, and section 6.5 discusses their importance for FDI policy and future research with concluding remarks.

6.2 Previous studies on the determinants of FDI in China

Many specific advantages in China are believed to be particularly significant as being the determinants of FDI. The previous studies classify the determinants of FDI inflows to China into three categories: Micro-, Macro, and strategic determinants (Swain and Wang, 1997; Zhang 2002; Razin, 2002). Micro determinants focus on specific advantages of the firms such as ownership, product superiority, cost advantages, economies of scale, multi-plant economics, advanced technologies, marketing and production distribution. Macro-factors consider the market size, growth, taxes, infrastructure quality, political stability, exchange rates and regulatory restrictions in the host country, and so on. And those long-term factors such as the defense of existing foreign markets, production diversification, the gaining or maintaining of a foothold in the host country, complementary investment, are included as strategic determinants.

The major determinants of FDI in the previous studies are briefly reviewed as follows.

Market demand and market size
Kravis and Lipsey (1982) and many other empirical studies find such positive relationship. Blomström and Lipsey (1991) show a significant size threshold effect for firms' decision to invest abroad. Lankes and Venables (1996), Genco et al. (1993) and EBRD (1994) suggest that most firms invest in Central and Eastern Europe to find new

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[26] Sun et al. (2002) firstly split their full sample 1986-1998 into two sub-samples 1986-1991 and 1992-1998. This research attempts to re-estimate their hypothesis using longer and newer data.

market opportunities for their products, regardless of the type of business. China is a vast country endowed with rich natural resources, and there is a great potential for developing China's market. The larger the market size of a particular province is, other things being constant, the more FDI the province should attract. The well-known product cycle theory declares that market-share extension is the critical strategy utilized by mature multinational corporations (Dunning, 1981, p. 47; 1988, pp. 71-2). To increase market share, foreign investors may take advantage of regional gaps in demand and supply. GDP (or GDP per capita) and its growth rate as well as population are often used as proxies for the size and growth of market demand. Plaut and Pluta (1983) use the ratio of two regional gravity measures as market variable, namely, the ratio of provincial personal income to the labour force employed by industry sector according to its geographical region. Whatever measures taken to represent market size, they are all tested to have a positive impact on the inflow of FDI, which has been confirmed by many scholars (Kim & Lyn, 1988, Yu & Ito 1988, Coughin, 1991, Chen, 1996, Wei, Liu, Parker and Vaidya, 1998, Fung, Izaka, Lee and Parker, 2000, Coughlin and Segev, 2000, Ali and Guo, 2005).

Labour cost

To maximize capital return, foreign investors usually aim at taking advantage of host country's cheaper factor inputs (relative to their home countries or other host countries). Labour cost is often considered an important factor, especially in labour intensive manufacturing. Indeed, Mainland China offers low-cost labour in comparison with other Asian countries. The average annual wage of staff and worker by industry is usually considered as a labour cost variable. However, such a measure is not without problems. Workers in the SOEs are typically provided with housing benefits and health care whereas workers in the private sector get 'pure' salaries with cash bonuses, which may not be reported for tax purposes. That weakens the ability of the variable to capture the true labour cost. On the other hand, in recent years of fast economic development, China attracts foreign investment not purely through cheap labour (Sun at al., 2002). Most Empirical results find that low wages in the host country encourages FDI (Schneider and Frey, 1985; Culem, 1988; Moore, 1993; Love and Lage-Hidalgo, 2000; Coughlin and Segev, 2000; Ali and Guo, 2005). However, Caves (1974), Kravis and Lipsey (1982), Coughlin (1991), Chen (1996) and Fung, Izaka, Lee and Parker (2000) show no evidence that low wages, associated with low per capita real income, were the

main attraction for FDI. Sun et al. (2002) find that wages has a positive relationship with FDI before 1991 but has a negative relationship after then. Branstetter and Feenstra (1999) point out those MNEs in China tend to pay a wage premium to their workers. This may be because MNEs want to hire quality workers. Higher wages may well reflect higher labour quality. Hence, it is conceivable that wages in those provinces that can attract relatively more FDIs can be higher, too.

International trade

The level of international trade is often used as an important indicator of a country's degree of openness. More trade implies a higher level of integration between the home and host countries. Frequent trading enables business partners to know more about economic, cultural, political, and social situations in each other's regions, and facilitate quick flows of information on investment opportunities. Many studies find that they are complementary and are positively correlated, namely, the higher the international trade (export and imports), the higher will be inward FDI in the host country (Ajami and BarNiv, 1984; Ray, 1989; Grosse and Trevino, 1996; Chen, 1999; Dees, 1998; Yao, 2006). However, some cross-country studies indicate that international trade and FDI are substitutes and negatively related (Horst, 1972; Jeon, 1992) because for an individual host country firm, export and FDI are the two alternative entry modes. If other things remain the same, then the higher the international transportation costs and tariff/non-tariff trade barriers, the more the firm will undertake FDI in the host country. If tariff/non-tariff trade barriers are low or absent, and if there are no other cost advantages in the host country, the home country firm may export its product. This export represents an equal amount of imports to the host. Thus, for an individual firm, trade and FDI are substitutes. Hence, the exact relationship between the two is an empirical question. We use the ratio of total export over GDP of a province to measure its degree of openness.

Infrastructure

Infrastructure covers many aspects, including highways, railways, inland waterways, airports, seaports, telecommunications, or even institutional development. A positive relationship between infrastructure and FDI is to be expected since the economy with good infrastructural investment seems to be more attractive to foreign investors. Empirical support for the importance of infrastructure in FDI location decisions is

proved by a large number of researchers. Fung, Lizaka, Lee & Parker (2000) indicate that because foreign firms might be unfamiliar with the environment of host country, better-developed transportation infrastructures are beneficial to host country to attract FDI. In addition, Coughlin (1991) and Chen (1996) identify that more foreign direct investment would be attracted by more developed transportation infrastructures. Similar results are also found   Gong (1995), and Broadman and Sun (1997). However, Peck (1996) argues that although the presence of certain basic infrastructure may be significant in attracting the initial interest of potential new investors, some infrastructure is designed for the specific demands made by new investors. Success in winning inward investment depends increasingly upon the degree to which they can exercise control over its present and future development. Coughlin and Segev (2000) suggest that transportation do not yield statistical significance in attracting FDI. In China, railroads remain the most efficient mode of transportation for moving raw materials and most heavy-industry products over long distances (Sun, 1988, pp. 311-68). Consequently, railroad mileage is frequently used as a proxy for transportation capability in the literature. In this chapter, we use the equivalent mileages of railways, highways and waterways per 1000 squared kilometres to measure transportation.

Human capital

This variable measures the relative endowment of skilled labour in each province and should have a positive impact on FDI. High labour quality not only raises output but also enables firms to operate production with advanced technology. Human capital is most easily measured by education levels and it would be expected to have a positive relationship with FDI inflows.[27] It is commonly measured by the percentage of population (or employee) who have received the secondary or above education. We use the number of students enrolled in higher education over population as a rough proxy for the level of human capital ant expect it to have a positive impact on the inflow of FDI. Chen (1996), Fung, Iizaka and Siu (2002) indicated that there is a strong evidence of a positive effect of labour quality for both Japan and Hong Kong. Broadman and Sun (1997) and Coughlin and Segev (2000) found that illiteracy has a negative and significant effect on FDI.

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[27] R&D expenditures and the number of patents are also measured by human capital in the literature , the higher level of scientific research should promote FDI in a province (Sun et al., 2002).

Agglomeration

Agglomeration refers to the concentration and co-location of economic activities that give rise to the economies of scale and positive externalities. It is thought to be an external factor to attract FDI. 'Pecuniary' externalities associated with demand and supply linkages, such as the possibility to use joint networks of suppliers and distributors were emphasised by the 'new' location theory suggested by Krugman (1991) and Venables (1993).It is also argued that knowledge-enhancing activities can only partly be appropriated by firms, implying that an externality is created and diffused to other firms, thereby reducing their costs (Romer, 1986; Sala-1-Martin, 1990; Griliches, 1979). If knowledge spill-overs and pecuniary externalities gain in importance for firm competitiveness, they seem to suggest that agglomeration forces will increasingly influence firms' location decisions. Thus, agglomeration is expected to be positively related with inward FDI. Wheeler and Mody (1992), Gong (1995), Braunerhjelm and Sevenson (1996), Heid and Ries (1996) confirm the positive relationship. Urbanization in general motivates foreign investment since more urbanized areas can provide corporate infrastructure, a larger pool of skilled labour, and a potentially larger market. Population density is a good index of urbanization, so it is used as a proxy of agglomeration.

Exchange rate

The effect of exchange rates on FDI has been examined both with respect to changes in the bilateral level of the exchange rate between countries and in the volatility of exchange rates. Until Froot and Stein (1991), the common wisdom was that (expected) changes in the *level of exchange rate* would not alter the decision by a firm to invest in a foreign country. In rough terms, while an appreciation of a firm's home country currency would lower the cost of assets abroad, the (expected) nominal return goes down as well in the home currency, leaving the rate of return identical.[28] Froot and Stein (1991) discuss the relative wealth effect of exchange rates. A rise in the exchange rate in terms of the host country currency over the home country currency implies a depreciation of the host country currency. A real depreciation of the host country currency favours home country purchasers of host country assets and therefore leads to an increase in inward FDI. Cushman (1985, 1988) and Culem (1988) emphasize the

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[28] McCulloch (1989, p.188) provides a simple sketch of this argument.

effect of exchange rate changes on relative labour costs. A real depreciation of the host country currency allows home country investors to hire more labour for a given amount of the home country currency, and therefore is associated with an increase in inward FDI. Klein and Rosengren (1994) support the significance of the relative wealth effect and fail to support the relative labour cost effect. Love and Lage-Hidalgo(2000) assert that exchange rate movements can affect FDI influencing the home currency cost of acquiring an asset abroad through testing the determinants of US direct investment in Mexico. Their results show that a depreciation of the peso (appreciation of the dollar) tends to encourage US direct investment in Mexico. Fung, Izaka, Lee and Parker (2000), Keer and Peter (2001) have similar results by testing the determinants of FDI in China. In general, the higher the ratio of the host country currency over the US dollar, the more inward FDI will be absorbed to the host country.

Country risk

Country risk is an important factor to consider, especially in developing countries. It may be obvious that internal political, economic, social instability and serious natural disaster in the host country will have a negative impact on FDI inflows. Firms tend to avoid any uncertainty or country risks. In relative terms, the higher the degree of home country risk in relation to the host country, the smaller inward FDI will be in the host country. However, Kobrin (1979) and Tallman (1988) have failed to confirm the significance. As we are dealing with a single country, China, which has relatively stable political and social environment since 1978, the difference in political risk among different provinces should not be much. Therefore, this study does not consider this factor.

Institutional Regime

The quality of institutions is likely an important determinant of FDI activity, particularly for less-developed countries for a variety of reasons. First, poor legal protection of assets increases the chance of expropriation of a firm's assets making investment less likely. Poor quality of institutions necessary for well-functioning markets (and/ or corruption) increases the cost of doing business and, thus, should also diminish FDI activity. Finally, to the extent that poor institutions lead to poor infrastructure (i.e., public goods), expected profitability falls as does FDI into a market.

While these basic hypotheses are not controversial, estimating the magnitude of the effect of institutions on FDI is difficult because there are no accurate measurements of economic institutions. Most measures are some composite index of a country's political, legal and economic institutions, developed from survey responses from officials or businessmen familiar with the country. Comparability across countries is questionable when survey respondents vary across the countries. In addition, institutions are quite persistent, so there is likely to be little informative variation over time within a country (Blonigen, 2005). Therefore, we also ignore it from our estimation in this study.

