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by

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The Location Decisions of Foreign Logistics Firms in China: Does Transport Network Capacity Matter?

Anthony Chin[1] and Hong Junjie[2]

Abstract

In recent years the logistic needs have created tremendous pressure on the 'hard' transport infrastructure. Logistics and the harness of information technology are the key facilitators of mobility. The Chinese logistics market is still in its infancy and creates tremendous opportunities for investors. It recognized as one of important driving forces both for national economy and business. Beijing, Tianjin, Shanghai, Shenzhen and Guanzhou aspire to be regional or international logistics hubs and have adopted preferential policies in attracting FDIs in logistics. From 1996 to 2001, foreign capital invested in transportation, storage, post and telecommunications increased from USD6.96 billion to USD15.16 billion.

This study looks at the location decisions of foreign logistics firms and identifies with the aid of a multinomial logit model factors that are crucial in attracting them to China. This is important as they have an important role to play in filling in the gap left by traditional Chinese firms, which largely concentrate, on warehousing and distribution.

The results suggest that location of logistics firms depends on transport infrastructure, market size, labor quality and cost, agglomeration economies, communication cost, economic privatization degree, as well as government incentives. The importance of the above factors varies by source of region. European and North American firms favor higher population densities, lower labor cost, convenient airway transport and large cities while logistics firms from Hong Kong, Macao and Taiwan put more emphasis on communication infrastructure.

INTRODUCTION

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The tremendous change and growth of the Chinese economy has lead to a proliferation multinationals or MNCs eager for a piece of the pie! MNCs firms have doggedly pursued manufacturing and marketing opportunities in China over the past 15 years. Often, the experience leaves them feeling like Sisyphus, the mythological figure who was doomed for eternity to push a heavy boulder up a mountain; each time he neared the top, the boulder would roll down the mountain!

The thrust of MNCs in the 1980s and early 1990s centred on ‘strategic’ considerations. It revolved around learning how to construct and consummate business deals, bringing new manufacturing capacity on line and developing sufficient knowledge of how to market both to commercial/industrial customers and to Chinese consumers. Many companies have met these challenges with dramatic results. A world-class manufacturing capacity was developed across a broad range of industries from consumer electronics to chemicals, to food products to fibres. Marketing and promotion has become increasingly sophisticated. Urban consumers are being blanketed by brand names from around the world. The next phase is to realise the investments transformed from "strategic" to economic.

In working to meet these challenges, MNCs have neglected a more pressing one that threatens to fundamentally block the success of most large-scale investments in China. This challenge is a logistical one: As transport and warehousing capacity has not kept up with growth in consumer demand, it has become increasingly difficult for manufacturers and marketers in China to get their products quickly, safely and reliably to customers. In this environment, those who can develop the means to deliver the goods stand to gain substantial competitive advantage.

One definition of logistics is the management of business operations, such as the acquisition, storage, transportation and delivery of goods along the supply chain. The Council of Logistics Management of the US defines it as, “Logistics is that part of the supply chain process that plans, implements, and controls the efficient, effective flow and storage of goods, services, and related information from the point of origin to the point of consumption in order to meet customers' requirements.” Perhaps, in addition to the above is the utilisation of technology in processing the information which will lead to the efficient procurement and distribution of goods and services and the establishment of a total support system which enhances and reduces the cost of movement.

This includes the role played by government policy in maintaining and enhancing economic competitiveness. While governments are also committed to reducing negative externalities of transport upon the environment, policy measures must designed need not only be aimed at vehicle or infrastructure, but can also be designed to influence the structure and behaviour of the supply chain and individual companies’ logistics strategies. It requires an understanding of where they will impact on the relationship between economic activity and freight transport demand at the most effective point. This understanding must be derived from insight into the drivers, barriers and enablers which affect individual firms’ logistics decision-making. These can be exemplified by examining the current trends in logistics and supply chain management. In this regard, this study attempts to ascertain an aspect in the supply chain and that is strategic location. An understanding of the factors, which affect the location of foreign logistics firms in China will assist in guiding strategic economic decisions.

The following section gives a brief introduction of the Chinese economy followed by a review of the transport and logistics infrastructure. The rest of the study will analyse the

review the literature location, followed by a multinomial logit analysis firm location choice and implications for logistics firms.

