THE ROLES OF AGGLOMERATION ECONOMIES AND COMPARATIVE ADVANTAGE IN THE REGIONAL DISTRIBUTION OF FDI IN CHINA

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Abstract

The coast-interior gap in attracting foreign direct investment (FDI) in China has widening, but FDI has been diffusing within the two areas. Using data for 28 Chinese provinces from 1985 to 2007, I examine the determinants of regional distribution of FDI among Chinese provinces under the guidance of three theories of FDI location choice: agglomeration economies, comparative advantage and location tournaments.

The regression results provide support for the hypothesis in all three theories. The self-reinforcing effect of FDI in China can be confirmed and tax incentive is indeed a significant determinant for FDI location choice. Among the four proxies for comparative advantages, wage and GDP per capita have the expected effects on FDI location choice while the effect of infrastructure is statistically insignificant. To my surprise, human capital shows a puzzling negative effect on the location choice of FDI.

I also find differences in the behaviour of two groups of foreign investors in China: Hongkong-Macao-Taiwan (HMT) investors and NON-HMT investors. HMT investment tends to be highly responsive to tax incentive, whereas NON-HMT investors do not take tax incentive as seriously as other determinants. Agglomeration economies are found to be more important to NON-HMT investment than to HMT investment.

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List of Abbreviations

ETDZ	Economic and Technology Development Zone
FDI	Foreign Direct Investment
FIE	Foreign Invested Enterprises
GMM	Generalised Methods of Moment
HMT	Hongkong-Macau-Taiwan
MOFCOM	Ministry of Commerce of the People's Republic of China
NON-HMT	Non Hongkong-Macau-Taiwan
OECD	Organization for Economic Cooperation and Development
QMLE	Quasi-Maximum Likelihood Estimation
SEZ	Special Economic Zone

Chapter I: Introduction

China is the largest recipient of foreign direct investment (FDI) among all developing countries with a total cumulative amount of US$692 billion FDI from 1979 to 2007[1]. FDI has been one of the critical engines for rapid economic growth in this country for the last three decades. In the modern history of economic development, no other countries have ever benefited as much as China has from FDI and hence FDI has always been one of the focal points in the literature on the growth of the post-reform Chinese economy. Moreover, FDI inflows into China have exhibited unique characteristics which are presented in the following sections.

1.1 Growth of FDI in China

China's FDI inflows started in 1979 when a new Law on Joint Ventures was passed, providing basic legal framework for foreign firms to operate in China. Under this new law, provincial and local governments were allowed considerable freedom in regulating the joint ventures established within their jurisdictions. The first four Special Economic Zones (SEZs) were set up in the Southern coastal provinces of Guangdong and Fujian[2], offering preferential tax and administrative treatment to foreign firms. These two provinces were chosen because of the geographic proximity and close links in terms of dialects and cultures to Hongkong and Taiwan. In addition, foreign investors in SEZs could enjoy an unusually free hand in their operations. Through most of the 1980s, incoming FDI grew steadily and made important changes to the regional economic development of Guangdong and Fujian.

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[1] China Statistics Bureau (CBS) (2007), China Statistics Yearbook 2007, Beijing: China Statistics Press.

[2] Xiamen in Fujian; Shantou, Shenzhen and Zhuhai in Guangdong.

In 1984, Deng Xiaoping proclaimed Shenzhen a successful experiment of SEZs and the government granted similar tax exemptions and administrative procedures to 14 additional administrative units (mostly municipalities on the coast). The local governments in these areas set up Economic and Technology Development Zones (ETDZs) which offer the same provisions as the SEZs, and authority at local level could approve FDI projects under US$30 million (this threshold was later increased to US$50 million).

A major regulatory change in FDI came in 1986, called "22 Regulations". Foreign Invested Enterprises (FIEs) were made eligible for reduced business income tax rates regardless of location and were granted increased managerial autonomy. In addition, foreign investments in "export oriented" projects and "technology advanced" projects could be given more special benefits.

The stream of incoming FDI turned into a flood after a string of remarkable speeches Deng Xiaoping made during his famous "Southern Tour" in Spring 1992, which endorsed the open-door policy. Local governments were encouraged to open further to foreign investors and eighteen new ETDZs were approved in 1992-1993 alone[3]. Contracted FDI jumped to US$11 billion in 1992, more than triple of that in 1990. The rapid growth continued and reached its first peak in 1997 with US$45.3 billion of FDI. Another reason for this surprising increase in FDI inflows was that China was then in the midst of an unsustainable expansion with rapid credit expansion. However, as we can see in Figure 1, there was a huge gap between contracted FDI and implemented FDI during this period as the contracts were usually for multi-year business plans. It could also be explained by the fact that foreign investors, especially Western investors, were unprepared for the cultural clashes and administrative

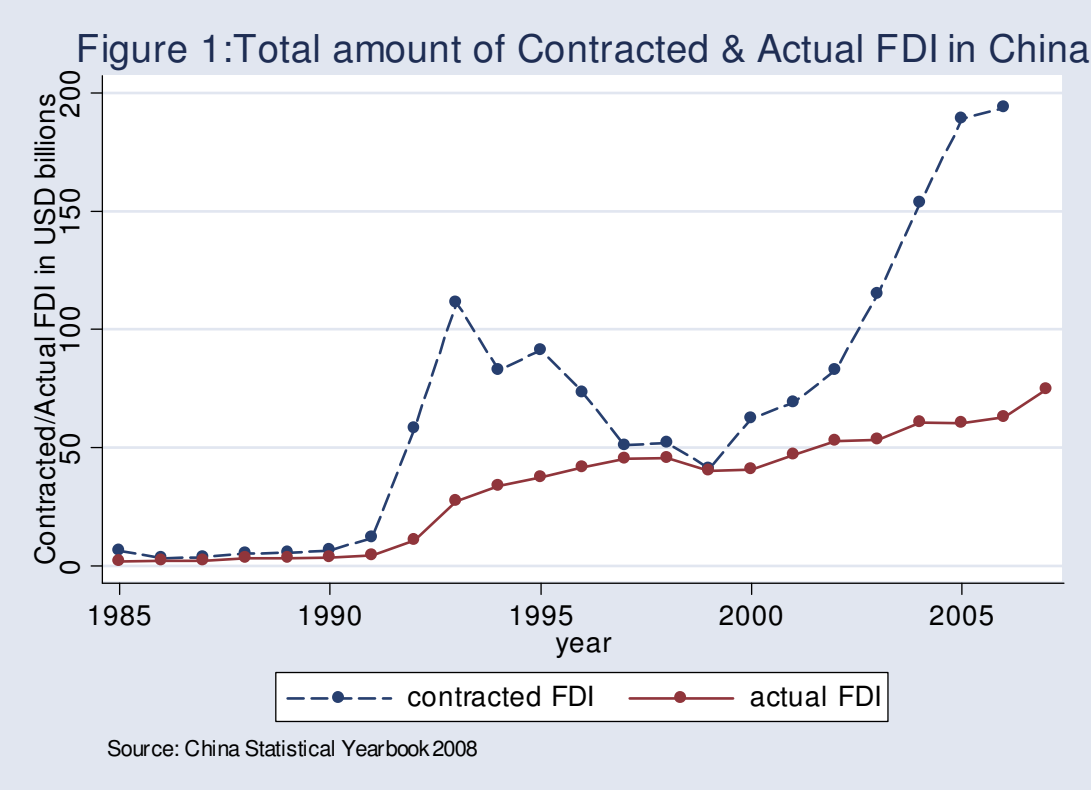
[3] Barry Naughton, "The Chinese economy: transitions and growth", MIT Press, 2007.

difficulties when they jumped in and only later did they find that the ventures turned out to be unprofitable and inefficient[4]. Figure 1 also shows that the gap between total amount of contracted FDI and actual FDI decreased sharply right after 1993, and by the end of 1990s the two amounts were almost equal.

There was a slight decrease in FDI inflows into China from 1997 to 2000. It resulted from monetary and fiscal policies of Zhu Rongji to reduce aggregate demand and moderate price inflation. Another important reason was the Asian financial crisis, which hit badly investors in Asia who were major investors in China. However, the FDI inflows increased steadily from 2001 and reached a new peak of over US$70 billion in 2005. This was an immediate result from bilateral agreement with the US in 1999 and China's WTO entry in 2001[5]. Another notable reason was the removal of austerity regime after the Asian financial crisis and the government sought to use a sizable fiscal stimulus to boost domestic demand. Again, we can observe a rapid increasing gap between total amount of contracted and actual FDI after 2000. It might take a long time for China to digest a huge total amount of contracted FDI of over USD 200 billion in the period 2005-2007 alone.

[4] Branstetter and Lardy (2006), China's embrace of globalization, NBER Working Paper 12373.

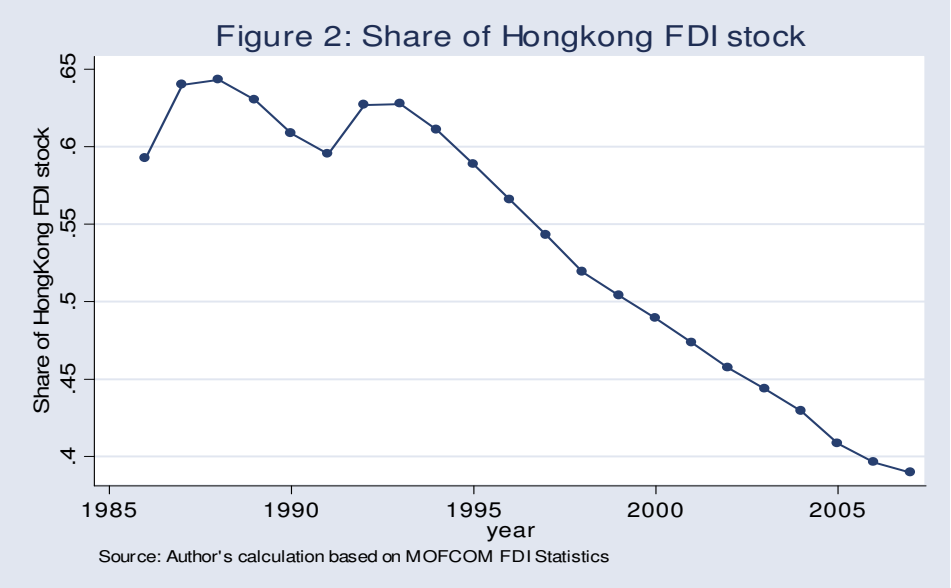
[5] Walmsley, Hertel and Ianchovichina (2006), "Assessing the Impact of China's WTO Accession on Investment," Pacific Economic Review, 11(3), 315-339.