Taxes

Interest in the effects of taxes on FDI has been considerable from both international and public economists. An obviousUS hypothesis is that higher taxes discourage FDI. Tung and Cho (2000) found that tax incentives were effective in attracting FDI into China. Other studies (e.g. Boskin and Gale, 1987; He and Guisinger, 1993; Hines, 1996; Fung, Iizaka and Parker, 2002; Fung, Iizaka and Siu, 2003) have also found tax incentives and the effect of taxes on rates of return to FDI to be important in attracting FDI. Young (1988) found that FDI (into the USA) through retained earnings was elastic with respect to domestic tax rates and rates of return on FDI, but that FDI through new funds was inelastic with respect to tax rates and rates of return. Other studies (e.g. Lim, 1983) have found no effect of tax incentives on FDI levels. In this study, we do not include tax factor and the reason is given next.

Geographical location

In China, the coastal region is easily accessed with a lower transportation costs for imports and exports. At the same time, the east coastal region possesses government's preferential policies, which include the fiscal incentives for foreign investors, such as lower income tax rates and reduced tariffs for imports used in the production of exports, have heavily slanted in favour of cities along the coast. In addition, the proximity of the coastal provinces to Hong Kong, Macau, Taiwan, Japan, and Korea makes them more attractive to foreign investors. The attraction is further strengthened because of the closer cultural and social linkages due to the overseas Chinese mainly from the east coastal area. Broadman and Sun (1997) found a statistically significant preference for investing in coastal provinces. Coughlin and Segev (2000) found coastal location is a positive determinant of FDI. Fung, Iizaka and Siu (2002) assess econometrically the

relative importance of factors in determining the flow of direct investment into each region of China from Japan and Hong Kong for the period from 1990 to 2000. The empirical results showed that a dummy variable of location had a significantly positive influence on FDI inflow in China. Fung, Izaka, Lee and Parker (2000) and Keer and Peter (2001) have the same results by testing the determinants of FDI in China over the period 1980-1998. However, Cheng and Kwan (1999) find that the importance of special economic zones declined over time whereas that of open coastal areas increased.

A dummy variable representing the east region is to control for the influence of determinants not included in the regression model that may differ systematically between coastal and non-coastal provinces. These may include superior access to sea-routes, geographical proximity to foreign countries, and increased experience of coastal provinces in absorbing FDI, especially as many of the provinces have enjoyed preferential treatment during China's early experimentation with FDI. The tax factor mentioned above is also largely explained by the east dummy. It is therefore not to be included in the regression model.

Certainly, there are other commonly used variables like the number of tourists, the number of telephones, promotion expenditures for attracting FDI and the special treatment offered to foreign investors that may have impacts, too. However, such data are neither available nor easy to measure.

6.3 Empirical models and data

6.3.1 Long-run static model

The discussion above suggests that FDI inflows to a province depend on policy instruments as well as location characteristics. In particular, FDI inflows at provincial level are expected to be affected by market size, labour cost, trade, infrastructure, human capital, agglomeration, exchange rate, location, and openness. Hence, FDI is defined as a function of these variables and can be expressed as equation (6.1).

FDI = f (market size, labour cost, export, infrastructure, human capital,

agglomeration, exchange rate, location, time)

(6.1)

In equation (6.1), market size is measured by GDP, labour cost by employee annual salary, export by the ratio of total export over GDP, infrastructure by transportation, human capital by the ratio of students enrolled in higher education over population, agglomeration by population density and exchange rate by real exchange rate. Location and time are dummy variables. Location variables include east and central, and a time dummy variable is used 1992-2003 to represent more openness of China to FDI.

Equation (6.1) is expanded and variables are all taken in natural logarithm as shown in equation (6.2).

$$FDI_{it} = \beta_0 + \beta_1 g_{it} + \beta_2 w_{it} + \beta_3 \exp_{it} + \beta_4 tran_{it} + \beta_5 h_{it} + \beta_6 a_t + \beta_7 exc_t$$
$$+ \beta_8 fdi_{-1} + \beta_9 East + \beta_{10} Central + \beta_{11} time92 + v_{it}$$

(6.2)

Where i (i = 1,2, ..., 29) and t (t = 1979, ..., 2003) denote province i and year t, FDI = ln(FDI), g=ln(GDP), w=ln(wage), exp= ln(Export/GDP), $tran$ = ln(equivalent highway mileage per 1000 km^2 of land area), human capital h = ln (number of students enrolled in higher education/population), agglomeration a=ln (population/ area), exchange rate exc = ln(real exchange rate), fdi_{-1} denotes FDI lagged by one year , *east* takes the value of 1 for an eastern province and 0 otherwise, *central* takes the value of 1 for a central province and 0 otherwise, time92 takes the value of 1 for the period 1992-2003 and 0 otherwise.

6.3.2 Short-run dynamic models with ECM

The long-run models presented in the previous subsection may be subject to criticism for possible spurious results if variables in the models are not cointegrated. Although other studies (e.g. Yao, 2006; Yao and Wei, 2007) have proved that there exist cointegration relationships among variables in the long-run models, it is still useful to run the same models in their short-run dynamic forms and use Engel-Granger's error

correction mechanism (ECM) to test whether the concerned variables are really cointegrated. Another advantage of estimating the short-run dynamic models is that both short-run and long-run elasticities can be derived at the same time.

Engle-Granger's error-correction mechanism (ECM) for cointegration analysis can be conducted using a two-steps approach. The first step is to run a regression of equation (6.2) and derive the residuals ($\hat{e}_{it}$). The second step is to run another regression based on equation (6.3) below.

$$\Delta y_{it} = f(\Delta \widetilde{X}_{it}) - \theta \hat{e}_{it-1} + v_{it} \qquad (6.3)$$

where Δ denotes first difference, $\hat{e}_{it-1}$ is the lagged term of the estimated residual obtained from the first regression, $f(\Delta \widetilde{X}_{it})$ denotes the short-run form of the original production function shown in equation (6.2). If θ is found to be significant and positive, there is a cointegration relationship among the variables specified in equation (6.2). The only problem of equation (6.3) is that the long run coefficients cannot be estimated. Even the short-run coefficients have to be estimated in two steps. To overcome these limitations, equation (6.3) is transformed into equation (6.4) so that it can be estimated in one single step.

$$\Delta y_{it} = f(\Delta \widetilde{X}_{it}) - \theta(y_{it-1} - f(\widetilde{X}_{it-1})) + v_{it} \qquad (6.4)$$

The short-run coefficients are obtained from the first term on the right hand side of equation (6.4). The long-run coefficients are derived from the coefficients derived from $-f(\widetilde{X}_{it-1})$ divided by θ. The dependent variable and the explanatory variables will be cointegrated if the long-run coefficients and θ are jointly significant.

There are a number of advantages of using the one-step ECM model specified in equation (6.4) to study the dynamic relationship between GDP growth and its explanatory variables. First, both short-run and long-run elasticities can be estimated in one equation. Second, the long-run disequilibrium can be corrected to give better estimates of the concerned parameters. Third, the problems of non-stationarity and

simultaneity can be avoided because all the variables are presented in their first (log) differences and pre-determined values (lagged terms). Finally, the estimation is simple and the estimated results are easy for interpretation.

The empirical models are estimated in several versions. Apart from the estimation on the entire period 1979-2003, two sub-periods 1979-1991 and 1992-2003 will be re-estimated separately to see if there is a structural break. Moreover, the same model is also estimated again using regional level data to examine whether the effects of these determinants vary across regions.

6.3.3 Data

Panel data analysis is adopted because the determinants of FDI distribution are estimated across provinces and over time. Same to the previous two chapters, the data are based on a panel of 29 provinces and municipalities for the period 1979-2003. Tibet is excluded and the data for Chongqing is merged with Sichuan. Two principal data sources are available: _China Statistical Data 50 Years 1949-98_ (NBS, 1999) and _China Statistical Yearbook_ (NBS, various years, 1987-2004).

FDI, GDP, export, transportation, human capital and exchange rate are defined and calculated in the same ways to chapter 4. The dependent variable FDI is actually used foreign direct investment. All the values are measured in 1990 constant prices.

Table 6.1 Summary statistics (24 years, 29 provinces, 1979-2003)

Symbols	Definition	Minimum	Maximum	Mean	S.D.
fdi	Ln(FDI)	-0.434	10.804	5.358	2.825
_g_	Ln(GDP)	7.863	13.661	11.003	1.090
_w_	Ln(wage)	7.137	9.289	7.840	0.436
exp	Ln(Export/GDP)	-0.746	4.467	1.981	0.908
tran	Ln(Transport)	2.699	7.357	5.572	0.877
_h_	Ln(human capital)	-3.110	1.138	-1.469	0.814
_a_	Ln (population/ area)	1.653	7.901	5.223	1.255
exc	Ln(Real exchange)	0.616	1.832	1.466	0.314

Notes: S.D. = standard deviation. All the values are measured in 1990 prices in million RMB (GDP, capital, FDI, DI, export); in percentage (FDI/(DI+FDI)), Export/GDP, human capital (higher education enrollment/population); in million people (labour); in km/1000KM^2 (transport); and in yuan/\$(real exchange rate).

Table 6.1 gives the summary statistics of all the relevant variables to be used for the empirical model. All the explanatory variables except for labour cost Ln(wage) are expected to have positive impact on the dependent variable Ln (FDI).

6.4 Interpretation of empirical results

6.4.1 Estimation results at the national level

Long-run static models for three sample periods

Equation (6.2) is estimated in a controlled random manner. Since previous studies have relied on ordinary least squares (OLS), we begin our discussion by looking at our results using this method. Table 6.2 contains results for three time samples (the entire period 1979-2003 plus two sub-periods 1979-91 and 1992-2003) on the estimation at national level with long-run static models. Similar to previous studies (such as Broadman and Sun, 1997; Coughlin and Segev, 2000), the overall explanatory power of the model is high: in all three cases more than 81% of the variation in FDI across provinces is explained.

Table 6.2   Panel data regression results at national level

period	1979-2003	1979-1991	1992-2003
	Coefficient	Coefficient	Coefficient
Constant	1.413 (1.203)	-4.704(-1.134)	3.241(2.818)***
ln(GDP)	0.290 (5.084) ***	0.355(3.410)***	0.423(7.710)***
ln(wage)	-0.714 (-4.450) ***	0.049(0.093)	-0.648(-4.870)***
ln(export/GDP)	0.034 (0.628)	0.138(0.618)	0.256(5.237)***
ln(transport)	0.303(2.180)**	0.533(2.205)**	0.143(1.151)
ln(human capital)	0.110(1.852)*	0.170(1.675)*	0.061(1.116)
ln(population/area)	-0.129(-1.295)	-0.282(-1.575)	0.033(0.382)
ln(Exchange)	0.904(5.918)***	0.664(2.393)**	-0.809(-1.839)*
ln(FDI)_1	0.686(28.065)***	0.673(16.631)***	0.573(20.686)***
East	0.552(4.386)***	0.676(2.987)***	0.535(4.880)***
Central	-0.006(-0.061)	-0.098(-0.584)	0.237(2.765)***
Time92	0.751(7.326)***		
Diagnosis	Adj-R^2=0.924	Adj-R^2=0.810	Adj-R^2=0.940
	t=24	t=12	t=12
	n=696	n=348	n=348

Notes: (1) Dependent variable = ln(FDI)[29], '_1' denotes lag for one period, '***' , '**' and '*'signify significance at 1%, 5% and 10% critical level respectively. (2) FDI = Actual used foreign direct investment. (3) Model is run in OLS with regional and time dummies. (4) East and Central are dummy variables for the East and Central provinces of China, regional definitions are in figure 1.1; the variable for time92 takes the value of 1 over 1992-2003 and zero otherwise. (5) All the variables are measured in constant 1990 prices.
Sources: NBS (1999) *China Statistical Data 50 Years*; and NBS (1987-2004) *China Statistical Yearbook* (various issues).

For the full sample period 1979-2003, as shown in column 2, most of the estimated coefficients are significant and have the correct signs. GDP is found to have a significantly positive impact on FDI, which is consistent to our expectation. Its coefficient is highly significant at 1% level with a value of 0.290. This means that a 1% increase in GDP of a host province leads to a 0.29% rise in FDI. This supports the hypothesis that market size and general development level of a province have a positive impact on FDI inflow. This is also consistent with previous findings in the US and other countries. GDP generally reflects the economic development of a country or a province. It also reflects a province's potential demand, and thus gives a good estimate of the province's market size (Broadman and Sun, 1997). Therefore, it can be argued that GDP is usually an important factor for foreign investors seeking to sell as well as to produce in a local market. Thus, the larger the market size of a province, the more FDI is likely to be received in that province.

Apart from GDP, other variables are also important for FDI. These variables include wage, transportation, human capital and real exchange rate. WAGE is found to have a negative effect. This implies increase in wages discourages FDI inflow. Numerically, a 1% increase in wage rate leads to a 0.714% decrease in absorbing FDI. This is consistent with Coughlin et al. (1991) and Friedman et al. (1996). Foreign investors generally tend to take advantage of cheap factor inputs, particularly cheap labour. FDI in China has been largely dominated by Hong Kong and other Asian countries during the earlier period, whose investments are mainly concentrated on traditional labour-intensive manufacturing industries, such as textiles and garments. Therefore, cheap labour cost has strongly encouraged FDI inflow.

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[29] I use the ratio value of FDI over the total investment as an explanatory variable in chapter 4-5 in order to avoid the multi-collinearity and double accounting. In this chapter, I think it is more appropriate to use its absolute value instead of its ratio value as the dependent variable. However, for comparison, I also tried to use the ratio value of FDI as dependent variables to run the regressions and got similar results.

Transport, the proxy for the infrastructure level shows up a significantly positive relationship with FDI at 5 % level. A 1% increase in transportation density is associated with a 0.303% rise in FDI inflow. This means that, as the investing environment matures, better-developed regions with superior transportation facilities became more attractive to foreign investors. Therefore, there is no dispute that the extent of a province's infrastructure development has a significantly positive effect on the location of FDI.

Human capital is another important variable to FDI even though its estimated coefficient is only marginally significant at 10% level. Recall that this variable is the ratio of higher education enrollment to population within a province. Its significance suggests that labour quality is indeed important to FDI consideration. When it rises by 1%, FDI inflow will increase by 0.11%. This means that foreign investors not only consider input costs, but also the quality of labour (Broadman and Sun, 1997). When all other things are equal, locals with highly skilled workers would be expected to compete more favourably than others in attracting FDI. Much of FDI in China has been from the Asian countries. For example, FDI from Hong Kong and Taiwan are often concentrated in labour-intensive industries, such as electrical appliances, food processing, footwear, textiles, and so on, where relatively lower level of skill is required. This may explain why FDI is inelastic with respect to human capital. However, the positive and significant effect of human capital on FDI reveals that labour quality and skills matter in attracting FDI. This is particular true for FDI from western countries, which are largely designated in capital and technology intensive industries such as electrical equipment, chemicals, electronics, transportation equipment, and so on. Thus, labour skill is a much more significant factor in determining the profitability of their projects. For example, a typical American firm is composed of many specialized operating units, which are coordinated through the hierarchy of administrative offices. The workers acquire skills through learning by doing rather than performing specific task assigned to them. This requires workers to be more versatile and flexible in job demarcation (Fung, Iizaka, Lee and Parker, 2000). Consequently, a province with higher human capital, should receive more FDI inflows relative to other provinces.

Exchange rate reflects the extent of openness in the foreign exchange market. RMB used to be overvalued in the earlier years of economic reforms, and hence an important

disincentive for foreign investors and exporters in China. The gradual devaluation of RMB improved China's international competitiveness. Exchange rate hence exhibits a positive relationship on FDI, statistically significant at the 1 per cent level. Furthermore, its estimated value is highest to be 0.904. This result suggests that the depreciation of the Yuan tends to strongly encourage foreign direct investment in China. A 1% depreciation in Yuan against US dollar brings about 0.904% increase of FDI into China. A real depreciation of the host country currency means the reduction of cost to the home countries, especially labour cost. It allows foreign investors to hire more labour or buy more local raw materials for a given amount of the home country currency, and therefore is associated with more attraction to inward FDI.

The export variable is statistically insignificant, but nonetheless exhibits the expected positive relationship in the full sample period 1979-2003. There are two possible explanations for the insignificant results on export. First, the attraction of FDI location may be dominated by the effects of GDP, wage, exchange rate. Second, the effect of export on FDI may be enshrouded by the strong explanatory power of location dummy variables. An auxiliary regression omitting dummy variables east and central is conducted and it is found that export becomes positive significant at the 1% level, and its estimated coefficient is 0.212. This means that export is a regional specific variable. Once all the location dummy variables are included, the effect of export is reflected in the dummy variables. This result further proves the eastern bias for FDI in China.

Dissimilar to the previous studies (Head et al, 1995; Head and Ries, 1996; Cheng and Kwan, 1999), agglomeration is surprisingly found to have a negative effect on FDI although it is insignificant. That means that foreign investors try to escape from the populated province due to their diminishing return on FDI in certain "hot" provinces. Another explanation may be due to the relatively strong correlation between GDP and population density. Population density becomes positive but not significant after GDP is eliminated from an auxiliary regression.

As expected, the estimated coefficients of the dummy variables east and time92 are significantly positive with t-values of 4.386 and 7.326 respectively. Their coefficients are also large, 0.552 and 0.751 respectively. Their dominant influences on FDI suggest that FDI is unevenly distributed by location and time. In other words, the east region has

shown a clear advantage over the central and west regions in their ability to attract FDI. The dummy variable for 1992-2003 is highly significant and positive, showing a clear turning point from 1992 after Deng's south tour. These two dummy variables are good reflection on China's openness. The results support the hypothesis that open policies are one of the key elements in determining the amount of FDI inflows. Therefore, the provinces located along the eastern coast clearly show the advantage of improving the economic environment for FDI than the central and west regions by implementing special policies favourable to foreign investors.

Turning our attention from the entire period 1979-2003, we re-estimate the long-run static model with two sub-periods. As discussed in chapter 3, FDI development in China takes several stages and the nature and source of FDI are different in different stages. The year 1991 marks the end of the second stage of FDI development. We hence split the full sample into pre- and post-1991 periods and examine individually to see if the relationship between FDI and the factors behave differently. The results of the two sub-period regressions are shown in columns 3-4 in Table 6.2.

Similar to the results of the full sample, GDP has a significant and positive effect on FDI in both sub-periods 1979-1991 and 1992-2003, but the impact in the second sub-period is stronger than in the first sub-period. Its estimate is 0.355 in the first sub-period, compared to 0.423 in the second sub-period. This indicates that a 1% increase in GDP will give rise to 0.355% in FDI before 1992, but 0.423% after 1992. As discussed before, the continuous opening of China to the outside world attracts foreign capital other than Hong Kong and Taiwan. FDI from Japan, Europe and US play an increasingly important part. Furthermore, the nature of investments is different. Instead of export-oriented, the investments target mainly at local market demand within China. Conceivably, provincial GDP becomes a more important consideration for foreign investing capital.

Interestingly, WAGE is found insignificantly positive before 1992 but significantly negative after 1992[30]. Recall that during the early period, a lion's share of China's FDI came from Hong Kong. Other than the ethnic and historical linkage between the

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[30] Sun et al. (2002) find wage is significantly positive in 1986-1991 and significantly negative in 1992-1998.

Mainland and the then British colony, one important reason for the influx of Hong Kong capital into China is the exceedingly high costs of production in Hong Kong like land and labour costs. During the 1980s, most of the Hong Kong manufacturers moved their factories into Guangdong and maintained only the head offices in Hong Kong. Since Hong Kong's manufacturing industry was export-oriented, a large share of goods produced by these factories was exported. Quality control for these export products was essential. In the first period of open door, factory managers with skilled workers were sent to China to train local workers. Needless to say, it was quite costly and hence Chinese skilled workers were in big demand. This situation may explain why WAGE has a positive relationship with FDI. The variable captures more on the skill level of workers than their cost, as labour cost in China in the 1980s was low anyway. Hong Kong manufacturers were too willing to give higher wages to quality workers than to station expatriates in China. In the second period of economic reform, China has impressive, continuous economic growth. Its annual growth rate of real GDP was as high as 10.57% during 1992-2003. It is conceivable that the labour cost picks up significantly with rapid economic growth, especially compared with that before the 1990s. More importantly, the products of joint-venture companies and foreign enterprises are for the local China market. As a result, high labour cost means high product cost which has a direct adverse effect on market demand. Labour cost hence becomes a significant and negative factor for FDI in the second period 1992-2003.

Such interpretation is supported by other variable, human capital, the proxy for labour quality, imposes a significantly and positive effect in the first sub-period but becomes insignificant in the second period. Apart from the above explanation on labour cost, China recovered its higher education since 1978 which was paralyzed in the culture revolution. As a result, human capital showed an important effect on FDI in 1979-91. Its insignificance in 1992-2003 indicates that as higher education become more popular and the effect of human capital becomes less apparent across regions in 1992-2003.

The effect of export/GDP ratio is insignificant in 1979-1991, but becomes significant in 1992-2003. The auxiliary regression without dummy variables east and central in 1979-1991 brought about a positive significance at 5% level to the estimated coefficient of the export/GDP ratio. This implies that the effect of export in attracting FDI in

1979-1991 was not as important as that in 1992-2003. The possible explanation is that export in China started to tremendously increase since China further encouraged the coastal region to open its door to foreign investors, resulting in a strong and positive relation between export and FDI.

Transportation is significant and positive at the 5% level before 1992 but becomes insignificant after 1992. The possible explanation for the results on transportation is, as mentioned in Chapter 4, that the government has invested heavily from 1998 in transportation and much of the investments has been allocated to the inland regions out of the policy of "the big development of the West" ("Xi Bu Da Kai Fa"). Consequently, the development of transportation may not have been significantly related to FDI at the provincial level in 1992-2003.

Population density is insignificant either in 1979-1991 or 1992-2003. Interestingly, the central dummy is insignificant in 1979-1991 but becomes significant and positive in 1992-2003, indicating that FDI has also spread to the central region in the second reform stage.

Most surprisingly, exchange rate which is significant and positive at 5% level in 1979-1991 becomes significantly and negative at the 10% level in 1992-2003. It indicates that the depreciation of China's currency has a positive effect in attracting FDI only in the first phase 1979-1991 but this effect becomes negative in the second phase 1992-2003. One possible explanation is that much of China's currency depreciation was completed before 1992. As a result, the effect of foreign exchange rate changes after 1992 may be less important as a determinant of FDI. Another possible explanation is offered as follows. In the first stage of open door to foreign investors in 1979-1991, the lion's share of investment has been from Asian countries, especially the round tripping of investment through Hong Kong, Taiwan and Macao, which had been export-oriented. The export-oriented FDI is motivated by foreign cheap labour relative to source countries (Zhang, 2000b). Hence, the depreciation of host country's currency means the lower costs of investment from home country, resulting in a rapid increase of export-oriented FDI. In the second phase of economic reform, with the dramatic economic growth and large population in China, more and more industrial countries such as EU, Japan and the USA which aim to exploit new markets recognized the

hugely potential market in China. Therefore, in 1992-2003, although the exported-oriented FDI from Asian countries still accounts for a major share, its proportion has been declining while the market-oriented FDI from the industrial countries mentioned above has been increasing. Since market-oriented FDI aims to set up enterprises to supply goods and services to the local market, the depreciation of the host country's currency implies less purchasing power for local consumers and offers less opportunity for MNEs to realize their effective economies of Scale. This may also explain the negative relationship between exchange rate and FDI inflow in 1992-2003 in China.

Short-run dynamic models with ECM for three sample periods

Equation (6.4) is estimated in two versions, one with and one without the ECM. Table 6.3 reports the regression results at three sample periods with national data. The ECM is tested to be significant as the joint test for the variables is highly significant. The results give important evidence to support the existence of a cointegration relationship among the variables in the long-run models.