1.2 Sources of FDI in China

By 2006, there were 274,863 foreign–invested enterprises (FIEs) with a total registered capital of US$946 billion[6]. Decomposing FDI in China according to the sources indicates that Hongkong has been the leading FDI source for China. Before 1990, cumulative FDI from Hongkong alone accounted for over 60% of the total FDI stock in China. Geographic proximity and cultural linkage between China Mainland and Hongkong could be the major reason for Hongkong being the largest foreign investor in China. The large scale of round

[6] China Statistics Bureau (CBS) (2007), China Statistics Yearbook 2007, Beijing: China Statistics Press.

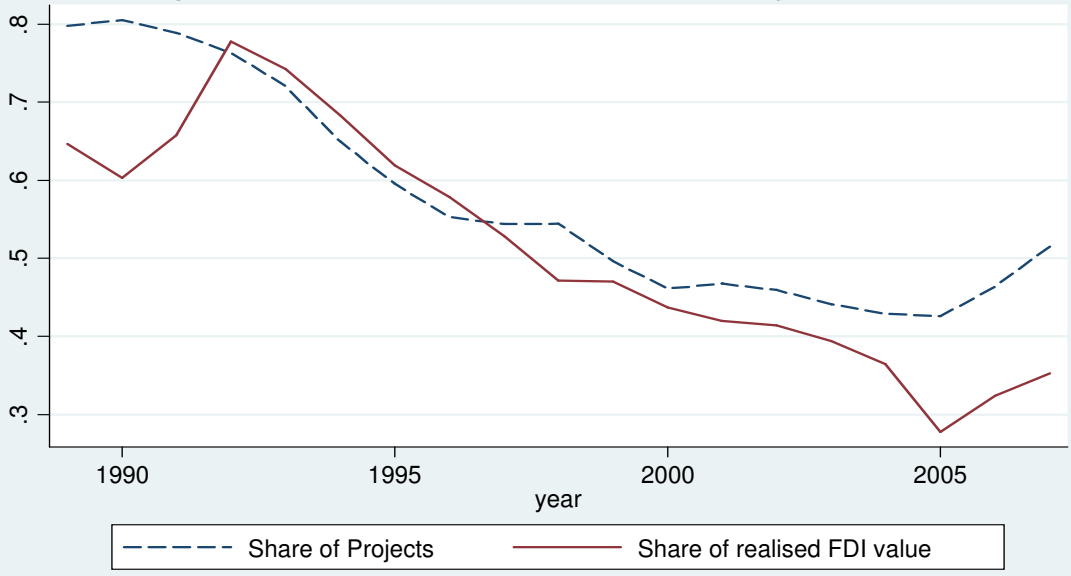


tripping FDI between China Mainland and Hongkong may also attribute to the exceptionally high FDI inflows from Hongkong. Another possibility is that investors from OECD countries may use Hongkong as a spring board to enter Chinese market. However, as China gradually opened to global economy, the dominance of Hongkong as the leading source of FDI decreased remarkably. In the period from 1985 to 1990, FDI from Hongkong accounted for 60.9% of total FDI stock, but this share dropped sharply to 48.5% in the period from 1991 to 2000 and 31.9% in the period from 2001 to 2006. The persistent decreasing trend in the share of FDI stock from Hongkong over the years in Figure 2 can help us visualise the situation.

Japan ranks second in terms of FDI stock in China. From 1985 to 2006, Japanese cumulative FDI stock was US$57.5 billion, or 8.4% of the total FDI stock for that period. The US ranked third with US$55.1 billion, about 7.9% of the total. Direct investment from European countries is relatively small compared with that of Japan and the US. German FDI stock in China accounted for about 2% of the total. FDI from the UK was roughly at the same level as that of Germany, while FDI from France was much smaller, only above 1% of the total stock.

One of the distinctive characteristics of FDI in China is that it predominantly came from East Asian economies, especially from Hongkong, Macau and Taiwan. In the period from 1985-2005, Hongkong, Macau, Taiwan and tax havens (most investments from tax havens into China originated from Hongkong and Taiwan[7]) accounted for 60% of total FDI stock in China; whereas cumulative investment from the US, EU and Japan was only 25%. This is quite notable when we know that the US, EU and Japan accounted for 92% of total worldwide FDI stock from 1998-2002[8]. As we can see in Figure 3, in early 1990s the annual share of investment from Hongkong and Taiwan, in terms of both projects and realised FDI value, accounted for over 70%. Though this share dropped dramatically after years, it still stayed at a significant level of nearly 40% by 2007. Therefore, it is worth examining the behaviours of the group of investors from Hongkong, Macau and Taiwan separately.

Figure 3: Annual Share of HK &Taiwan Projects and FDI



Source: Author's calculation based on MOFCOM FDI Statistics

[7] Barry Naughton, "The Chinese economy: transitions and growth", MIT Press, 2007.

[8] Barry Naughton, "The Chinese economy: transitions and growth", MIT Press, 2007.

1.3 Sectoral composition of FDI in China

Sectoral composition of FDI in China is also different from that of other developing countries. On average, 38% of the FDI stock in developing countries was in manufacturing sector, while Chinese manufacturing accounted for 62% of foreign registered capital by the end of 2002. In 2003-2004, 70% of total FDI into China was in manufacturing. The share in service sector in 2003 was 27% and 55% for China and other developing countries respectively[9]. This can be noted as one of the distinctive characteristics of FDI in China.

Several reasons might attribute to this fact. First, comparative advantage in Chinese manufacturing has remained strong in comparison with other countries at the same level of development. Second, China still maintained restrictions on foreign entry into most important service industries. These restrictions must be gradually removed when China has to follow its WTO commitments and we may see a greater stream of FDI into service sectors after 2007. Lastly, there might be a difference in the methodology for FDI statistics in China[10].

1.4 Regional distribution of FDI in China

The distribution of FDI within China has always been extremely biased towards the coastal areas. In 1985, the share of FDI stock of all coastal provinces accounted for 90% of the total FDI stock. Though this share slightly declined to 87% in 1993 and 85% in 1997, it almost stayed around this level for the rest of the years and in 2003 the share of FDI stock in coastal provinces was 86%.

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[9] Barry Naughton, "The Chinese economy: transitions and growth", MIT Press, 2007.

[10] http://www.unctad.org/en/docs/iteiiamisc20075_en.pdf

In the early stage, Guangdong was the largest recipient of FDI among Chinese provinces as three out of the first four SEZs were located in this province. Guangdong also enjoyed close links in terms of geography and language with Hongkong, where most initial FDI into China originated. As we can see in Figure 4, Guangdong alone in 1985 accounted for 50% of nationwide FDI stock, while the second and the third largest FDI recipients (Beijing and Shanghai, respectively) obtained less than 10% each. However, the dominance of Guangdong province has been diminishing steadily over the years. The leading province in 2003 was Jiangsu with almost 20% of total FDI stock and Guangdong was the second largest with over 15%. Shanghai, Shandong and Zhejiang each hosted approximately 10% of total FDI stock by 2003. Therefore, FDI has been obviously diffusing within the coastal provinces[11], resulting in much more even distribution. However, most interior provinces still received little FDI in comparison with coastal provinces. Among interior provinces, only Hubei, Hunan and Jiangxi showed certain progress in attracting FDI.

I decompose the variance of FDI distribution over 28 provinces into three components: within coastal provinces, within interior provinces and between the two groups to check whether the patterns we found above have been a consistent trend:

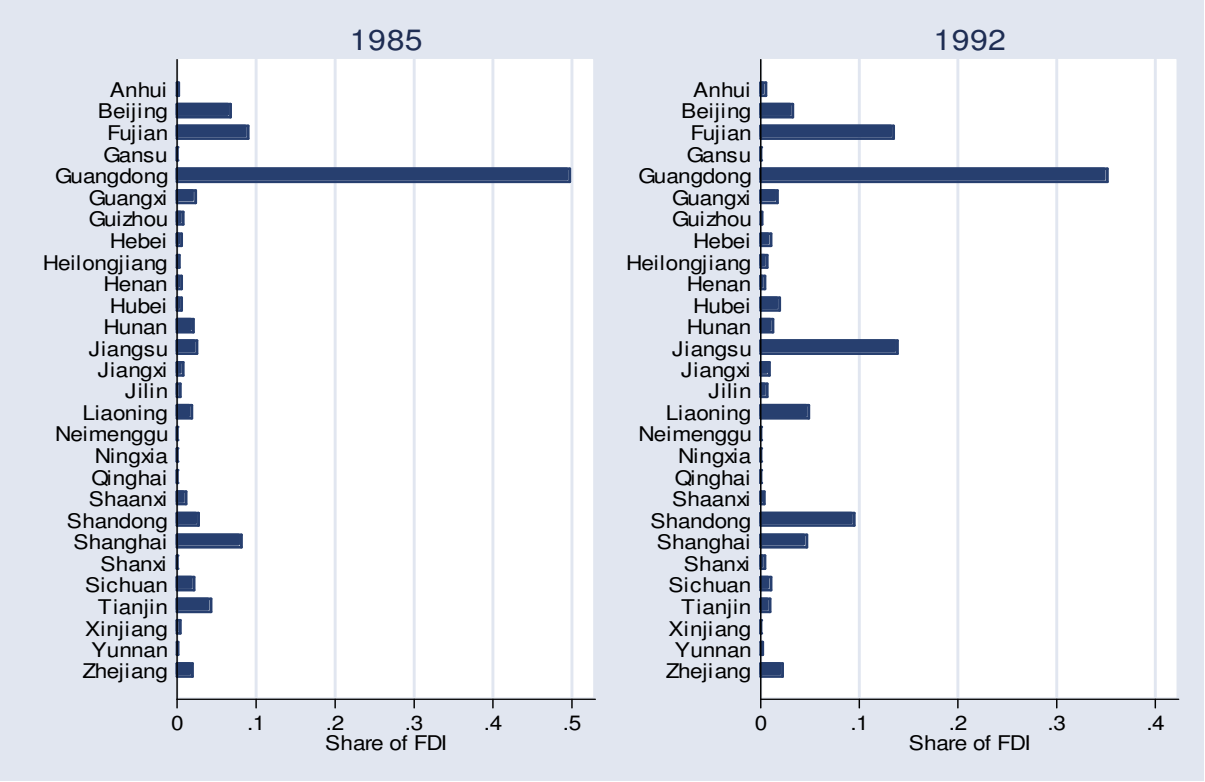
$$\frac{1}{N}\sum_{i=0}^{1}\sum_{j=1}^{N_i}(I_{ij}-\bar{I})^2=\frac{1}{N}\sum_{i=0}^{1}\sum_{j=1}^{N_i}\left[\left(I_{ij}-\bar{I}_i\right)+\left(\bar{I}_i-\bar{I}\right)\right]^2$$