As for the full sample period 1979-2003, the short-run model without ECM brings about the right sign and significance on GDP, wage, export, human capital and population density. Other variables such as exchange rate, transportation and all three dummy variables are found to be insignificant. Transportation and time92 dummy are even negative. When the model is corrected with an ECM, the results have considerable improvement. GDP, wage, export, human capital, and population density are still in their correct signs and more significance for the last three variables. Furthermore, east and time92 dummy variables become significant and positive at 1% level. In addition, the significance of exchange rate has improved although it is still insignificant and the coefficient of transportation becomes positive but it is insignificant.

As for the interpretation of long-run estimation with ECM, we start with the coefficient on the lagged dependent variable θ in equation (6.4), which is 0.303. As this coefficient is highly significant, it is hence easy to prove that ECM is also significant in the short-run model and an evidence for the existence of a long-run cointegration relationship. All the long-run coefficients except for population density are significant

and in the right signs. The coefficient on population density is negative but insignificant.

The short-run and long-run elasticities are derived and presented in Table 6.4. GDP, wage, export and human capital are presented in their expected signs with high significance in either short-run or long-run. It confirms that large market size, low labour cost, vast export and high skilled employees are no doubt the four dominant factors for attracting FDI into China. Transportation and exchange rate are significant and positive in the long-run but insignificant in the short-run. It indicates that the effects of these two factors in attracting FDI may not be as important as those of other variables. As a result, their explanatory powerful on FDI may be partly concealed by the effects of other variables or dummy variables in the short-run model. Population density is, out of expectation, positive and highly significant in the short-run but turns negative though not significant in the long-run. This does not support the hypothesis that agglomeration of economy is one of the determinants of FDI in China.

The dummy variables east and time92 are significant with ECM. This confirms that FDI have pronounced uneven distribution in China. The eastern areas have attracted a dominant proportion of FDI because of their long commercial and industrial traditions, geographical and ethnic links with Hong Kong, Macao and Taiwan as well as major beneficiaries of economic reform. On the other hand, these two variables confirm that open policy is a key factor to attract FDI, because China further opened its door to foreign investors after 1992. The results hence also suggest that FDI flows to where open policy are more widely adopted.

The results of two long-run models in Table 6.2 and 6.5 show quite similar findings. But the latter shows more statistical significance and higher estimated values of the relevant coefficients. For example, export/GDP which is not significant in Table 6.2 becomes significant at the 5% level in Table 6.4. The estimates of WAGE and exchange rate change from -0.714 and 0.904 to -2.469 and 3.099, respectively. In short, the regression results of the dynamic model with ECM largely confirm those obtained in the long-run static equation.

Table 6.3   Regression results of dynamic models at national level

	Controlled random without ECM	Controlled random with ECM	Controlled random without ECM	Controlled random with ECM	Controlled random without ECM	Controlled random with ECM
	1979-2003		1979-1991		1992-2003	
	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient
Constant	-0.215(-.080)**	1.482(1.182)	-0.327 (-2.072)**	-7.973(-1.825)*	-0.425(-2.948)***	4.591(3.192)***
Δln(GDP)	4.947(5.757)***	4.009(5.060)***	3.361(2.655)***	3.068(2.550)**	8.203(7.074)***	5.484(5.806)***
Δln(wage)	-2.22(-3.819)***	-1.671(-3.166)***	-2.316(-2.711)***	-1.598(-1.886)*	-0.905(-1.179)	-0.475(-0.791)
Δln(export/GDP)	0.386(1.775)*	0.032(2.217)**	0.287(1.354)	0.147(1.908)*	0.449(2.122)**	0.173(2.035)**
Δln(transport)	-0.017(-0.030)	0.535(1.044)	1.386(0.947)	1.932(1.395)	-0.163(-0.346)	0.120(0.339)
Δln(human capital)	1.041(3.137)***	1.262(3.985)***	1.817(3.516)***	1.698(3.501)***	0.186(0.454)	1.251(3.515)***
Δln(population/area)	1.594(2.426)**	1.642(2.722)***	2.801(3.079)**	2.363(2.757)***	-0.343(-0.193)	0.437(0.333)
Δln(Exchange)	0.379(1.063)	0.454(1.346)	0.901(1.705)*	0.809(1.532)	-0.741(-1.691)*	-1.260(-2.782)***
East	0.037(0.457)	0.455(3.648)***	0.266(1.926)*	0.556(2.481)**	0.272(2.281)**	0.331(3.106)***
Central	0.060(0.701)	-0.029(-0.311)	0.184(1.279)	-0.084(-0.514)	-0.115(-1.296)	0.109(1.326)
Time92	-0.074(-0.854)	0.572(5.325)***				
ECM						
ln(FDI)_1		-0.303(-12.485)***		-0.314(-7.735)***		-0.402(-15.004)***
ln(GDP) _1		0.272(4.829)***		0.345(3.370)***		0.398(7.505)***
ln(wage) _1		-0.748(-4.323)***		-0.438(0.439)		-0.783(-5.415)***
ln(export/GDP) _1		0.050(2.234)**		0.113(1.656)		0.283(5.416)***
ln(transport) _1		0.301(2.183)**		0.479(1.982)**		0.161(1.327)
ln(human capital) _1		0.121(2.037)**		0.112(1.088)		0.117(2.206)**
ln(population/area) _1		-0.128(-1.282)		-0.207(-1.137)		-0.002(-0.021)
ln(Exchange) _1		0.939(6.103)***		0.571(1.982)**		-1.187(1.835)*
Diagnosis	Adj-R²=0.251 t=24 n=696	Adj-R²=0.265 t=24 n=696	Adj-R²=0.071 t=12 n=348	Adj-R²=0.201 t=12 n=348	Adj-R²=0.146 t=12 n=348	Adj-R²=0.553 t=12 n=348

Notes: (1) Dependent variable = Δln(FDI), '_1' denotes lag for one period, '***' and '**' signify significance at 1% and 5% critical level respectively. (2) FDI = Actual used foreign direct investment. (3) The first model is run in OLS with regional and time dummies but without ECM, the second model is run with ECM and regional and time dummies. (4) East and Central are dummy variables for the East and Central provinces of China, regional definitions are in figure 1.1; the variable for time92 takes the value of one for 1992-2003 and zero otherwise. (5) All the variables are measured in constant 1990 prices. Sources: NBS (1999) *China Statistical Data 50 Years*; and NBS (1987-2004) *China Statistical Yearbook* (various issues).

Table 6.4 Short-run and long-run elasticities at national level

Variables	1979-2003		1979-1991		1992-2003	
	Short-run	Long-run	Short-run	Long-run	Short-run	Long-run
ln(GDP)	4.947***	0.898***	3.361***	1.099***	8.203***	0.990***
ln(wage)	-2.22***	-2.469***	-2.316***	-1.395	-0.905	-1.948***
ln(export/GDP)	0.386*	0.165**	0.287	0.360	0.449**	0.704***
ln(transport)	-0.017	0.993**	1.386	1.525**	-0.163	0.400
ln(human capital)	1.041***	0.399***	1.817***	0.357	0.186	0.291**
ln(population/area)	1.594**	-0.422	2.801**	-0.659	-0.343	-0.005
ln(Exchange)	0.379	3.099***	0.901*	1.818**	-0.741*	-2.953*

Notes: '***' and '**' signify significance at1% and 5% critical level respectively.

Sources: Table 6.3.

Columns 4-7 in Table 6.3 show the short-run results with or without ECM for two sub-periods. As expected, the estimated coefficient of GDP is always significant and positive. But its estimated value and significance are much higher in 1992-2003 than in 1979-1991. For example, estimated coefficient of GDP without ECM is 3.361 with a t-value of 2.655 in 1979-1991 and 8.203 with a t-value of 7.074 in 1992-2003. It confirms the long-run results in Table 6.2 that China's rapid economic growth creates larger market size for MNEs in the second stage of economic reform. As a result, it can play a more important role in attracting FDI than in the first stage.

Unlike the result in Table 6.2, WAGE is found significantly negative before 1992 but insignificantly negative after 1992. Export ratio is observed marginally significant positive at 10% level with ECM in 1979-91 and becomes significantly positive at 5% level in 1992-2003 with or without ECM. Furthermore, like GDP, its estimated value becomes higher after 1992. This finding is consistent with that in Table 6.2. It implies that export play a more important role in attracting FDI in the second stage of economic reform than in the first stage. Dissimilar to the result in Table 6.2, there is no evidence of significance for transportation in the short-run either in the full sample or in each sub-sample period. Its coefficient in 1992-2003 without ECM is even negative although it is insignificant. On the contrary, human capital is found to be significant and positive at 1% level in both two sub-periods (only insignificant without ECM after 1992). However, its estimate with ECM reduces from 1.698 to 1.251. It implies that a 1% increase in high educated students leads to a more proportionate rise in attracting FDI before 1992 than after 1992. This result is consistent with that of the long-run static model.

Interestingly, population density is found significant and positive in period 1979-1991 but not significant in 1992-2003. It suggests that the hypothesis that agglomeration of economy is one of the determinants of FDI in China was supported before 1992. This may be possibly explained by the export-oriented FDI focusing on labour-intensive industries from Asian countries. As a result, population density and lower labour cost is therefore two main advantages of a province to attract FDI in this period. After 1992, the market-oriented FDI from western countries played an increasing role. The advantage of population density thus was diminishing. The east region dummy, as expected, is all significant and positive in two phases while the central region dummy is insignificant in the short-run. In addition, like GDP, the east region dummy has a higher value and significance in the second sub-period. This confirms that after 1992 with further open door policies the east region has kept attracting the lion's share of FDI.

In light of the long-run estimation with ECM, the coefficient on the lagged dependent variables θ is 0.314 and 0.402 for the periods 1979-1991 and 1992-2003 respectively. These two values are highly significant and negative. It shows a strong evidence for the existence of a long-run cointegration relationship and significance in the short-run models in both sub-samples as well. The long-run coefficients in Table 6.4 are derived from the coefficients in Table 6.3 divided by θ, namely 0.314 and 0.402 respectively in two periods.

Comparing the results of two sub-periods in the long-run static results in Table 6.2 with the long-run dynamic elasticties in Table 6.4, we can see that in 1979-1991, GDP, transportation and exchange rate are all significantly positive.. Furthermore, like the full sample period, the results with ECM in Table 6.4 present more significant and higher estimated values for all these variables. Export and population density are similar in the two models. However, labour cost and quality show some differences. Wage, which is insignificant and positive in Table 6.2, becomes insignificant and negative in Table 6.4, and significant and negative in its short-run model at 1% level. Human capital, which is marginally significant at 10% level in Table 6.2, becomes insignificant in Table 6.4 but it is significantly positive at 1% level in its short-run estimation. Overall, human capital must have played a significant rose in attracting FDI although its effect may not have been as important as that of other relevant variables.

As for the results in 1992-2003, the results with ECM in Table 6.4 provide more estimated significance. Furthermore, human capital, which is not statistically significant in Table 6.2, becomes significantly positive at 5% level. However, population density becomes negative although it is still insignificant.

To conclude, the estimation results from the long-run static and short-run dynamic models show similar findings and the latter shows more estimated significance. In the full sample period 1979-2003, all variables except for population density are statistically significant with expected signs. This confirms the expectations that large market size, low labour cost, more export, better infrastructure and human capital and depreciation of currency have contributed to FDI inflows into China. However, agglomeration does not play an important role in attracting FDI as expected.