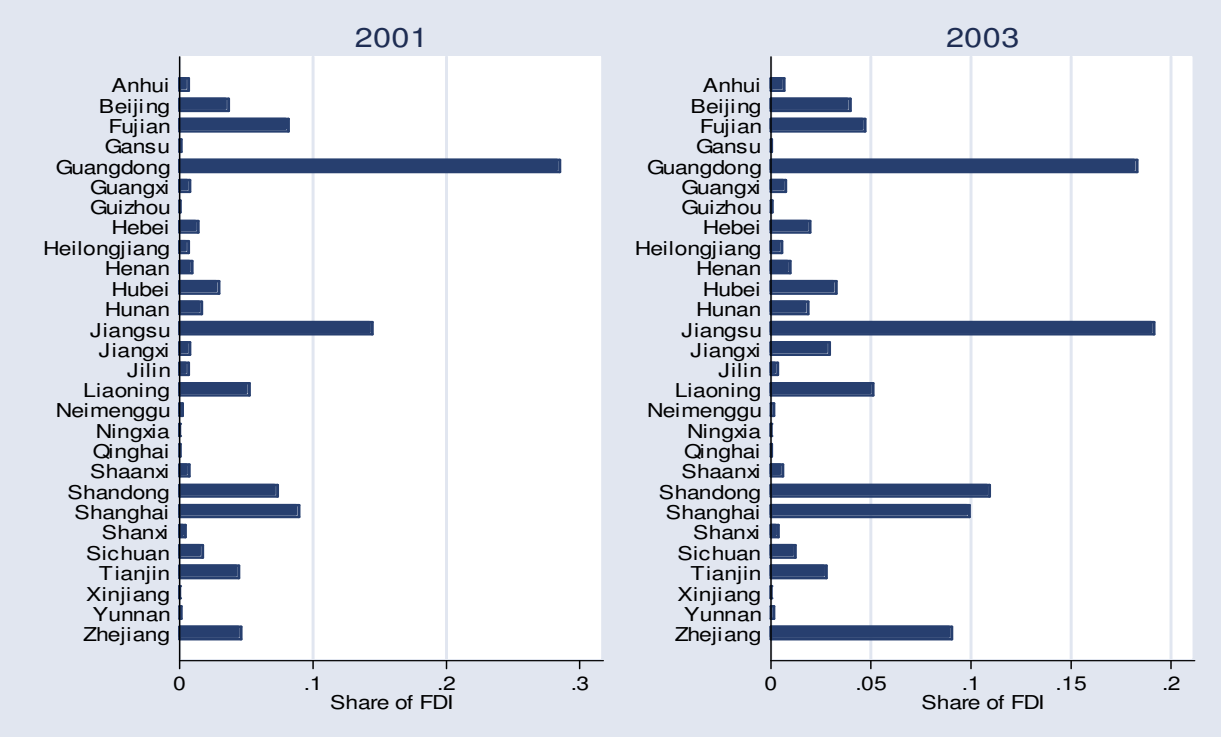
$$=\frac{N_0}{N}V_0+\frac{N_1}{N}V_1+\frac{1}{N}\sum_{i=0}^{1}N_i\left(\bar{I}_i-\bar{I}\right)^2$$

[11] In my thesis, coastal provinces in China include Beijing, Fujian, Guangdong, Guangxi, Hebei, Jiangsu, Liaoning, Shandong, Shanghai, Tianjin and Zhejiang. All others are interior or inland provinces.

where I_{ij} is the amount of FDI province *j* receives in a given year and *i* denotes whether the province is on the coast or not. The total number of province is N, the number of coastal provinces is N_1 and the number of interior provinces is N_0. A bar denotes the mean of the sample. Therefore, $(N_0/N)V_0$ represents the share of FDI variation of interior provinces and $(N_1/N)V_1$ represents the share of FDI variation of coastal provinces. The rest will be the share of FDI variation between the two groups.

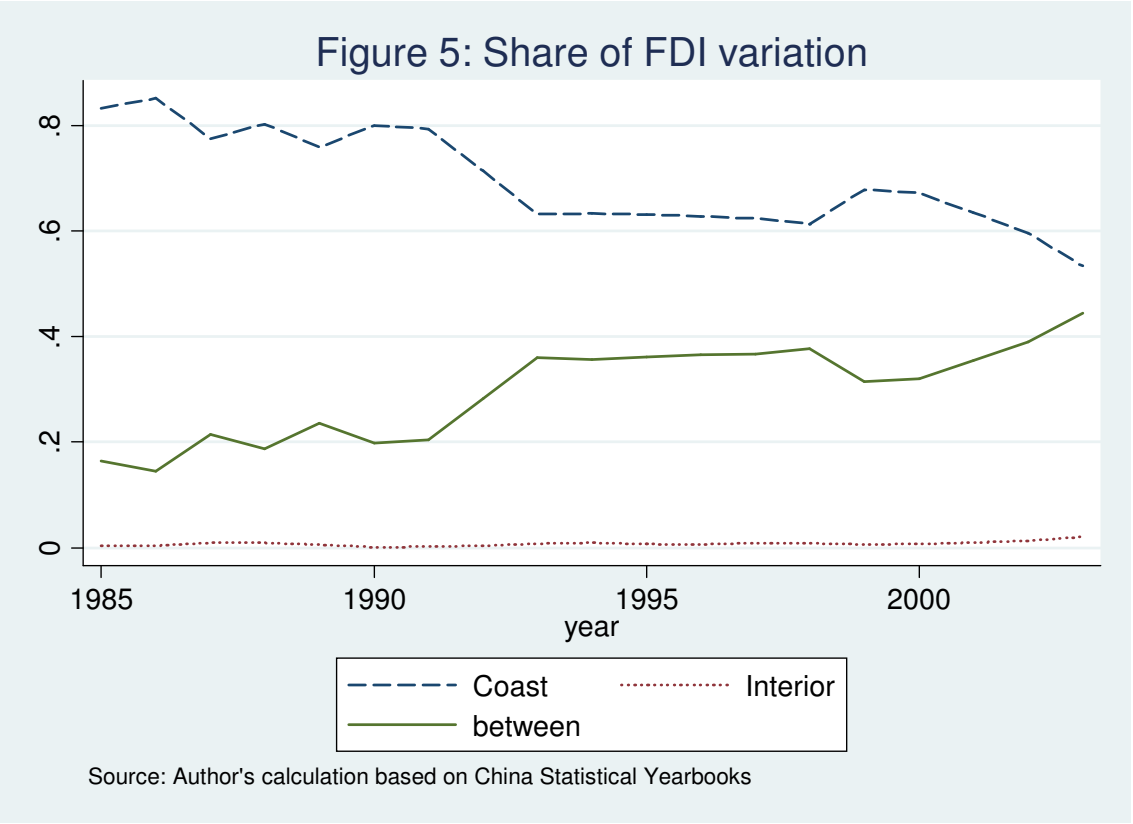
Figure 4: Share of FDI stock by regions in China





Source: Author's calculation from China Statistical Yearbooks.

The results shown in Figure 5 indicate that the within-coastal share of total variation in FDI has been falling while the within-interior share has been almost the same for the whole period. The gap between coastal and interior groups has been increasing and it accounted for over 40% of total spatial variation in FDI by 2003. In other words, we can say that FDI has becoming more evenly distributed among coastal provinces but the divide between coastal and interior group has been widening over the period from 1985 to 2003. Therefore, there naturally come two questions: what made FDI only diffuse among coastal provinces and why interior provinces over time have obtained smaller share of total FDI in China?



Source: Author's calculation based on China Statistical Yearbooks

1.5 Research questions

From the overview of FDI in China, we can see that FDI in China is characterised by uneven distribution between coastal provinces and interior provinces, the dominance of FDI inflows from Hongkong, Macau and Taiwan against the investment from all other countries and the focus of foreign investors on Chinese manufacturing sector. Therefore, my thesis aims to answer the following questions:

- What are the determinants for FDI location choice in China? And among these determinants, which one(s) might be the most influential?

- As investors from Hongkong, Macau and Taiwan play a crucial role in investment climate in China; are there any differences in the behaviour of this group of investors against that of investors from other countries?

In order to answer the questions, I firstly investigate the literature of FDI location choice, both theoretically and empirically, in chapter two. Then in chapter three I will describe my first empirical model for regression using provincial level data in China in 1990s and early 2000s. Chapter four will present the second model for the same data set with results and discussion for policy implications. The last chapter will conclude my thesis.

Chapter II: Literature Review

2.1 Theoretical studies for FDI location choice

There are three theories which can explain FDI location choice: agglomeration economies, comparative advantage and location tournament. I will in turn present the three theories.

Marshall (1920) was the earliest work to explain geographical concentration of economic activities. Marshall stated three advantages of localized industries: first, a pooled market for specialized workers can help employers easily find workers with a special skill they need and it is also natural for workers to go to this place to seek for a job; second, subsidiary industries can devote themselves each to a small segment of the whole production process, resulting in backward and forward linkages; lastly, knowledge spill-over effects help firms learn good work from each other and new ideas can be further developed. This theory may explain the existence of a tendency of investing in a region with a large number of well-established firms.

David and Rosenbloom (1990) also indicates the advantages of a pooled labour market. If the fortunes of individual firms are not perfectly correlated, the spatial concentration of industry will help laid-off workers find new jobs with other firms faster. Increased number of firms in one location, therefore, reduce the risk of being unemployed for a long time. As a result, workers elsewhere will tend to move into this location for job search and this, in return, benefits the firms as well by increasing the supply of specialized labour and reducing the risk premium embodied in wage. On the other hand, Markusen (1990) shows that finer divisions of labour in intermediate input markets will lower unit costs for final producers and a firm's decision to invest in a region can promote creation of specialized labour, resulting in increasing attractiveness of the region to investors.

Krugman (1991b) states the advantages of agglomeration through concentration of the users and suppliers of intermediate goods. Such agglomerations help to reduce total transportation costs and create large enough demand for highly specialised components. Therefore, more assemblers will come and this will encourage new arrivals with additional specialization. Fujita (1988) also implies that increased diversity of inputs increases the productivity of final goods producers.

Knowledge spillovers attribute significantly to agglomeration effects, though it is rather hard to be quantitatively captured. We predict that useful technical information seems to flow between firms in various industries, and foreign-invested firms may share the experience-based knowledge on how to operate most efficiently in a foreign region. Physical proximity may enhance knowledge sharing by making casual communication less costly and more frequently. However, as stated earlier, we find it hard to examine the geographical extent of these spill-over effects, the degree they spread between and/or within industries and the scope they may flow between firms of different nationals.

The Marshallian agglomeration economies, in summary, suggest that location of FDI is subject to a self-reinforcing process in which regions historically that possess a higher level of FDI concentration will continue to receive more FDI while those with much lower FDI stock level hardly see their share of FDI rising over time. However, it is worth distinguishing a type of agglomeration which may not necessarily result in the concentration of FDI if foreign-invested firms set up linkages with domestic suppliers or customers, and hence they choose to locate near Chinese business partners instead of other foreign firms.

Another theory for location choice of FDI is comparative advantage. Henderson (1986) states that there is a limit to agglomeration benefits, which implies agglomeration effects cannot

escalate forever. Head et al. (1995) also argues that the location will become less attractive when firms congregate since competition among them bids up the price of the inputs. Therefore, beyond a certain level of concentration, the benefits from FDI agglomeration will be less than the opportunity cost generated by comparative advantage in other regions. Over agglomeration will lead to energy shortage, rising labour cost, congested infrastructure and expensive intermediate inputs, making alternative locations more attractive to foreign investors. As a result, FDI inflows will go to regions which offer the lowest operation costs.

However, it is not that simple for a firm to relocate its production site due to externalities it has internalised by being close to others. Henderson (1985) reveals that even when an old site becomes inefficient and a more favourable site emerges, firms in inefficient sites may not have incentive to move to the new, low-cost site as they have to disconnect the well-established linkages. In this case, government should encourage firms to relocate by offering external benefits through policy adjustments, promotional campaigns and incentive programs. This is what David (1984) has termed "location tournament" and it is proved to be more effective in cases when foreign investment is perceived as footloose. Rauch (1993) shows that developers of industrial parks can discriminate pricing of land over time in order to remove first-mover disadvantages which prevents relocation.

To sum up, FDI location choice is mainly affected by the actual interaction of these three forces: agglomeration economies, comparative advantage and location tournaments. While the "winning" in a location tournament can be said to be unstable as once the winner halts the subsidies, industry location patterns will revert to their predetermined state, it seems unclear whether the other two play an equally important role in attracting FDI or not.

2.2 Empirical studies of FDI location choice

Unlike theoretical studies, empirical studies of FDI location choice are rather numerous. I will briefly summarise the findings of several key papers regarding the three forces, i.e. agglomeration, comparative advantage and location tournament.

2.2.1 Empirical studies for agglomeration effects

Coughlin et al. (1991) applies a conditional logit model of the location decision of foreign firms investing in manufacturing sector in the United States from 1981-1983. The authors use manufacturing density variable as a proxy for market demand, but they also argue that manufacturing density can be served as a proxy for agglomeration economies. Their empirical results show that the more dense the manufacturing activity (the higher level of agglomeration economies), the more likely is FDI to occur.

Wheeler and Mody (1992), on the other hand, studies the manufacturing investments by U.S multinationals in the 1980s. The authors use degree of industrialization, level of FDI and infrastructure quality as agglomeration benefit indices in the econometric test and the results suggest that agglomeration economies are indeed the dominant influence on investor calculations.

Head et al. (1995) also use the conditional logit method like Coughlin et al. (1991) to estimate a location choice model using data from 751 Japanese manufacturing plants built in the U.S in 1980s. Their estimations support the argument that agglomeration externalities play an important role in location decisions with an increase of 10% in any of their agglomeration measures leading to a chance of 5-7% increase in future selection. Moreover, agglomeration effects seem to be much more beneficial than inter-state differences in terms

of natural resources, labour cost and infrastructure quality. The geographic extent of manufacturing agglomeration also helps to increase the level of industrial activity in neighbouring states.

Agglomeration effects in FDI location choice in China have been investigated in numerous papers. Head and Ries (1996) tries to quantify the role of agglomeration economies which lead to a phenomenon of self-reinforcing FDI. Using a sample of 931 foreign ventures established from 1984 to 1991 in 54 Chinese cities, their estimation results support the FDI agglomeration hypothesis and assert that agglomeration effects considerably magnify the role of local incentives. Incentive zone status attracted 30% more foreign investment than otherwise and the gains attributable to incentives decline to 13% in the absence of agglomeration effects.

Cheng and Kwan (2000) confirms the phenomenon of self-reinforcing FDI in China found earlier in Head and Ries (1996). Applying Chow's (1967) partial adjustment model to estimate the effects of the determinants of FDI in 29 Chinese regions from 1985-1995, Cheng and Kwan (2000) finds a strong self-reinforcing effect of FDI on itself. Various other papers like Chunlai Chen (1997d) and Wei et al. (1999) also show a strongly significant, positive relationship between agglomeration economies and FDI inflows into a region in China.

2.2.2 Empirical studies for comparative advantage

Comparative advantages in FDI locations include a wide set of variables: GDP (or GNP) per capita, human capital or literacy rate, labour cost or wage rate, infrastructure, exchange rate, geopolitical risk and international relationship etc. However, as the theme of my thesis focuses on FDI location choice within China, variables that affect FDI inflows for the whole

country like exchange rate or political risk are out of my interest. Instead, I will concentrate on the following popular and relevant variables for my study: GDP or GNP per capita[12], human capital, wage rate and infrastructure.

* *GDP per capita*: empirical papers usually use this variable to capture the local market size or demand strength. It is widely argued that big market size will attract horizontal FDI firms with an aim to serve the local needs. However, as it is noted in Coughlin and Segev (2000), determining a firm's market is really difficult. Furthermore, within a particular market, supply is also an important factor, and therefore it is more precise to use demand/supply ratio to capture a market's desirability for a firm's output. Thus, we should keep in mind that while this variable is a rough proxy for market strength, it is not necessary so.

Empirical studies in various countries present similar results. Studies for the case of the U.S in Coughlin et al. (1991), Wheeler and Mody (1992), or for the case of the U.K and France in Hill and Munday (1995) find a significantly positive relationship between market size and foreign investment. Papers investigating FDI location choice in China such as Broadman and Sun (1997), Chunlai Chen (1997d) , Wei et al. (1999), Cheng and Kwan (2000), and Coughlin and Segev (2000) all show that larger regional income per capita is associated with higher level of FDI. Broadman and Sun (1997) can even point out that one percent increase in the market size of the province may lead to almost one percentage point more FDI into the region.

* *Human capital*: The quality of the skills of the labour force influences foreign investors' location decisions as regions with highly skilled workers would be expected to be more

[12] In the context of my thesis, this variable is provincial GDP per capita.

attractive to FDI, all other things equal. This quality is most easily measured by education levels. However, the criteria for education levels in various papers are not the same. While most papers use the ratio of the number of primary school pupils (or lower secondary school, upper secondary school or even college students) to total population as the proxy for human capital, Broadman and Sun (1997) and Coughlin and Segev (2000) uses illiteracy and semi-illiteracy rate.

The results in Broadman and Sun (1997) and Coughlin and Segev (2000), as expected, exhibit a negative, statistically significant relationship between illiteracy rate and regional FDI inflows in China. However, when Cheng and Kwan (2000) uses the ratio for three different levels of education (primary, secondary and upper secondary) separately and all the results for each three are statistically insignificant, though they have expected positive sign.

* *Wage rate*: All else equal, lower wage rate will attract foreign firms, especially export-oriented foreign invested firms which aim to exploit the advantage of cheap labour cost. However, we should be aware that low wage rate might be accompanied by lower productivity, and thus the effective wage rate is not low. Therefore, it is ideal if the productivity is controlled in the regression analysis.

Past studies of FDI have found rather conflicting results for the effect of wages, likely due to some extent to the omission of a productivity variable. For example, using state level data, Luger and Shetty (1985), Coughlin et al. (1990 and 1991), and Friedman et al. (1992) found wages to be a negative determinant of FDI in the United States as expected. Nevertheless, Smith and Florida (1994) found the wage rate to be a positive, statistically significant determinant of Japanese automobile-related factories using county level data for the United States. But when Woodward (1992) includes a specific productivity measure for wage rates

in his study of the location of Japanese manufacturing start-ups, the finding is negative, statistically significant. Ondrich and Wasylenko (1993) did not find a statistically significant relationship between wage rates and FDI in the United States.

Regarding the case of China, Broadman and Sun (1997) finds a positive, statistically insignificant relationship between wages and FDI inflows. Broadman and Sun (1997) did not explicitly include the measure of worker productivity, but even when Head and Ries (1996) has controlled for productivity differences, its result is still insignificant. On contrary, Coughlin and Segev (2000) and Chunlai Chen (1997) both find wage rates a negative and statistically significant determinant of FDI as expected. Chunlai Chen (1997) uses average provincial wage divided by the host province's overall industrial productivity, while Coughlin and Segev (2000) only uses average annual wage in each province in the regression model.

* *Infrastructure*: It is quite natural for an investor to consider a region's infrastructure development before they decide to invest as good infrastructure helps to increase productivity and lower total transportation cost. Infrastructure may cover a variety of dimensions, ranging from highways to waterways, or from railroads to telecommunication systems, and even from seaports to airports. Many papers just calculate the total length of transportation routes (highways and railways) within the province and then normalised by provincial geographical size. Some papers include interior waterways in the calculation, and some papers calculate each of the three measures separately. Coughlin and Segev (2000), in addition to total length of highways in a province divided by its area, takes the number of total staff and workers in state-owned units of airway transportation in a province divided by its population. Head and

Ries (1996) uses the number of 10,000-ton capacity deep-water berths to capture the importance of transportation facilities for exports, together with railroads and airports.