The different results in two sub-periods show that the importance of FDI determinants in China moves through time. For example, GDP is significant and positive in two sub-periods, it has more significance after 1992. Wage is found to be significantly negative after 1992 but not before. Export is also found to be significantly positive in 1992-2003 and human capital is more significant after 1992. On the contrary, transportation is significantly positive before 1992 but insignificant after 1992. These results may be possibly explained by the following reasons. (1) The actual amount of export-oriented FDI after 1992 has increased rapidly although its share has been gradually declining. China hence jumped to the third biggest country of international trade in the world in 2005. As a result, the mutually enhancing effect between FDI and export needs time to be fully exploited. This may explain why export has more effect in attracting FDI in 1992-2003 than before. (2) Human capital was already an important consideration of Asian investors in the first stage; however, the supply of good quality labour falls short of its demand because China's higher educations did not prosper until mid 1990s. It implies that there are more advantages for human capital to play its role in attracting FDI since then. (3) One of the explanations for the different significance of transportation on FDI over time has been explained in the previous section. Another reason may be due to the lagged effect of infrastructure on FDI in the inland area. The large investment in the inland regions in the late 1990s may have not brought in FDI but possibly happen in the future. (4) Exchange rate brings about a surprising result. It is

significantly positive in 1979-1991 but becomes significantly negative in 1992-2003. Apart from the reason explained in the previous sub-section that the nature of FDI has changed from simply exported-oriented before 1992 to export-oriented and market-oriented together after 1992. Another possible explanation could be the fact that China's currency may have been undervalued in recent years. As mentioned before, China's currency RMB used to be overvalued in the earlier years of economic reforms. Then the gradual devaluation of RMB improved China's international competitiveness and became a big attraction for FDI in the earlier period. However, its currency which has been slightly declining in the past decades may be undervalued somewhat under the situation of the enormously economic achievements since 1990s with further economic reform and opening up[31], and therefore is associated with a negative effect on FDI in 1992-2003.

Finally, population density is insignificant and negative in two sub-stages. It is only significantly positive in the short-run estimation, indicating that the hypothesis that the positive effect of agglomeration in attracting FDI is not supported in our study or it just played a minor role in the first sub-period 1979-1991.

6.4.2 Estimation results at the regional level

As introduced before, FDI is highly unevenly distributed across China's regions. In the past decades, the coastal region received a lion's share of the total FDI in China, more than 86%, while the inland region only received less than 14%. Why were foreign investors attracted to the eastern region rather than the inland regions? How can the inland region attract more FDI in the future? This section attempts to find the answers to these questions by re-estimating the same models using regional level data.

Long-run static model at regional level

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[31] The People's Bank of China decided to appreciate the value of RMB by 2% against the US dollar in July 2005. The central bank also claimed that RMB would be adjusted on the basket of hard currencies, rather than the dollar alone.   Since that, RMB has been slightly appreciating with light fluctuation.

Table 6.5 reports the estimation results of equation 6.2 with regional data. Most the variables are significant with correct signs and the goodness-of-fit are high in all models.

Apart from the three regions, east, central and west, the inland region comprising the central and western regions is also estimated in order to compare the different attributes of FDI between the coastal and inland regions. GDP is found to have a significantly positive effect on FDI in all regions. Surprisingly, the highest estimate of GDP is found in the central region while the lowest is in the east region. A 1% increase of GDP leads to 0.163%, 1.01%, 0.422% and 0.487% increase of FDI to the east, central, west and inland regions, respectively. Recall the finding in chapter 5 that the central region has not only the most intra-regional income equality but also the highest speed to converge to its own income steady state. This may have gestated the most potential market demand in the central region. On the other hand, the lowest estimate of GDP with a lowest t-value of 2.324 in the East may indicate that the market advantage of the east has been lessening and foreign investors tend to move to the inland regions because they are not able to achieve their maximum profit due to the theory of diminishing marginal efficiency. This is consistent with the result of Sun et al.(2002) that the cumulative FDI relative to cumulative domestic investment has a negative impact on new FDI, indicating that MNEs may want to consider investing in provinces not yet flooded with FDI.

Wage is found to have a negative relationship with FDI in all regions but only significant in the central and inland regions. It implies that high labour cost deters the inflow of FDI in the central while it is not the main concern of foreign investors in the east and west.

Surprisingly, export is found to have an opposite relationship with FDI in the coastal and inland regions. It is significantly positive in the East, while significantly negative in the inland region. Recall that export-oriented FDI came from Asian countries and they focused on the coastal provinces due to the links of geography, culture and language, forming a virtuous relationship between export and FDI in the coastal area. As a result, FDI and export are able to stimulate each other in the cast region. The inland region received small amount of FDI due to the geographic obstacle, and lack of favourable

polices. Export activities in the inland region have been depending on local enterprises. Therefore, for an individual firm in the inland region, export and FDI are two alternative entry modes. This can probably explain why export and FDI are substitutes and negatively related in the non-coastal region.

Transportation is only found significantly positive in the east region. It is even insignificantly negative in the West. This can be probably explained by the fact that the east region is firstly opened to foreign investors as it provided good infrastructure with great support by the government to attract FDI in the early stage of reforms. The successful attraction of FDI has played an important role in the economic growth in the East so that the local government was able to develop better infrastructure to attract more and more FDI, forming another positive link between FDI and infrastructure in the coastal areas. As mentioned before, the central government started to invest in infrastructure in the inland area in the late 1990s in order to reduce regional income disparity. However, the infrastructure developed only in recent years in the inland region is still incomparable with that in the coastal region which was well-developed for decades. Furthermore, it may take more time for the inland region to form a mutually enhancing relationship between infrastructure and FDI inflow. As a result, the developing infrastructure in the inland needs more efforts and time to play a significant role in attracting FDI.

Opposite to transportation, human capital is significantly positive in the central, west and inland regions at 10%, 5% and 1% level respectively, but not significant in the east region. It reveals that the inland regions have higher human capital but poor infrastructure, while the east region has relatively lower human capital and better developed infrastructure. A 1% increase of higher education students leads to a 0.382% increase of FDI inflow in the inland area, while a 1% increase of transportation leads to a 0.498% rise of FDI in the coastal region. Besides, it reflect that labour intensive FDI is concentrated in the coastal region while most FDI in the inland region are other industries such as technology intensive industry, or capital intensive industry, etc. This also can explain why population density is significantly positive at 5 % level in the east region but insignificant in other regions.

Exchange rate is time-variant but location-invariant as all the provinces faced the same foreign exchange rate. Therefore, it is expected to play the same role in FDI in each region. The estimation result in Table 6.5 supports our expectation that it is significantly positive to attract FDI in all regions.

Table 6.5   Panel data regression results at regional level, 1979-2003

Region	East	Central	West	Inland
Constant	-2.925*	-0.948	0.110	0.902
	(-1.824)	(-0.239)	(0.038)	(0.412)
ln(GDP)	0.163**	1.005***	0.422***	0.487***
	(2.324)	(4.212)	(3.295)	(4.865)
ln(wage)	-0.191	-1.196**	-0.480	-0.742***
	(-1.004)	(-2.359)	(-1.181)	(-2.669)
ln(export/GDP)	0.116**	-0.245	-0.234	-0.265**
	(1.979)	(-1.365)	(-1.560)	(-2.411)
ln(transport)	0.498**	0.163	-0.018	0.135
	(1.975)	(0.301)	(-0.055)	(0.608)
ln(human capital)	0.09	0.420*	0.345**	0.382***
	(1.115)	(1.719)	(1.987)	(2.861)
ln(population/area)	0.140**	-0.186	0.091	-0.055
	(1.994)	(-0.537)	(0.327)	(-0.327)
ln(Exchange)	1.100***	1.572***	0.918**	1.289***
	(4.503)	(4.007)	(2.505)	(4.928)
ln(FDI)_1	0.784***	0.559***	0.648***	0.648***
	(23.126)	(9.734)	(10.708)	(16.742)
Central dummy				0.114
				(0.988)
Time92	0.497**	0.857***	0.272	0.617***
	(2.428)	(2.759)	(0.814)	(2.712)
Diagnosis	Adj-R^2=936	Adj-R^2=882	Adj-R^2=0.855	Adj-R^2=877
	t=24	t=24	t=24	t=24
	n=288	n=216	n=192	n=408

Notes: (1) Dependent variable = ln(FDI), '_l' denotes lag for one period, '***' , '**' and '*'signify significance at1%, 5% and 10% critical level respectively. (2) FDI = Actual used foreign direct investment. (3) Model is run in OLS with regional and time dummies. (4) East and Central are dummy variables for the East and Central provinces of China, regional definitions are in figure 1.1; the variable for time 92 of the time over 1992-2003. (5) All the variables are measured in constant 1990 prices. (6) Inland region = the Central + the West

Sources: NBS (1999) *China Statistical Data 50 Years*; and NBS (1987-2004) *China Statistical Yearbook* (various issues).

The insignificant central dummy indicates that FDI in the central region does not distinguish much from the west region. However, the time92 dummy variable shows that there is difference of FDI inflow between these two inland regions since 1992. Time92 is significantly positive in all regions except for the west. This implies that not

only the east but also the central region has a tremendous increase in attracting FDI since 1992, while the west does not show an obvious rise in attracting FDI.

ECM dynamic model at regional level

Table 6.6 reports the estimated results of equations (6.3) and (6.4) based on regional data without and with ECM. As for the short-run models without ECM in the left part, GDP is significantly positive in all regions. WAGE is significant and negative for all the regions except for the west region. Export ratio is significantly positive in the east region but significantly negative in the inland region. Transportation is significant and positive in the east region in the long run model and insignificant in all the other regions and all the short run models with or without ECM. Human capital is insignificant in the east in Table 6.5 but significant in all the other regions and in all the short-run dynamic models with or without ECM. Population density is significantly positive at the 10% level in the east but insignificant in all the other regions. The time92 dummy variable is significantly positive in all regions. Exchange rate is significant in the east but insignificant in all the other regions. The results in the short-run dynamic model shown in Table 6.6 are similar to those in the long-run static model shown in Table 6.5 except for export in the east and time92 dummy for all regions. The short-run dynamic model results with ECM show significant improvement on the sizes and significance of most estimated coefficients, implying that there exists a cointegration relationship among all the determinants of FDI. Consequently, the short-run dynamic model with ECM is considered to be a better representation of data than the same model without ECM.

The short-run and long-run elasticities are summarised in Table 6.7. GDP is significantly positive in all cases. WAGE is significantly negative in most regions and specifications. It is only insignificant in the east in the long-run model and the west in the short-run model. Export ratio is significantly positive in the east but negative in the inland region. Transportation is significant and positive at the 10% level in the east in long-run model but insignificant in all the othere regions and specifications. Human capital is significantly positive in all cases except for the east region in the long-run model. Population density is significant and positive in the east at the 10% level in both the short-run and long-run estimations. Exchange rate is significant in all regions in the long-run model and insignificant in the short-run models.