Using state level data in the United States, Coughlin et al. (1991) finds statistically significant, positive relationship between FDI and three separate measures of transportation infrastructure. Wheeler and Mody (1992) suggests the overriding importance of infrastructure development in developing countries in attracting investment from U.S multinationals. Head and Ries (1996) can also report similar results for Chinese cities. Broadman and Sun (1997), Chunlai Chen (1997d), Wei et al. (1999), Cheng and Kwan (2000) all produce significantly expected results for infrastructure, while Coughlin and Segev (2000) finds that roadway per area and staff in air transport industry are statistically insignificant.

2.2.3 Empirical studies for location tournaments

As mentioned earlier, "location tournaments" may include policy adjustments, promotional campaigns and policy incentives offered by local authorities to attract investment from multinational firms. To capture these phenomena, Wheeler and Mody (1992) uses quite a few variables representing the openness of an economy: restrictions on imports, export requirements, price controls, local content requirements, expropriation risk, currency convertibility, profit repatriation controls and limits on foreign ownership/new investment. Their findings are rather paradoxical when short-run incentives have limited apparent impact on location choice by U.S multinationals. Nevertheless, Coughlin et al. (1991), a study of the location decision of foreign firms investing in manufacturing sector in the United States from 1981 to 1983, finds expected result when it shows strong evidence that higher taxes deterred foreign investment and promotional expenditures by the government are positively related to FDI.

However, variables used in Wheeler and Mody (1992) can hardly be applied when we investigate the location choice decisions within the boundary of one country. In the case of China, an important instrument the local authorities usually exercise is the establishment of special zones where foreign investors can enjoy generous benefits in the forms of lower land prices and tax breaks. These zones can have different names, such as Special Economic Zones (SEZs), Economic and Technological Development Zones (ETDZs) or High and New Technology Development Zones. Hu (2007) suggests that the technology park initiative and policies to attract FDI are strongly complementary policy instruments. Since the amount of FDI a region receives can be used as a criterion to evaluate the local government officers' performance, local Chinese authorities compete in the FDI location tournament by providing lower tax rates and cheaper land prices, particularly in these economic and technology zones.

As a result, numerous papers investigating FDI location choice in China consider the roles of SEZs and ETDZs as location tournament. For example, Head and Ries (1996) uses dummy variable for incentive zones to capture the benefits of tax breaks. Their finding is that the incentive effect is strong and non-declining and early recipients of incentive zone status can attract up to 30% more investment than they would have in an incentive-free environment. Cheng and Kwan (2000) takes SEZs as a single variable while groups all other zones into one. They can also find significantly positive coefficients for the two variables as expected.

2.3. Further contributions in my thesis

As we can see through literature review, most of the key papers investigating FDI location choice in China were published quite some time ago. Since then, no more well-known research has been done to update whether there is any change in FDI location choice in China. Furthermore, most published papers used rather simple ways to capture the fact that

coastal provinces clearly receive more FDI than interior provinces. For example, Broadman and Sun (1997), Chunlai Chen (1997d) and Coughlin and Segev (2000) just include a dummy variable for coastal provinces to capture the advantages of being on the coast line of 12 provinces, or Cheng and Kwan (2000) uses dummy variable for provinces with SEZs and/or ETDZs. All results, of course, show that coastal provinces or provinces with SEZs/ETDZs attract much more FDI than others. My approach in this thesis is to use tax information in industrial parks to examine local incentives offered to foreign investors.

However, analysing Table 1 we can clearly see that the number of FDI firms (both from NON-HMT and HMT[13]) and stock of FDI in coastal provinces are much larger than those in interior provinces. One of the interesting things is while in coastal provinces the mean of the number of NON-HMT firms is much smaller than the mean of the number of HMT firms, it is opposite in interior provinces. This raises a question whether NON-HMT investors behave differently from HMT counterparts across China, or across China coastal regions and interior regions[14].

To sum up, though my first research question is nothing new compared to those in literature review, I attempt to examine whether there is any change when we have more updated data. Regarding my second research question, I try to discover the differences between the two groups of investors from NON-HMT countries and from HMT, which has been ignored so far

[13] In my thesis, I divide foreign invested firms in China into two groups: the first group includes foreign invested firms from Hongkong, Macau and Taiwan (HMT) and the rest is NON-HMT group.

[14] I would like to take this opportunity to acknowledge the ideas raised in Hu, A.G. and R.Owen, "Gravity at Home and Abroad: Regional Distribution of FDI in China", National University of Singapore, 2007, Mimeo.

in literature. In addition, I also hope to specify the change(s), if any, in the preferences of foreign investors when they move into interior provinces.

Table 1: Summary statistics

	Coastal			Interior		
Variable	**Mean**	**Std.Dev**	**Obs.**	**Mean**	**Std.Dev**	**Obs.**
N of FDI firms	3219	3157	165	249	228	255
N of NON-HMT firms	1119	645	121	121	116	187
N of HMT firms	1548	2000	121	117	124	187
FDI stock	15450.25	25522.99	253	1403.48	2240.9	392
GDP per capita	6621	5645	220	2343	1288	340
Wage	9640	9149	253	6876	5733	391
Capital/Labour	35537	41254	220	15039	12961	340
Infrastructure	0.489	0.292	253	0.232	0.191	391
Human capital	477	113	253	482	127	391
Tax rate	0.049	0.021	110	0.051	0.018	147

Source: author's calculation based on various issues of China Statistical Yearbook

Note:

- FDI stock: million USD

- GDP per capita, wage and capital/labour: Yuan

- Infrastructure: kilometre/squared kilometre

- Human capital: number of high school students/10,000 population

Chapter III: First Differenced Generalised Methods of Moment Model

I intentionally use two empirical models in my thesis, the first one is first-differenced Generalised Methods of Moment (GMM) and the second one is Poisson quasi-maximum likelihood estimation (QMLE). The first model is used to capture the dynamic process of FDI, or self-reinforcing FDI effects, in China. The second model is used to identify the determinants of location choice underlying FDI equilibrium stock.

3.1 First-differenced Generalised Methods of Moment (GMM) model

I apply Chow's (1967) partial adjustment model to analyse the Chinese FDI data from 1985 to 2007. Let Y_{it} be the stock of FDI in region *i* at time *t* and Y_{it}^* the corresponding equilibrium or desired stock. We focus on capital stock as the profitability of investment depends on the marginal return to capital, which is a decreasing function of the capital stock. We assume that the flow of investment serves to adjust Y_{it} towards Y_{it}^* according to the following process:

$$d \ln Y_{it}/dt = \alpha(\ln Y_{it}^* - \ln Y_{it}),\ 0< \alpha <1 \qquad (1.1)$$

Equation (1.1) says that the percentage change of the FDI stock is proportional to the difference between $\ln Y_{it}^*$ and $\ln Y_{it}$. We have $d \ln Y_{it} = dY_{it}/Y_{it}$, so (1.1) can be rewritten as:

$$dY_{it}/dt = \alpha Y_{it}(\ln Y_{it}^* - \ln Y_{it}),\ 0< \alpha <1 \qquad (1.2)$$

Equation (1.2) says that if the gap between Y_{it} and Y_{it}^* is hold constant, the rate of change of FDI stock is proportional to the existing stock. The term Y_{it} on the right hand side of (1.2) represents a self-reinforcing or "positive feedback" effect. This effect is consistent with

agglomeration effect, which means that FDI attracts further FDI as emphasized in literature review.

In this partial equilibrium model, Y_{it} is taken to affect its own future value, not Y_{it}^*. However, the term ($\ln Y_{it}^* - \ln Y_{it}$) implies that the self-reinforcing effect of Y_{it} will diminish when the actual stock approaches the desired stock, which captures a process of gradual adjustment toward desired stock. Therefore, the positive feedback effect and gradual adjustment in our model will interact to determine the actual path of adjustment. As they both point in the same direction through a product term, we cannot decompose their individual contribution to the actual investment flow.

Conditional on a particular level of the equilibrium stock ($Y_{it}^* = Y_i^*$ for all t), equation (1.1) can be solved as a differential equation:

$$Y_{it} = \exp(\ln Y_t^* - \exp(-\alpha t)) \tag{1.3}$$

Equation (1.3) describes the natural growth of the FDI stock which would have prevailed had there been no change in factors that shift the desired stock. Equation (1.1) therefore includes two elements that account for the accumulation of FDI. First, the self-reinforcement effect and the adjustment effect drive the FDI stock towards a desired level. Second, the equilibrium level itself shifts as a result of changes in the environment.

In empirical applications, equation (1.1) is replaced by the discrete version:

$$y_{it} - y_{it-1} = \alpha(y_{it}^* - y_{it-1}) \tag{1.4}$$

where lower case letters stand for logarithmic values.

After collecting terms we have: $y_{it} = (1 - \alpha)y_{it-1} + \alpha y_{it}^*$ (1.5)

As $0 < \alpha < 1$, the adjustment process in equation (1.5) will be stable (non-explosive and non-fluctuating)[15].

To estimate equation (1.5), we need to specify the determinants of y_{it}^*. On the basis of existing literature on the location choice of FDI decision, both theoretical and empirical, we can postulate that y_{it}^* is a function of region *i*'s regional GDP per capita, human capital, wage rate, infrastructure, capital-labour ratio and tax policies. Regional GDP per head measures the power of market demand of a province and higher regional GDP per head will help to attract foreign invested firms with an aim to serve the local needs. As a large share of FDI in China has been in manufacturing with labour intensive nature, we may predict that cheap labour cost is an important determinant for the decision of location choice. In my thesis, I use average annual wage[16] in each province to capture the effect of cheap labour cost. The next variable is the human capital and I use the ratio of the number of high school students to total population in a province as a proxy. The last variable for comparative advantage is infrastructure and I only use the sum of total lengths of highway and railroad divided by the regional land area. Some papers include waterway and sea ports in the calculation, but I would not follow suit as adding waterway and seaports will be biased in favour of coastal provinces.