Table 6.6   Regression results of dynamic models, 1979-2003

	Controlled random without ECM				Controlled random with ECM			
	East	Central	West	Inland	East	Central	West	Inland
Constant	-0.096	-0.092	-0.655***	-0.327**	-1.724	-0.031	3.336	2.551
	(-0.816)	(-0.435)	(-2.917)	(-2.146)	(-1.032)	(-0.007)	(1.016)	(1.080)
Δln(GDP)	3.510***	2.797*	8.063***	4.954***	3.584***	3.649**	5.920***	4.306***
	(3.391)	(1.714)	(3.942)	(3.764)	(3.519)	(2.255)	(3.037)	(3.532)
Δln(wage)	-1.847***	-5.176***	-1.726	-3.557***	-0.560	-3.550***	-1.299	-2.404***
	(-3.021)	(-4.292)	(-1.384)	(-4.115)	(-0.902)	(-3.011)	(-1.054)	(-2.857)
Δln(export/GDP)	0.296*	-0.533	-0.296	-0.374**	0.071**	-0.743**	-0.407	-0.534***
	(1.913)	(-1.642)	(-1.359)	(-2.050)	(2.283)	(-2.270)	(-1.449)	(-2.600)
Δln(transport)	0.153	0.471	-0.147	0.111	0.848	1.286	-0.076	0.333
	(0.189)	(0.402)	(-0.155)	(0.151)	(1.100)	(1.148)	(-0.084)	(0.488)
Δln(human capital)	0.711*	2.165***	1.442**	1.847***	0.964**	2.366***	2.169***	2.352***
	(1.897)	(2.873)	(1.999)	(3.512)	(2.540)	(3.108)	(2.856)	(4.497)
Δln(population/area)	1.206*	7.803	3.746	5.339	1.243**	0.155	3.418	3.303
	(1.880)	(0.942)	(0.627)	(1.119)	(1.977)	(0.020)	(0.592)	(0.733)
Δln(Exchange)	0.853**	0.869	0.270	0.612	0.334**	0.707	0.173	0.269
	(2.184)	(1.363)	(0.422)	(1.361)	(2.763)	(1.061)	(0.242)	(0.553)
Time92	0.572***	1.427***	0.905***	1.151***	0.249	0.695**	0.192	0.481**
	(2.587)	(4.358)	(2.792)	(4.977)	(1.187)	(2.257)	(0.582)	(2.157)
ECM								
ln(FDI)_1					-0.219***	-0.458***	-0.324***	-0.352***
					(-6.341)	(-7.881)	(-5.323)	(-9.290)
ln(GDP)_1					0.132*	0.858***	0.390***	0.425***
					(1.919)	(3.650)	(3.076)	(4.831)
ln(wage)_1					-0.333	-1.218**	-1.048**	-1.006***
					(-1.586)	(-2.191)	(-2.247)	(-3.408)
ln(export/GDP)_1					0.138**	-0.176	-0.254	-0.273**
					(2.050)	(-0.983)	(-1.656)	(-2.513)
ln(transport)_1					0.436*	0.172	0.292	0.251

					(1.734)	(0.317)	(0.843)	(1.143)
ln(human capital) _1					0.058	0.344*	0.264**	0.275**
					(0.667)	(1.936)	(2.511)	(2.142)
ln(population/area) _1					0.099*	-0.161	-0.188	-0.160
					(1.776)	(-0.461)	(-0.641)	(-0.947)
ln(Exchange) _1					1.090***	1.772***	1.177***	1.499***
					(4.418)	(4.347)	(3.120)	(5.586)
Diagnosis	Adj-R²=0.096	Adj-R²=0.134	Adj-R²=0.100	Adj-R²=0.114	Adj-R²=0.241	Adj-R²=0.327	Adj-R²=0.232	Adj-R²=0.281
	t=24	t=24	t=24	t=24	t=24	t=24	t=24	t=24
	n=288	n=216	n=192	n=408	n=288	n=216	n=192	n=408

Notes: (1) Dependent variable = Δln(FDI), '_1' denotes lag for one period, '***' and '**' signify significance at1% and 5% critical level respectively. (2) FDI = Actual used foreign direct investment. (3) The first model is run in OLS with regional and time dummies but without ECM, the second model is run with ECM and regional and time dummies. (4) East and Central are dummy variables for the East and Central provinces of China, regional definitions are in figure 1.1; the variable for time 92 of the time over 1992-2003. (5) All the variables are measured in constant 1990 prices.

Sources: NBS (1999) *China Statistical Data 50 Years*; and NBS (1987-2004) *China Statistical Yearbook* (various issues).

Table 6.7 Short-run and long-run elasticities at regional level, 1979-2003

Region	East		Central		West		Inland	
Variables	Short-run	Long-run	Short-run	Long-run	Short-run	Long-run	Short-run	Long-run
ln(GDP)	3.510***	0.603*	2.797*	1.873***	8.063***	1.204***	4.954***	1.207***
ln(wage)	-1.847***	-1.521	-5.176***	-2.659**	-1.726	-3.235**	-3.557***	-2.858***
ln(export/GDP)	0.296*	0.630**	-0.533	-0.384	-0.296	-0.784	-0.374**	-0.776**
ln(transport)	0.153	1.991*	0.471	0.376	-0.147	0.901	0.111	0.713
ln(human capital)	0.711*	0.265	2.165***	0.751**	1.442**	0.815**	1.847***	0.781**
ln(population/area)	1.206*	0.452*	7.803	-0.352	3.746	-0.580	5.339	-0.455
ln(Exchange)	0.853**	4.977***	0.869	3.869***	0.270	3.633***	0.612	4.259***

Notes: '***' and '**' signify significance at1% and 5% critical level respectively.
Sources: Table 6.6.

In short, the effects of various determinants of FDI differ across China's regions during 1979-2003. Market size plays a positive role on absorbing FDI in all three regions, although, the same unit increase of market demand leads to the highest increase of FDI in the central and the lowest in the east region. Wage is significant only in the central region, indicating that foreign investors in that region concern more about labour cost than the other two regions. Transportation and population density are significant only in the east region while human capital is significant only in the inland areas. This reflects the fact that most labour intensive FDI industries concentrate in the coastal region, which has better infrastructure and higher population density, while the inland regions mainly receive technology intensive industries. This is further confirmed by the effect of export on FDI which is positive in the east region and negative in the inland areas. The time92 dummy variable is significant not only in the east but also in the central region. It implies that the central region has become more open to FDI after 1992, following the experiences gained in the east region. Compared to its central or east counterpart, the west region was left behind in attracting FDI even in the post-1992 period.

6.5 Chapter summary and further study

The impressive achievements of economic growth and FDI inflow in China since the economic reform in 1978 have attracted worldwide attention. From the early stage of pulling in exported-oriented industries from Hong Kong and Taiwan that are lured by cheap production cost in China to the later stage of drawing in investments from the Western countries that are eager to tap into the huge domestic market, China has gradually opened up to the rest of the world, especially after its accession to the WTO in December 2001. It is well known that among the three regions, the east region is the richest while the west is the poorest. The east has been accounting for more than half of the total GDP of China while the west less than 15%. Interestingly, the distribution of FDI in China has been highly concentrated in the eastern coastal area. Since China opened its door to foreign investors in 1979, the east region received the lion's share of total FDI, more than 86%, while the central and west regions combined received less than 14%. However, the study on the regional determining factors in attracting FDI is far from being well understood. In addition, the different attributes of FDI in China over

time is rarely investigated. This chapter provides a timely study, making a fresh and useful contribution to the literature on FDI and its regional distribution in China.

Using Dunning's "OLI" explanation of the causes of FDI by focusing on the location advantages, the empirical analysis of this chapter has shown that given the ownership advantages of source countries and the incentives for their multinational enterprises (MNEs) to internationalise their ownership advantages in order to reduce transaction costs, the location advantages or the location determinants of host regions are crucial in attracting FDI inflows. In other words, facing the same set of source countries, regional differences in the magnitude of FDI inflows received from the same set of source countries are determined by the differences in location advantages of host regions. Therefore, the uneven regional distribution of FDI inflows into China is caused by the differences in regional characteristics and location factors of each region.

This chapter differentiates our study from other similar studies on the determinants of China's FDI by looking at possible changes in the importance of determining factors through time and different regions in the same country. As a result, the study advances our understanding in the factors affecting the level of FDI across China's regions over time. By respectively using long-run static and short-run dynamic models with ECM, apart from estimating the determinants of FDI into China for the full sample period 1979-2003, we re-estimate the same issue on two sub-sample periods 1979-1991 and 1992-2003 to see if FDI determinants change through time. Furthermore, we estimate the same models with regional data to see if there is different importance of the factors effecting FDI in different regions.

The estimations based on long-run static and short-run dynamic models without/with ECM show approximately similar findings and the latter method shows more estimated significance. As for the whole country at the full sample period 1979-2003, to summarise, the province with larger market size, higher human capital, more export, better-developed transport and higher degree of openness attracted relatively more FDI inflows, while higher wages deterred FDI inflows. In addition, the depreciation of RMB

was also an important factor in attracting FDI into China. However, the hypothesis of a positive impact of agglomeration on FDI is not supported in this study.

In view of the estimation on the two sub-sample periods 1979-1991 and 1992-2003, the results provide evidence that the importance of FDI determinants moves through time. GDP as a proxy of market size is always found to have a significant and positive effect on FDI, but its effect is stronger in the second sub-period. It indicates that large market size of China played a greater important role in attracting FDI after 1992 with more development and experiences of the country's open policy. The effect of wage was insignificant before 1992 but significant and negative after 1992, indicating that labour quality was more important than labour cost in the first sub-period because Asian investors, especially investors from Hong Kong, aimed to export good quality products in the early period of openness. Another reason was due to the fact that wages were low anyway during the first stage of economic reform, and hence it was relatively more affordable to hire high-skilled labour at slightly higher wages. Before 1992 export was not a significant determinant of FDI but became an important factor after 1992. Infrastructure and human capital had a significant and positive effect on FDI before 1992 but became insignificant after 1992. Most surprisingly, exchange rate had a positive relationship with FDI before 1992, but a negative relationship since then. The east dummy is significant in both sub-periods but its estimated significance improved after 1992, while the central dummy is insignificant before 1992 but became significant . thereafter.

At the regional level, the estimated results indicate that the determinants of FDI varied across China's regions over 1979-2003. GDP, similar to previous findings, has a significant and positive relationship with FDI in all regions, but in comparison to the level of regional GDP per capita, the effect of GDP in attracting FDI is the strongest in the central, and the poorest in the east region. Accordingly, wage in the central region has the highest negative relationship with FDI, while the west region has the highest and the east region the lowest negative linkage with FDI. It means that labour cost in the coastal region is not an important consideration of foreign investors. Surprisingly, export is significantly positive in the east region but significantly negative in the inland region. This implies that the relationship between export and FDI is interdependent in the coastal region but not in the inland region. Transportation and population density are

significant only in the east while human capital is significant only in the inland areas. It may be explained by the fact that exported-oriented FDI is mainly concentrated in the coastal region and the inland regions mainly attract market-oriented FDI. On the other hand, the inland regions have some advantages in terms of human capital and natural resources although its infrastructure needs to be significantly improved to attract FDI.

The results from this study provide useful information on how to attract more FDI into China especially in the inland regions. Firstly, given that international investment and trade are most likely to take place in areas with good transportation facilities, the infrastructure, which is relatively poor-developed in the inland region, needs to be improved. Secondly, human capital needs to be much more invested and improved. Combining the result in chapter 5, it is concluded that human capital in China particular in the inland regions is far from playing its potential role in economic growth and FDI. The finding that FDI has a different nature through time reveals that the type of FDI in China is changing from a simple export-orientation to a mix of export, market, and R&D considerations. Correspondingly, apart from the traditional labour intensive industries, various industries such as technology intensive, capital intensive, knowledge intensive have been increasing in China. Obviously, labour quality will play a more and more important role in China's economic growth as well as the increasingly imperative factor to attract FDI. Thirdly, the insignificance of population density in the inland regions suggests that local governments in the inland region should try to promote the development of labour-intensive industries in order to absorb its large labour force and to reduce the pressure on migration to the coastal region. Finally, the negative relationship between exchange rate and FDI after 1992 implies that RMB may be undervalued after 1992 in terms of its tremendous economic development. In fact, the value of RMB has started to be appreciated somewhat since July 2005. However, it may need to be further appreciated to make China more attractive to FDI.

This study has several limitations that deserve further investigations. Firstly, this study has used only macro-level data but has not examined such factors as sectoral or industrial variations in FDI. For instance, Wheeler and Mody (1992) find that factors important to FDI in the electronics industry may not be important to the manufacturing industry. There may be a clientele effect in the sense that different provinces may attract

different types of FDI. Aggregate data may well conceal some important factors and their differences in explaining the behaviour of foreign investors. Secondly, due to data limitation, we are not able to consider the tax effect of FDI on China. Hines (1996) demonstrates that in the US, higher state tax rates have a significantly negative effect on investment. From 2007, China will gradually reduce the tax conception granted to FDI. The corporate tax rate will increase from its current level of 15% to 33% which is levied on domestic firms. The change in tax policy may have an important impact on FDI inflows but it needs time to test the effect of tax reform. Thirdly, Kinoshita and Mody (2000) suggest a new and interesting perspective that private information of investing firms about the host country is an important factor in making FDI decisions. On the other hand, Wei (2000) suggests that the corruption and red tape problems are important deterring factors that make China an under-achiever as a host of FDI. Further quantitative studies including these factors may provide essential clues for a better comprehension of the determinants of FDI in China.

Chapter 7 Summary and Conclusions

FDI has been an important factor in China's economic growth and development over the last three decades, especially after Deng Xiaoping's South Tour in 1992. There have been hectic debates in the literature on the relationship between FDI and regional economic growth, on whether FDI has been a driving force for economic growth, on whether FDI has crowded out domestic investments and stimulated the widening of regional income inequality, and on what are the main factors responsible for FDI inflows into China.

This thesis addresses three important issues relating to FDI development in China. First, it thoroughly studies the exact mechanism as to how FDI has contributed to China's economic growth. It is concluded that FDI helps reducing domestic production inefficiency and accelerating China's technological progress. Second, it thoroughly studies how FDI has contributed to economic convergence (or divergence) among the Chinese regional economies. It shows that FDI is an important factor driving the conditional convergence of regional economies. It also suggests that regional differences in FDI inflows are responsible for the differences of regional incomes. Third, it thoroughly studies the main determinants of FDI inflows into the Chinese regions. It suggests that market size, human capital, location, among other factors, are important determinants of FDI.

7.1 A general summary

China has seen enormous changes since the economic reforms and open door policy were brought about in the late 1970s. Not only did impressive economic achievement contribute to this advancement; but it also shone to light the inequalities amongst the regional economies. Being the main beneficiaries of this economic boom, the coastal provinces have experienced faster economic growth, generating much higher per capita incomes than their inland counterparts. Meanwhile, as FDI inflows in the country are highly unevenly distributed among the regions, with a lion share in the coastal area and a very small share in the west region, many scholars and policy makers have blamed the inflows of FDI as one of the main factors driving the Chinese regions apart. This

argument, however, contradicts the positive effect of FDI on economic growth which has been widely believed in the literature. This thesis is an attempt to disclose these two controversial and provocative issues in the economic development literature.

Chapter one was an overall introduction and outline of the thesis and chapter two reviewed and summarized the related previous studies. In chapter three, the development of economy and FDI inflows in the post-reform period has been expatiated. China's economy reforms chiefly included rural and urban reform, price policy reform and the adoption of the open door policy. Household Responsibility System (HRS) was introduced in the rural reform while state-owned enterprises (SOEs) reform was adopted in the urban area. SOEs reform is regarded far from success by many scholars and HRS is blamed recently to be a bottleneck of further scale production in rural China. However, due to given more power of self-determination, independence and flexibilities, as well as the new distribution system which emphasizes what they gain lies on how they produce, both HRS and SOE reforms are commonly believed to have greatly stirred up the farmers and worker's incentives. Meanwhile, China's price system became a mechanism of market-based pricing under macro-economic adjustment. It was becoming increasingly rationalized, creating a relatively fair marketplace for all enterprises to compete on an equal footing. More importantly, the open door policy was China's gateway to the outside world; the main purpose of this policy was to attract foreign capital, to allow foreign direct investment (FDI), to establish joint ventures or exclusively foreign-owned enterprises and to expand foreign trade. In a short, FDI, along with the factors of rural reforms and SOEs, structural adjustments of industries, increase of the domestic investments and expansion of trade are widely considered as the most important instruments of the swift growth of China.

Statistically, China has seen an extraordinary economic progress and an enormous increase of FDI inflows since the late 1970s, particularly after 1990s. Its real GDP has increased from RMB 670.38 billion in 1979 by 14.83 times to RMB 9.94 trillion in 2005, which consequently means an average growth rate of 10.93 % per annum during 1979-2005. The country's growth rate diverged obviously in different stage of reform, for example, 11.92% in 1992-2005 and 9.95% in 1979-1992. Concurrently FDI saw the same pattern, it went up from a dismissal zero in 1979 to a colossal $11 billion in 1992, and continue its ascent to a remarkable over $69 billion in 2006.

China's economic phenomenon was brought about by the reform and open door policy, but unfortunately, not all Chinese regions had benefited equally from its economic advancement. The coastal provinces enjoyed the faster growth while their inland counterparts still struggled in their backward states. This intense separation has led to scholars expressing their concerns about whether if this disparity will not cause social and political problems for China, as has been with other countries facing this particular dilemma. The ratio of East-Central-West per capita real GDP was 1.71:1.23:1 in 1979, 2.03:1.15:1 in 1992 and 2.98:1.56:1 in 2005. And the same can be seen with FDI, whose inflows are seriously unevenly distributed in China's regions; with the eastern provinces accounting, as well, for its biggest share of 86% or more.

Followed chapter three, three empirical chapters, using the largest panel dataset covering 29 Chinese provinces in the post-reform period and employing an augmented Cobb-Douglas production, have attempted to reveal the real causal relationship between economic development and FDI in China's regions from three steps: first, in chapter 4, by estimating the economic growth in the presence of FDI in China, the exact mechanism by which FDI impacts upon the development process for a newly industrialising economy was observed. It indicates that FDI have played a dual role on economic growth as a mover of production efficiency and a shifter of production frontier. However, this finding can not reconcile the argument that FDI worsened income disparities across China's region in the previous studies. Accordingly, the study of how FDI play the role on the process of income convergence was then tested in chapter 5. The results suggest that it is not FDI itself, but its uneven geographic distribution which has caused regional growth differences. Consequently, the key policy issue is that FDI should be guided towards the inland areas with preferential policies in order to improve the spatial allocation of investment as a means to reduce regional inequality. Therefore, Chapter 6 opportunely investigated the potential advantageous factors for China how to further encourage FDI inflow, especially for inland China. And, thus, following in the next three sub-sections we have endeavored to summarize the results draw from these empirical studies.

7.I.1 Economic growth in the presence of FDI: a case of China

Chapter 4 presented a theoretical framework to study the role of FDI in economic growth. Two major hypotheses not considered in the economic literature about the role of FDI in economic growth viewed from the perspective of a newly industrialising economy were presented: FDI is a mover of production efficiency and, also a shifter of production frontier in the host economy. Having maintained an extended period of swift growth, being the fastest and largest industrialising economy in the world, and due to its economic revolution brought about by its open door policy, China is the perfect example to test the aforementioned hypotheses.

In conjunction with export, human capital, transportation and the real exchange rate, FDI is standardized into the production function in the empirical models that are based on an augmented Cobb-Douglas production function. At the national level, all the explanatory variables are found to have the expected results and positively and significantly affected on output. More importantly, FDI as a proportion of total investment and its cross term with a time trend are also observed to have a significant and positive effect on production, which, consequently, substantiate the two hypotheses brought forth for the whole country. Adding 3.5-4.3% of total economic growth on an annual basis, technological progress played a vital role in China's economic growth. FDI input, which is up to 30% of total technological progress in China, is a strong sustain to the second hypothesis that FDI is a shifter of China's production frontier over time, given the fact that its total investment is only about 5%.

In order to observe if there are different effects of FDI and other environmental variables on economic performance across regions, the models are also re-estimated utilizing regional level data. Strong evidences proved that the impact of FDI, export, transportation, human capital, technological progress on economic performance was asymmetric across regions, notwithstanding the fact that the regression results reject the impact of FDI and export on economic growth in the inland regions. On the other side of the coin, generally speaking, environmental variables (human capital, transportation, export and FDI) are found to have limited impact on production in the West region, in spite of FDI having some effect on its technological advancement. The annual growth of technological progress, including both domestic and FDI-induced, was as high as 4% in

the East, but less than 2% in the Central and less than 0.2% in the West. This, as a result means that a two-step 'water-fall' shape of technology development is present in China, commencing at the highest level is the East, then, following in the middle is the Central and coming right down to the base is the West. This is due to the fact that FDI has played a greater part in the Coastal than in the Inland regions, as opposed to FDI widening the gap between those two areas.

Furthermore, similar to the version of the whole country, both hypotheses of FDI have been verified in the east and the central regions; in the west region, however, only the second hypothesis, i.e. FDI a shifter of production frontier was supported. One possible explanation is that the volume of FDI in the west is still small and it may take time for FDI to become an important and integrated part of local production. Hence, inland provinces should be stimulated in attracting more FDI and exports.

7.1.2 The impact of foreign direct investment on regional inequality in China

The task of chapter 5 was to answer two questions whether there is increasing income inequality across China's regions in the post-reform period and, how FDI play the role on this process. Two classical convergence approaches σ-convergence and β-convergence were employed to answer these two questions. The estimations were employed not only for the whole country, but also within each region and, also between each pair of two regions, namely, east-central (EC), central-west (CW) and east-west (EW).

The results from σ-convergence estimation presented a slight decline over 1979-2003 and, also showed three sub-phases of the process of income inequality in China. It declined in the first decade, expanded in the second and then started to decline again from the third decade. This pattern mirrors the process of economic reform and policies inclined during the past decades in China. At the beginning, not only did the initially richer area benefit from economic reform and then achieve impressive economic development, but other initially poorer economies also performed notable economic advancement, leading to a contraction of income gap for the country. The second decade saw the coastal provinces having disproportionate benefits and FDI with an

export-orientation invading the coastal cities, thus broadening the income gap between coastal and inland regions. However, since the mid 1990, out of the socialist ideology and the egalitarian ideas, the central government moved the new predisposed programs on the west and central regions, as a result, the income disparity started to narrow.

Regarding the CV of each single region, there exist different CV from both size and tendency amongst regions. The East had the highest value of CV and the Central held the lowest one, indicating largest income gaps within the east region and smallest within the central region. Furthermore, these two regions showed similar trends of CV value to the whole country. However, the west, unlike the others, has kept relatively stable value over the past decades, implying its internal income difference has not experienced much changed in the reform era. This, to some extend, reflected the west provinces have not yet influenced much by the economic reform.

Although the CV value came down a bit in the past decades, it might not be statistically significant for the whole country as CV is a non-parametric approach which is not subject to statistical testing. Moreover, a declining CV does not certainly suggest economic convergence if a reduced CV is not originated by the poorest regions catching up with the richest regions, but by the catching of the medium income regions with high income regions, or by the convergence among the medium income regions. Thus entailing that, though CV can be used to indicate the tendency of general inequality, it is not the ideal measurement for income convergence for all regions within a country. Another inability of CV is that it cannot demonstrate why regions are converging or diverging in per capita incomes.

In contrast, β-convergence is a more practical tool to estimate income convergence since it can not only testify whether poor regions are catching up with rich ones, but also clarify the reasons why regions are converging or diverging in per capita incomes. After different estimations with both the cross-sectional and pooled analyses, the β-convergence test, in this thesis, reveals no evidence of absolute convergence in either inter- or intra-region. It implies that neither the poor provinces nor poor regions have been able to grow faster than their rich counterparts. It resulted to the conclusion that, during the data period, the regional inequality increased rather than declined during the data period.

The findings from conditional convergence test which was adopted to explain the reason of widening inequality can be summarized as following: (1) every single region only can converge to its own steady state by controlling for the differences in saving rate, population growth, human capital endowment, transportation, and above all FDI and exports; (2) the same factors that have a significant effect with national level data have similar effect with regional (or groups of regions) level data; and (3) FDI is singled out to have played a consistent and positive effect on growth differences in all specifications except for the West region.

A conclusion could be easily drawn from these findings that FDI is one of important factors causing regional disparity, especially if the fact that the skewed distribution of FDI among the three regions in China which is coincided with a similar spatial pattern of real per capita GDP is taken into consideration.

If we were to go along and view this conclusion as the correct and rational understanding, as has been argued and suggested by numerous previous studies, then decreasing FDI inflows into China would be able to control the ever-growing tendency of regional income disparity. The reconciliation of the positive result of FDI on economic growth and its 'negative' effect on income allocation would be made difficult by such a policy implication. The controversy of this type of conclusion and its policy implications indicate the need of a better understanding and a more accurate reading of the econometric results which illustrate a positive and significant relationship between FDI and economic growth in all kinds of model specifications presented in chapter 5.