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[15] The solution in general form for equation (1.5) is $y_{it} = y_{i0}(1-\alpha)^t + y_{it}^*$ where y_{i0} is the initial value of y_{it}. If $\alpha>1$then $y_{i0}(1-\alpha)^t$ will fluctuate (negative and positive) when t goes to infinitive; hence the adjustment process of y_{it} towards y_{it}^* will be fluctuating. If $\alpha<0$, then $y_{i0}(1-\alpha)^t$ will go to infinitive when t goes to infinitive; hence y_{it} will explode. The cases when α equals 0 or 1 are obvious: we cannot have an adjustment process in these two cases. Then the assumption $0<\alpha<1$ is to ensure y_{it} converges to y_{it}^* in a smooth process.

[16]Average annual wage refers to the average wage in money terms per person in a certain year for staff and workers in enterprises, institutions, and government agencies, which reflects the general level of wage income in that year and is calculated as follows: average annual wage equals total wage bill of all workers and staff in a certain year over average number of workers and staff in that year. (Source: China Statistical Yearbook 2008).

The capital-labour ratio positively correlates with the degree of industrialization of the province. It is easier for foreign invested firms to form linkages when the degree of industrialization is greater. On the other hand, the capital-labour ratio can be a proxy for manufacturing density, and as it is argued in Coughlin et al. (1991) this variable can help to examine the agglomeration effects as well. The calculation for this ratio is the total value of capital assets in each province over its total labour force[17].

As stated earlier, local governments in China compete in FDI tournament by offering lower tax rates and cheaper land-use right, especially in SEZs and ETDZs[18], because the amount of FDI inflows into a region will be used to evaluate the performance of local officials. The magnitude of the local governments' attempt to attract FDI is measured by the tax rate that an average foreign invested firm expect to pay in the technology parks. However, in my model I use the information on the tax revenue of these parks and their total industrial output to calculate the proxy for tax incentives. The ratio of the two variables can help us capture the level at which local authorities are willing to give up tax revenue in exchange for FDI. The reason I choose this proxy is though the announced official tax rates are basically the same across SEZs and ETDZs, local authorities may offer "implicit" extra benefits to foreign investors in their actual enforcement. Hence, I predict this proxy can have more explanatory power than the tax rates themselves.

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[17] One may also argue that capital-labour ratio can possibly be correlated with wage as higher capital-labour ratio means higher labour productivity, thus higher wage. However, this ratio will be controlled in the regression to deal with the correlation issue.

[18] Statutory enterprise income tax rate is 33%, but in SEZs and ETDZs this rate is only 15%. Coastal cities and provincially established zones can lower the rate to 24%. In addition, enterprises that export at least 70% of the output or "hi-tech" enterprises may enjoy the tax rate below 10%. Tax holiday is also granted for the first two profitable years.

So the equilibrium stock can be expressed as:

$$y^{*}_{it} = \pi' x_{it} + \lambda_i + \gamma_t + \varepsilon_{it} \qquad (1.6)$$

where π is a vector of parameters; λ_i and γ_t are unobserved region-specific and time-specific effects respectively; ε_{it} is a random disturbance. Substituting (1.6) into (1.5) we have a dynamic panel regression for empirical implementation:

$$y_{it} = (1-\alpha)\, y_{it-1} + \beta' x_{it} + u_{it} \qquad i=1,2,..,N \text{ and } t=2,3,...,T \qquad (1.7)$$

where $\beta = \alpha\pi$, $u_{it} = \alpha\lambda_i + \alpha\gamma_t + \alpha\varepsilon_{it}$

Equation (1.7) is a dynamic panel data regression with a lagged dependent variable on the right-hand side. It is important to ascertain the serial property of the disturbances in the context of a dynamic panel data. Moreover, the problem of reverse causality needs to be addressed by dealing with the potential endogeneity of the explanatory variables arising from the feedback effects of FDI.

The above-mentioned issues can be solved under first-differenced Generalised Methods of Moment (GMM) framework[19]. The approach starts with the first-differenced version of equation (1.7):

$$\Delta y_{it} = (1-\alpha)\Delta y_{it-1} + \beta' \Delta x_{it} + \Delta u_{it} \quad i=1,2,...,N \; ; \; t=3,4,...,T \qquad (1.8)$$

in which the region-specific effects are eliminated through differencing.

[19] Arellano and Bond (1991), Arellano and Bover (1995), Blundell and Bond (1998)

Under the assumption of serial uncorrelated level residuals, values of y lagged for two periods or more will be qualified as instruments in the first-differenced system, implying the following moment conditions:

$$E(y_{it-s}\Delta u_{it}) = 0 \quad t=3,4,...,T \text{ and } s \geq 2 \tag{1.9}$$

But GMM estimation based on equation (1.9) alone can be highly inefficient. In most cases, it is necessary to make use of the explanatory variables as additional instruments though this may lead to critical issue of endogeneity due to reverse causality. For strict exogenous explanatory variables, both past and future Δx are valid instruments:

$$E(\Delta x_{it-s}\Delta u_{it}) = 0 \quad t=3,4,....,T \text{ and all } s \tag{1.10}$$

However, using equation (1.10) with $s<2$ will lead to inconsistent estimates if reverse causality exists. To allow for this possibility, we may assume x to be weakly exogenous (i.e. $E(x_{is}\alpha\varepsilon_{it})=0$ for $s<t$) and then we have the following subset of equation (1.10):

$$E(\Delta x_{it-s}\Delta u_{it}) = 0 \quad t=3,4,....,T \text{ and all } s>2 \tag{1.11}$$

Equations from (1.8) to (1.11) imply a set of linear moment conditions to which the standard GMM methodology applies. The consistency of GMM estimators depends on the validity of these moment conditions. We use the Sargan test to check the validity of these moment conditions. The null hypothesis of no misspecification is rejected if the minimized GMM criterion function registers a large value compared with a chi-squared distribution (with the degree of freedom equal to the difference between the number of moment conditions and number of parameters). We can also conduct the Sargan difference test to evaluate the validity of extra moment conditions in a nested case. Strict exogeneity implies extra moments

over that of weak exogeneity. If these extra moment conditions are rejected by the Sargan-difference test, the stronger assumption of strict exogeneity might be irrelevant.

The serial correlation property of the level residuals can be checked by Arellano-Bond m_1 and m_2 statistics. If the level residuals were indeed serially uncorrelated, the first-differenced residuals in equation (1.8) would follow a MA(1) process, implying that autocorrelations of the first-order are non zero but the second or higher order are zero. The Arellano-Bond m_1 and m_2 statistics test the null hypotheses of zero first-order and second-order autocorrelation respectively. An insignificant m_1 and/or significant m_2 will tell us the likely presence of invalid moment conditions due to serial correlation in the level residuals.

3.2 Data

All provincial data are collected from various issues of the China Statistical Yearbook and the latest one is China Statistical Yearbook 2008. I can collect the data for the number of foreign invested firms from 1993 to 2007, but the data for the number of foreign invested firms in NON-HMT and HMT subcategories are available from 1993-2003 only. The tax information is obtained from MOST (2001). Missing information on tax revenue from 2001 to 2007 is a limitation in my thesis. However, this is all I can find within my utmost effort.

Three provinces are excluded in my thesis for different reasons. Tibet is excluded because there is so little FDI in this region that it is not worth examining. Hainan was divided from Guangdong in 1988 and most of the data for Hainan are about 1% of those for Guangdong, which does not make any difference in our analysis. On contrary, though Chongqing was separated from Sichuan in 1997, I still sum up the data of these two regions and treat Chongqing as part of Sichuan for consistency in the database. The reason is Chongqing

accounts for about 30% of total amount of FDI stock and combined number of foreign invested firms in Sichuan and Chongqing as a single administrative unit.

3.3 Regression results

The results of estimation by GMM are reported in Table 2. The null hypothesis in the Sargan test of over-identifying restrictions is rejected because of the large value of chi-squared of 247.23. Therefore, there is no misspecification and the moment conditions are valid, implying that GMM estimators are consistent. Arrellano-Bond m_1 and m_2 statistics are significant and insignificant respectively, which tells us that there is likely no presence of invalid moment conditions due to serial correlation in the level residuals. Being aware that GMM estimation based on equation (1.9) alone might be unstable, I run the regression with the fixed effects model (the Hausman test with large chi-squared of 55.01 rejects the null hypothesis in favour of the random effects model) for the same data and the results are almost similar in terms of signs and significant levels. Therefore, the GMM estimation in Table 2 can be said to be reliable.

Results in Table 2 can confirm that there exist self-reinforcing effects of FDI stock in China. The current FDI stock is positively associated with past FDI stock at high significant level, which is consistent with findings in many other papers like Cheng and Kwan (2000). The coefficient of 0.626 for logarithmic value of FDI stock implies that if FDI stock in a certain region increases by 10%, the FDI stock in the next period of this region will be possibly 6.26 percentage points higher. However, the capital-labour ratio has shown unexpected sign at significant level of 90% with the coefficient of -0.12[20]. Wage and GDP per capita variables

[20] More explanations will be given in the next chapter.

have expected signs with high level of significance; however, the magnitude of GDP per capita variable is 2.355, almost four times higher than that of wage variable. Among all variables, the coefficient of GDP per capita is the highest and it shows that a 1% increase in GDP figure of a province may lead to an impressive increase of 2.355 percentage points of FDI stock of that province in the next period. High wage rate will have a negative impact on FDI stock with a 1% increase in wage rate probably resulting in a slight decrease of over half a percentage point of FDI stock in the next period. The results for infrastructure and tax are statistically insignificant, but the sign for infrastructure is negative, which is opposite from our expectation. Though the result for tax is negative as expected, its coefficient of -0.006 is too small to have any practical impacts. Most surprisingly, human capital has an opposite sign with high significant level. If the logarithmic value of the ratio of high school students in a province is 1% higher, its FDI stock is predicted to be 1.346 percentage points lower in the next period. I have actually tried two other ratios of the total number of primary and college students over total population in the regression. The results are insignificant and positive as expected for primary school enrolments, but the ratio for college students produces similar results as the results for the ratio of high school students. This issue, together with others, will be discussed in more depth in the next chapter.