The conclusion drawn by this study differs from that concluded by many other authors: FDI is an important factor of economic growth but it is unevenly distributed across regions, as a result, it is the uneven distribution of FDI, rather than FDI itself, that has been a cause of regional income inequality. Moreover, reconsidering the result found in chapter 4 that FDI has been proved to be a shifter of production frontier for all the regions, given massive FDI inflows in the western and central regions, therefore, it is deemed possible for these inland provinces to upgrade their production frontier and steady states. Consequently, the differences of the steady states between inland and coastal regions were expected to narrow. This confirms our aforementioned conclusion.

Therefore, resulting from the conclusion that to provide a better environment for absorbing FDI in the west and central regions, in order to reduce regional inequality, FDI has to be directed towards these relatively backwards areas through governmental intervention and preferential policies to reduce regional inequality

7.1.3 Determinants of foreign direct investment in China's regions

Although the rapid growth of FDI has achieved, China has only held very small amount of FDI per capita compared to the average of the world, particularly to the developed countries. Moreover, the share of FDI in China to the world's total has been declining in the past few years. This suggests that not only the inland region but also the whole country need to be largely further encouraged to receive FDI. Chapter 6 thus finally investigated the factors which may influence the FDI inflows to China and especially to its inland region. To find out whether the inland region possessed its own advantageous factors to attract FDI compared to its coastal counterpart, the possible changes of determinants across regions and through time have been focused on.

Although extensive studies give detailed input on the determinants of FDI in China by utilizing various data forms, hardly any assesses the determinants of FDI in different periods and regions. We have, therefore, endeavored in this study to augment the literature by evaluating changes in the importance of FDI determinants across Chinese regions and through time. By respectively using long-run static and short-run dynamic models with ECM, apart from estimating the determinants of FDI into China for the full sample period 1979-2003, we re-estimate the same issue on two sub-sample periods 1979-1991 and 1992-2003 to see if FDI determinants change through time. Furthermore, we estimate the same models with regional data to see if there is different importance of the factors effecting FDI in different regions.

The results in the national level at the full sample period 1979-2003 showed that the provinces with larger market size, higher human capital, more export, better-developed transport and higher degree of openness lured comparatively more FDI inflows whilst higher wages discouraged FDI inflows. In addition, the depreciation of RMB was also

an important factor in attracting FDI into China. However, the hypothesis of a positive impact of agglomeration on FDI is not supported in this study.

The findings on two sub-sample periods 1979-1991 and 1992-2003 provided evidences that the importance of FDI determinants changed through time. With a constant significant and positive effect on FDI, GDP effect is stronger in the second sub-sample period. Wage was seen insignificant before 1992 but significant and negative after 1992, indicating that forepart Asian investors inclined to labour quality rather than labour cost. Moreover, owing to the fact that wages were very low in mainland China before early 1990s, as a result, the change of wage was not sensitive to the foreign investors' intent. Regarding the effect of export, it was not significant before 1992 but became strongly significant after then. Opposite to export, infrastructure and human capital were significant and positive before 1992 but became insignificant after 1992. Most interestingly, exchange rate had a positive relationship with FDI before 1992, but a negative relationship since then. As for two location dummy variables, the east dummy, similar to GDP was significant in both sub-periods but its estimated significance improved after 1992, while the central dummy, like export, was insignificant before 1992 but became significant thereafter.

As for regional level, the estimation results also differed amongst regions. During the period 1979-2003, GDP effect on FDI is highest in the Central and lowest in the East regions. Wage is significant and negative only in the inland region, especially in central region, but insignificant in coastal ones, indicating that in coastal area, labour cost is not a primordial concern with foreign investors. Surprisingly, the relationship between FDI and export is inter-reliant in the coastal regions and not in the inland ones, as export is significantly positive in the east region but significantly negative in the inland region. It implied that export-oriented FDI is more intense in the coastal region and the inland regions for the most part attract market-oriented FDI or a mix of export, market and R&D considerations, this could be the explanation why transportation and population density are significantly positive only in the east while human capital is significant only in the inland areas. Though its infrastructure has to be significantly enhanced to attract FDI, the inland regions have some advantages in terms of human capital and natural resources.

7.2 Contribution of this thesis

This thesis has undertaken a comprehensively theoretical and empirical analysis of regional economic development in the presence of FDI in China. Compared with the existing studies, this thesis has made respectable new features and contributions to the literature on the understanding of the impact of FDI on the economic development of China.

This thesis, being the first, ever, in this field, systemically analyze the impacts of FDI in China by combining three issues which include the impact of FDI on economic growth, the role of FDI on regional income inequality and the determinants of FDI in China. These topics have been more or less studied separately in the literature. They seem to be unattached but virtually inter-correlative. To our knowledge, there hasn't been any published study providing a comprehensive and in-depth analysis on uniting these three questions above.

Moreover, this thesis also enriches theoretical framework on studying the role of FDI in economic growth from the perspective of a newly industrialising economy by presenting two important hypotheses which have not been considered in the economic literature (chapter 4), however, which might be considered as a major contribution of the thesis. First, FDI is presumed a mover of production efficiency because it helps reduce the gap between the actual level of production and a steady state production frontier. Second, FDI being embedded with advanced technologies and knowledge is then assumed a shifter of the host country's production frontier. Due to its dual role as a mover of production efficiency and a shifter of production frontier, FDI is a powerful driver of economic growth for a newly industrialising economy to catch up with the world's most advanced countries. These two hypotheses were supported by testing the example of China which has achieved impressive economic growth and massive FDI inflows over the past two more decades.

Additionally, this study makes further contributions in terms of research, design and scope. First, based on an augmented Cobb-Douglas production function, this thesis

employs long-run static model and its short-run dynamic form with Engel-Granger's error correction mechanism (ECM) to test whether the concerned variables are really cointegrated (chapter 6). Another advantage of estimating the short-run dynamic models is that both short-run and long-run elasticity can be derived at the same time. The results from the short-run dynamic models reaffirm the main conclusions drawn from the long-run static models. Secondly, it uses the largest dataset for 29 Chinese provinces and municipalities for the period 1979-2003. Thirdly, it adopts both cross-section and panel data approaches to study the linkage between FDI and regional income convergence (chapter 5). The fourth point is, apart from examining perspectives of inter- and intra-regions, this study is the first to examine regional inequality by the inter-group (each pair of two regions, chapter 5) in order to compare the income convergence story between each two closer regions, for example, west and central, central and east. The purpose of examining the same issue of FDI on spatial growth differences and income inequality with various model specifications and estimations is to provide a comprehensive anatomy on whether FDI has caused regional income inequality, which is a controversial issue in the literature with significant policy implications on economic growth and development of China and any given under-developed economy in the world with similar pattern. The fifth point of this study has been differentiated from other akin on the determinants of China's FDI (chapter 6) by looking at probable changes in the significance of formative factors through time and different regions in the same country. So therefore we have an in-depth understanding of the factors affecting the levels of FDI across Chinese regions in order to create corresponding policies to attract FDI, especially for the inland regions.

Finally, this thesis has provided several striking findings. In chapter 4, both hypotheses that FDI is a mover of production frontier and a shifter of production frontier have been proved in the versions of the whole country, the east and the central region. However, in the west region, only the shifter of production frontier has been supported. This mainly explains why there is such a wide gap of technological progress between the west and the rest of China's regions. Further combining the finding from chapter 5, this thesis concludes that FDI cannot be blamed for causing regional inequality; it is the uneven distribution of FDI, instead of FDI itself, which has caused regional growth differences. Moreover, the findings in chapter 5 report that there is only evidence of

conditional convergence, indicating regions can converge to their own steady states only after controlling the differences in saving rate, population growth, human capital endowment, transportation, and above all FDI and exports. Rethinking FDI has been proved as a shifter of production frontier even in the poorest regions of the west, given enough FDI, the inland regions are expected to upgrade their own steady states and then narrow the differences from the coastal region. This affirms the conclusion that FDI can accelerate the process of income convergence, rather than widen the income disparity across China's regions. Therefore, FDI inflows should be further encouraged instead of being restricted into China, especially to the west and central regions. Furthermore, almost all the factors are found to have changes on affecting FDI inflows through time and different regions in China in chapter 6. All these findings are very useful and important for China to apply policies on regional development and FDI attraction.

7.3 Policy suggestions

As stressed repeatedly in the previous chapters, China's impressive achievements has been accompanying widening income inequalities since economic reform and opening up. Many scholars have expressed their worries that the expansions of the disparities in the country may create serious social and political problems and generate nationalist conflicts and negatively influence China's economic and social stability. The concern of enlarging disparities in China has become one of most important policy issues for the central government. In September 2004 in the Fourth Session of the 16th Plenary of CCPC, the Chinese Communist Party advanced the dominant socio-economic target of building harmonious society. It serves as the ultimate goal for the ruling Communist Party of China along with "Xiaokang Society". This idea deviates China's focus from economic growth to overall societal balance.

It is a complex and long-term system project to reduce inequalities in China. According to our research objective and content, the final sub-section of this study is to provide policy suggestions from the visual angle of FDI on how to reduce regional income inequality.

As previously mentioned, one downside effect of economic reform has been the ever rising inter-regional inequality. As FDI is highly unevenly distributed across regions, many scholars and policy makers have blamed the inflows of FDI as one of the main factors driving the Chinese regions apart. However, the findings of this thesis have brought about a different conclusion: the real problem is not because FDI causes the widening gap between the East and the Inland areas, but it is because of the uneven distribution of FDI, instead of FDI itself, which has caused regional growth differences. In another word, the amount of FDI in the inland region, especially in the west is too small to exert the full potential spillover of FDI to local development. For example, FDI in the west, only play a shifter of the local production frontier but not a mover of the local production efficiency. As a result, policy should not discourage FDI to move away from the Inland area, especially the West. Instead, the preferential policies that the authorities have adopted in the east region should be farther extended to the central and western regions. To achieve the full potential of FDI, preferential policies and government intervention have to create a better environment and conditions for absorbing FDI in these relatively backward areas.

Both developed and developing countries are drastically competing to lure FDI and this eagerness, frequently, goes beyond the national to the sub-national level, with different regional authorities following their own approaches and gathering their own baskets of incentives to attract, new investments; thus the implementation, with a varied range of results, of different reforms and strategies. Critics have argued that it would be more profitable improving a country's general business environment, instead of spending vast amount of finances on initiatives to attract FDI. The resources gathered under this issue look at the mixed methods adopted by policymakers to attract FDI and their effectiveness. These approaches include: (1) providing targeted fiscal incentives, such as tax concessions, cash grants, and specific subsidies; (2) improving domestic infrastructure; (3) promoting local skills development to meet investor needs and expectations; (4) establishing broad-reaching FDI promotion agencies; (5) improving the regulatory environment and decreasing red tape; and (6) engaging in international governing arrangements.

However, the incentives above are general approaches. The findings in Chapter 6 offered another helpful knowledge on attracting more FDI in China, focusing on its

inland regions. The first point being that, the infrastructure which is comparatively under-developed in the inland region needs to be greatly enhanced, given the fact that international investment and trade will almost certainly take place in areas with good transportation facilities. Secondly, combining the result in chapter 5, human capital, especially in inland regions, is a long way from reaching its potential role in economic growth and FDI, as a result human capital is in greater need of much more of investment and improvement. The findings indicated that China's FDI was going from a basic export-orientation to a mix of export, market and R&D considerations. On the increase, apart from the traditional labour intensive industries, are various industries such as technology intensive, capital intensive, knowledge intensive; although it goes without saying that labour quality will play a most important role in China's economic growth as well as the increasingly imperative factor to attract FDI. Thirdly, the insignificance of population density in the inland regions suggests that local governments in the inland region should try to promote the development of labour-intensive industries in order to absorb its large labour force and to reduce the pressure on migration to the coastal region. The fourth point is that, the negative relationship between exchange rate and FDI after 1992 implies that RMB may be undervalued after 1992 in terms of its tremendous economic development. In fact, the value of RMB has started to be appreciated somewhat since July 2005. However, it may need to be further appreciated to make China more attractive to FDI. Finally, other policies such as cross-regional investments are also important in the long match to reduce inter-regional disparity in income and production in China.

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