Table 2: Determinants of FDI location – GMM

	GMM	GMM	FIXED
Log(FDI stock)	0.599***	0.626***	0.679***
	(0.0454)	(0.0429)	(0.0442)
Log(wage)	-0.659***	-0.528***	-0.223**
	(0.157)	(0.134)	(0.109)
Log(GDP per head)	2.356***	2.355***	1.658***
	(0.257)	(0.232)	(0.235)
Log(Human_Highschool)	-1.238***	-1.346***	-0.923***
	(0.169)	(0.162)	(0.162)
Log(Infrastructure)	-0.153	-0.117	-0.0305
	(0.16)	(0.158)	(0.146)
Log(Tax)	-0.018	-0.00589	0.00989
	(0.0312)	(0.0305)	(0.0313)
Log(capital-labour)	-0.132**	-0.120*	-0.0765
	(0.0644)	(0.0634)	(0.0691)
Log(Human_Primary)	0.126		
	(0.123)		
Log(Human_University)	-0.207*		
	(0.122)		

Standard errors are in bracket.

*-significant at 90% level; **-significant at 95% level; ***-significant at 99% level.

Chapter IV: Poisson Quasi-Maximum Likelihood Estimation Model

4.1 Poisson quasi-maximum likelihood estimation (QMLE) model

As stated earlier, the first-differenced GMM model is used to mainly capture the dynamic process of FDI, or self-reinforcing FDI effects. The regression results for human capital, infrastructure, tax and capital-labour ratio variables are somehow unexpected or unexplainable. Therefore, I use Poisson QMLE model to identify the determinants of location choice underlying FDI equilibrium stock. The model is based on three hypothesis of FDI location: agglomeration effect, regional comparative advantage and location tournament. I model FDI as the number of foreign invested firms[21] in a province and we can see that the number of foreign invested firms registered each year can be treated as a count variable with the same length of observation time. As the normal distribution for count data is the Poisson distribution, I can have a basic model formulation in which the mean of the number of foreign invested firms is determined by:

$$E(FDI_{it}) = \exp(\beta_i X_{it-1}) \tag{2.1}$$

Take log for both sides we have:

$$\text{Log}(E(FDI_{it})) = \beta_i X_{it-1} \tag{2.2}$$

where dependent variable $E(FDI_{it})$ is the expected value for the number of registered foreign invested firms and X_{it-1} consists of three groups of determinants of FDI: agglomeration, comparative advantage and location tournament. The variables for comparative advantage and location tournament are the same as those in GMM model. One of the two variables to

[21] I follow Arthur (1990) which captures agglomeration economies through the number of firms in a location.

test agglomeration effects is the log of accumulated FDI in a region. The larger existing stock of FDI in a province up to the last period, the more attractive a province it is in the eyes of future foreign investors. From our functional form we can find a proportional relationship between the number of foreign invested firms in a province and its existing stock of FDI ($\%\Delta E(FDI_{it}) \sim (100\beta_i)\Delta X_{it-1}$). Similar to what I have done in GMM model, the other variable to capture agglomeration effects is the capital-labour ratio in each region.

As equation (2.1) is nonlinear in its parameters, we cannot use linear regression methods. We may use nonlinear least squares, but this method does not exploit the fact that all standard count data distributions exhibit heteroskedasticity. Therefore, we will rely on maximum likelihood and the important related method of quasi-maximum likelihood estimation. Though Poisson distribution has a very nice robustness property (β_j are consistent and asymptotically normal estimators whether or not the Poisson distribution holds), Poisson MLE analysis is often too restrictive with the Poisson variance assumption $\text{Var}(y|x) = E(y|x)$. This assumption is usually violated and leads to smaller, incorrect standard errors. Therefore, when we do not assume the Poisson distribution is entirely correct, we use Poisson quasi-maximum likelihood estimation (QMLE) analysis in our regression to get robust standard errors.

4.2 Regression results and discussion

4.2.1 Agglomeration, comparative advantage or policy?

The results of estimation by Poisson QMLE method with robust standard errors are reported in Table 3 and Table 4. In Table 3, in addition to the columns showing regression results for two separate groups of foreign invested firms (HMT and NON-HMT) and a column for

results without tax variable, I include a column of GMM estimation results to compare the two models[22]. Table 4 presents the estimation results for two groups of foreign invested firms in coastal provinces and inland provinces.

As we can see in Table 3, while the coefficients of GDP per capita are positive in both models, it is statistically insignificant in Poisson QMLE model and highly significant in the other. Moreover, the coefficients of GDP per capita also change dramatically from 2.355 in GMM model to only 0.56 in Poisson model. The case of tax variable is opposite; it is statistically significant in Poisson QMLE model but insignificant in GMM model, though both produce expected negative sign. As I mentioned earlier in the previous chapter, the magnitude of tax variable in GMM model was too small to have any practical impacts. However, under the Poisson model, tax variable turns out to be a strong determinant with the coefficient of -3.724, which means a decrease of 1% in the ratio between tax revenue and industrial output of industrial parks in a province might be associated with a 3.724 % increase in the logarithmic value of the average number of FIEs in the province.

Both models can confirm agglomeration effects in which previous FDI stock can positively affect future FDI inflows in a region, though the coefficient in GMM model is slightly larger (0.626 compared to 0.42). Capital-labour ratio has unexpected sign but it is insignificant in Poisson estimation, which means we cannot confirm the existence of upward or downward linkages among firms, both foreign and local, in China. It is worth noted that the capital-labour ratio is calculated with the total value of capital assets in each Chinese province over

[22] As the dependent variable is the mean of the foreign invested firms in year *t*, there might be fixed locational effects which are not taken into account in the Poisson QMLE regression. Hence comparing Poisson QMLE regression results with those from GMM fixed effects model can possibly help to figure out whether fixed locational effects, if any, in Poison QMLE model may significantly divert the findings.

its total labour force, therefore I cannot say anything about upward or downward linkages among foreign investors themselves. In GMM estimation, capital-labour ratio is statistically significant with the coefficient of -0.12, which is opposite from expectation in agglomeration theories. This is also against findings in Henderson (1986) which indicates that more dense manufacturing activities will improve productivity of resources in any industry and hence more investors will be attracted. One possible explanation is foreign investors are against the incentives to set up linkages with local manufacturers, instead they wish to congregate in special locations designated for foreign investors only. Another surprising finding is that the negative impact of human capital with high level of significance against FDI inflows can be found in both models. However, the absolute value of the coefficient in the Poisson model is much smaller (-0.002 compared to -1.346). This reminds me of a result in Cheng and Kwan (2000) in which the authors found no significant relationship between education and FDI. Similar to what I have done in GMM model, I also tried to use the ratios between the total number of primary students and college graduates over the total provincial population separately in the regression, but similar results or insignificant results were reported. This is rather counter intuitive as when wage rate is controlled, higher level of education means higher labour quality and productivity, which possibly attracts more foreign investors. Infrastructure is found to be statistically insignificant in both models, similar to the finding in Coughlin and Segev (2000) though the coefficient in Poisson model is positive as expected whereas it is negative in GMM model. The role of wage rate in two the models is almost the same in terms of coefficient and significant level, which means the two models can confirm the negative relationship between wage rate and FDI inflows in China.

Tax incentives can strongly affect FDI location choice of foreign investors. The coefficient of tax variable in Poisson model shows a significant negative effect on FDI inflows, which

means higher tax revenue over total industrial outputs in technology parks may discourage foreign investors. Moreover, the presence of tax variable in the Poisson model can tell us something interesting. As we can see in Table 3, adding tax variable leads to dramatic change in the significant level of FDI stock and GDP per capita variables. The coefficient of FDI stock becoming statistically significant when we include tax variable can be interpreted that self-reinforcing effects of FDI would exist only when the local government had provided greater tax incentive. This may also mean that tax incentive magnify the role of agglomeration economies, while the finding in Head and Ries (1996) is opposite: agglomeration effects magnify the role of local incentives. Similarly, tax incentive may outweigh the benefits of the strong local market demand when adding tax variable in the regression leads to a change from statistically significant level to statistically insignificant level of GDP per capita variable. Moreover, the coefficient of GDP per capita variable when adding tax incentive is nearly four times lower than that if tax incentive is excluded in the regression. With the absence of tax incentive, GDP per capita is the most influential determinant with the largest magnitude of 1.9, but then it turns out to be insignificant with a small coefficient of 0.56 when tax incentive is included in the regression. Meanwhile, Wheeler and Mody (1992) implies that developing countries which are doing well in offering comparative advantages do not need location tournaments to attract U.S multinationals.

In short, the results I have obtained in both models can confirm the self-reinforcing effects of FDI and location tournaments. Another proxy for agglomeration economies, i.e. capital-labour ratio, shows an opposite finding in comparison with theoretical and empirical studies, but there may exist a valid reason for this fact. For comparative advantage, wage rate and GDP per capita can produce expected signs with statistical significance, while infrastructure and human capital variables cannot. Moreover, the unexpected finding on human capital is

rather counter intuitive and it is hard to understand what lies behind this result. Though it is really hard to conclude the dominance between agglomeration effects and comparative advantage, we can assert that tax incentive, which is a proxy for local government's effort to attract FDI, has a very strong impact on the location choice of foreign investors.

4.2.2 Hongkong, Macau and Taiwan (HMT) vs. NON-HMT investment

As mentioned earlier in the introduction section, FDI from Hongkong, Macau, Taiwan (HMT) and tax havens accounted for quite a large share of total FDI in China before 1990. However, this share has been declining steadily when investment from developed countries such as Japan, the U.S, EU and South Korea makes up most of the rest of China's FDI since early 1990s. Hongkong alone accounted for 60.9% of FDI stock in China from 1985 to 1990, but this share dropped sharply to 31.9% in the period from 2001 to 2006.

Therefore, it is worthwhile to examine the behaviours of firms from these two separate groups, i.e. NON-HMT and HMT groups. I investigate the determinants of FDI for the two groups of firms in Table 3 and Table 4 and some differences can be highlighted. While the results of Poisson QMLE regression for all foreign invested firms show that tax policy is an important determinant for location choice, it turns out to be insignificant for NON-HMT firms; whereas it is highly significant and twice larger (in absolute value) for HMT firms. HMT investment can be said to be strongly responsive to tax policy, but NON-HMT investors do not take tax issues as seriously as other determinants[23]. In addition, the magnitude of the coefficient for agglomeration economies reduces by almost 50% (from 0.575 to 0.309) and the level of significance is also much worse when we compare the NON-

[23] As earlier mentioned, this finding is similar to that in Wheeler and Mody (1992) in the case of U.S multinationals.

HMT group with the HMT group (see Table 3). This may imply that while investors from NON-HMT countries tend to prefer regions with higher FDI stock level, HMT investment shows no interest in locating in regions with high FDI density. HMT investments seem to prefer enjoying favourable tax policy instead. Insights of this issue will be discussed in more depth when I look into the behaviours of HMT investors in coastal regions in the next part.

Other two variables (wage and human capital) can also help us distinguish the two different mechanisms of FDI location choice between the two groups. While HMT investors tend to prefer regions with low-skilled workers and lower wages, NON-HMT investors pay much less attention to these factors. As we can see in Table 3, human capital is statistically insignificant for NON-HMT firms, whereas it is highly significant for HMT enterprises. However, the negative value of the coefficient of human capital variable is counter intuitive as discussed earlier and I cannot find any valid explanation for this fact. For the wage rate, though the coefficients have the same sign, the magnitude for HMT investment is much stronger than that for NON-HMT investment (-0.894 compared with -0.356). Furthermore, the result for HMT investment is statistically significant at 99% level while it is insignificant for NON-HMT investment. The fact that lower wage rate can attract more HMT firms, but not NON-HMT firms, might result from the observation that HMT investors focus more on labour-intensive industries.

I can draw moderate contrast in the behaviour of NON-HMT and HMT investors in China. Tax incentive is more effective in attracting HMT investment than NON-HMT investment. Moreover, HMT investors seem to prefer regions with low labour cost and low-skilled workers, while NON-HMT investors pay much less attention to these determinants. Finally, agglomeration effects are more important to NON-HMT investments.

4.2.3 Coast vs. Interior

As we can see in regional distribution figure, FDI has been diffusing dramatically among coastal regions with some provinces like Jiangsu, Shanghai, Shandong, Beijing etc. catching up with Guangdong in attracting FDI. However, inland regions still remain poor performers and the FDI distribution among these regions shows really little change.

I estimate the equation for Poisson QMLE model for coastal provinces and interior provinces, and then for each of the two groups in two areas[24]. The results in Table 4 can present some notable differences in driving forces of FDI location between the two areas.

Foreign investors who established ventures in China inland provinces tend to strongly favour agglomeration effects and comparative advantage, while tax has no impact on their decisions. They prefer inland provinces with low capital-labour ratio, low wage and low education level. The fact that foreign investors move to regions with low capital-labour ratio might hint their attempt to take first-mover advantages in less-developed regions (as explained earlier, the low capital-labour ratio means poor degree of industrialization of a region). However, they still want to be located near each other and the reason might be that they can benefit from previous neighbouring foreign investors in terms of information and experience sharing.

On the other hand, investors in coastal provinces are driven by tax incentives and agglomeration economies. However, dividing investors in coastal regions into two groups may reveal quite interesting issues. Though HMT investors in coastal provinces have been highly responsive to tax rates, it seems they do not care about agglomeration effects. This is

[24] In my thesis, the two words "province" and "region" are inter-changeable, while the word "area" refers to a group of all provinces whether on the coast or inland.

rather strange at a first glance as we predict one of the main reasons for HMT investment to flood coastal regions is the kind of agglomeration economies generated by the linkages between local and foreign firms sharing the same culture and coastal borders. But on second thoughts, it might be explained by the fact that investors from HMT have so close links to China's coastal provinces (especially southern coastal provinces) that they feel quite confident to navigate their business among local firms and the only important thing they need to care is tax incentive. This explanation could be confirmed when we see that agglomeration effects turn out to be quite important and significant to HMT investors when they move inland, while tax incentive is no longer their concern. In contrast, it is NON-HMT investors in coastal provinces who take into account agglomeration effects, but not tax incentive. I interpret this result as evidence that these NON-HMT investors rely on vertical linkages to the upstream and downstream industries within themselves, and another reason is they indeed need to learn good lessons of how to operate efficiently in a uniquely transitional economy like China from other foreign investors. Therefore, tax incentive plays much less an important role than agglomeration effects from NON-HMT investors' perspectives.

To sum up, foreign investors in China behave differently both between two groups and two areas. While investors in interior regions pay attention to agglomeration effects and comparative advantage, investors in coastal regions take into consideration tax incentive and agglomeration effects. However, HMT investors in coastal regions focus mainly on tax; whereas NON-HMT investors in coastal provinces prefer agglomeration effects.

Table 3: Determinants of FDI location- Poisson QMLE compared with GMM

			Poisson		
	GMM	**Poisson**	**NON-HMT**	**HMT**	**W/o tax**
Log(FDI stock)	0.626***	0.420**	0.575***	0.309	0.112
	(0.0429)	(0.195)	(0.171)	(0.205)	(0.114)
Log(GDP/capita)	2.355***	0.56	-0.847	1.652	1.904***
	(0.232)	(1.243)	(1.226)	(1.218)	(0.708)
Log(wage)	-0.528***	-0.649***	-0.356	-0.894***	-0.638***
	(0.134)	(0.229)	(0.273)	(0.227)	(0.241)
Infrastructure	-0.117	0.541	0.195	0.841	0.531
	(0.158)	(0.796)	(0.504)	(0.992)	(0.535)
Human_Highschool	-1.346***	-0.00202*	-0.00118	-0.00289**	-0.00224***
	(0.162)	(0.00107)	(0.00098)	(0.00129)	(0.00081)
Tax	-0.00589	-3.724**	-2.29	-4.517***	
	(0.0305)	(1.7)	(2.339)	(1.578)	
Log(Capital/Labour)	-0.120*	(-0.303)	(-0.222)	(-0.364)	(-0.406*)
	(0.0634)	(0.314)	(0.392)	(0.268)	(0.241)

Robust standard errors are in bracket.

*-significant at 90% level; **-significant at 95% level; ***-significant at 99% level.

Table 4: FDI location: Coast vs. Interior

	Coast			Interior		
	All	NON-HMT	HMT	All	NON-HMT	HMT
Log(FDI stock)	0.533*	0.744**	0.369	0.894***	0.897***	0.890***
	(0.291)	(0.296)	(0.276)	(0.171)	(0.189)	(0.182)
Log(capital/labour)	-0.711	-0.729	-0.654	-0.311***	-0.276***	-0.355**
	(0.833)	(0.982)	(0.738)	(0.116)	(0.0987)	(0.161)
Log(GDP/head)	0.459	-1.458	2.028	0.601	0.543	0.55
	(1.843)	(1.791)	(1.789)	(1.305)	(1.481)	(1.289)
Log(wage)	-0.0499	0.247	-0.326	-1.645***	-1.712***	-1.514***
	(0.478)	(0.512)	(0.506)	(0.473)	(0.419)	(0.585)
Infrastructure	0.413	-0.212	0.755	-1.542	-1.413	-1.659
	(0.624)	(0.478)	(0.61)	(2.521)	(3.13)	(1.994)
Human_Highschool	-0.00212	-0.00039	-0.00373**	-0.00438**	-0.00459**	-0.00432**
	(0.0015)	(0.00134)	(0.00153)	(0.00189)	(0.00216)	(0.00181)
Tax	-3.040*	-1.011	-4.306***	-0.145	0.971	-1.499
	(1.81)	(2.741)	(1.527)	(3.185)	(3.104)	(4.212)

Robust standard errors are in bracket.

*-significant at 90% level; **-significant at 95% level; ***-significant at 99% level.

Chapter V: Conclusion

The spatial distribution of FDI across Chinese provinces has been changing in the past 20 years. In particular, FDI has been diffusing fast among coastal provinces with more even distribution. However, the gap between the coast and interior in receiving FDI has been widening. In my thesis, I aim to investigate the determinants of the spatial distribution of FDI and its evolution in China in 1990s and early 2000s, together with the examination of NON-HMT and HMT investors' behaviours.

I hypothesize that the interaction of the three driving forces (agglomeration economies, comparative advantage and location tournament) has determined the geographical distribution of FDI inflows in China. Agglomeration economies imply a self-reinforcing process in which regions started with higher level of FDI stock continues to receive bigger share of FDI inflows, while regions with lower level of FDI stock hardly see any improvement in attracting FDI. On the other hand, comparative advantage may turn foreign investors' attention to regions offering lower operation cost and better infrastructure. However, the presence of agglomeration externalities may prevent firms to move to new, lower cost sites. By offering preferential policy incentives, local governments can lessen such inertia and motivate foreign firms to relocate in the designed destinations.

Using data on Chinese provincial FDI and other categories plus the information on the tax revenue in the technology parks within a province, I estimate two FDI location equations in two different models. The results in both models are almost similar and confirm the self-reinforcing effects of FDI in China. It is paradoxical when human capital turns out to be a significantly negative determinant of FDI in both models. For the case of capital-labour ratio,

it might be interpreted that foreign investors are against linkages with local manufacturers; instead, they wish to congregate in their designated zones. Though I cannot conclude whether agglomeration economies play a more important role than comparative advantage or vice versa, I find that tax policy, a proxy for location tournament, indeed has a very strong impact on the location choice of foreign investors in China.

There are also interesting differences between NON-HMT investors and HMT investors concerning their location choice. There is evidence that NON-HMT investors tend to locate in provinces with larger existing presence of FDI, both on coastal line and inland, while tax policy does not seem to play any role. On contrary, HMT firms prefer regions with low labour cost and low tax rates, while agglomeration has limited apparent effects on their location choice decisions.

The preferences of NON-HMT and HMT investors change when they move their investment into interior regions. Tax incentives seem to be an important determinant for HMT investors across China, but when we examine this group of investors in interior regions alone they do not respond to tax policy at all. Agglomeration effect for HMT investors is opposite, it is insignificant when they invest in coastal regions, but then turns out to be highly significant for HMT investors in interior regions. Both NON-HMT and HMT investors take into account the effects of wage and capital labour ratio only when they invest into inland provinces.

Updating the data does not change any results in the regression. I had run the regression with data till 2004, and then when I redid it later with updated data till 2007 the results were almost identical. This can be interpreted that the behaviours of foreign investors in China are rather persistent.

I am also fully aware that missing information on tax revenue is a drawback in my thesis. However, I have struggled in digging the data with my utmost efforts but in vain. The results found in my thesis could be improved when there is updated information available in the future.

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