BRIEF BACKGROUND TO THE CHINESE ECONOMY

The growth of the Chinese economy can be seen as either a threat (creating a 'hollowing' out effect of regional economies) or a compliment ('pushing' regional economies up the supply chain or a growing consumer market). Its sustained economic growth can act as a hedge for the region's economies. The Asia-Pacific Economic Cooperation (APEC) and the World Economic Forum (WEF) views China as the cornerstone of economic stability in Asia. However, this will depend on two interrelated issues, terrorism and sustained recovery of the global economy with or without the resurgence of SARs, international terrorism or 'bird flu'.

Most analysts agree that China has a historic role to play. During the 1997 financial crisis as Asian currencies fell in value like dominoes, China kept steady the worth of its currency, providing a measure of stability in a stormy time but at the expense of its own external competitiveness. FDIs have increased. The Economists Intelligence Unit (EIU) estimates an annual capital inflow of near to USD50 billion in 2002. The EIU report points out that investment seeks cheap, educated labour and political stability. Asian economies and companies must seek to complement Chinese investments to reap an increase in export of capital. Connectivity and investments in transport infrastructure such as road and railway links to connect China with North and South East Asian regions is crucial. Strategic investments in hub ports and airports will consolidate its position as a logistics hub and enhance connectivity to regional hubs.

However, the Chinese economy is vulnerable, given the magnitude of bad debts. Non-performing loans account for 26.6 per cent of total lending by China's four state-owned commercial banks: China Construction Bank, Industrial and Commercial Bank of China, Bank of China and Agricultural Bank of China. All four banks issue 70 per cent of all loans and hold 80 per cent of all deposits in China. This is not managed well could cripple the fragile financial system and bring grave consequences to the country and the region.

Development of the Western Region (*Xibu Da Kaifa*)

The Great Western Development Strategy (Xibu Da Kaifa) was launched in January 2000 to attract and allocate money and other resources for the development of China's poorer, and historically more neglected, central and western regions. The provinces that lie inland from China's coast cover 56 percent of the country's land area and has 23 percent of its population (most of them the country's minorities). The per capita gross domestic product is only 60 percent of the national average. A secondary reason is to better develop the minority areas and integrate them to the rest of China. The area covered by the plan includes six provinces (Gansu, Guizhou, Qinghai, Shaanxi, Sichuan, and Yunnan), three autonomous regions (Ningxia, Tibet, and Xinjiang), and one province-level municipality (Chongqing) (also Inner Mongolia and Guangxi Zhuang Autonomous Region).

Much of China's fiscal budget is expected to shift from coastal provinces to the west. The state has allocated 70 percent, or RMB 4.78 trillion of fixed-asset investment and foreign loans into the west. The initial investment of RMB 31 billion has already been allocated for infrastructure development. While many remain sceptical about the immediate impact of this

strategy it is expected that it will take 10 to 15 years for the western regions to reach current level of economic development as experienced in the east.

Continued Growth of the Eastern Region: Impediments and challenges

A casual observation will reveal 11 'regional cities' in China comprising of metropolitan cities with populations of five to seven million. These are Shenzhen, Shanghai, Dalian, Beijing, Tianjin, Shenyang, Xiamen, Qingdao, Suzhou, Fuzhou and Dongguan. These cities are growing at 15 to 20 per cent a year and are the nucleus of six mega-regions with populations of 100 million, each sharing common dialects and histories yet competing among themselves domestically for labour and investments. If these Chinese mega-regions were nations, the GDPs of five of them would put them among Asia's top 10, surpassing Singapore, Malaysia and the Philippines.

Short of a global war and domestic socio-political instability, these cities will continue to drive the national economy for at least another 15-20 years. This fuelled by an inexhaustible supply of cheap labour and the successful implementation of economic reforms begun by former Premier Zhu Rongji. More than half of the revenues earned in Shanghai is returned to Beijing.

It is inevitable that the Chinese economy will be driven by the mega-regions and on their own would have overtaken every other Asian economy and when added together exceed Japan's as well. Asian economies have a 10 to 20-year reprieve to complement their economy China's be left behind in the global race for competitiveness. As it takes some 10 to 20 years to build up a global brand, China will be receptive to foreign investors during this period. In 2000, about USD45 billion entered China as FDI but only USD10 billion went to Japan and even less to other Asian economies.

Many of these cities possess high quality labour and managers and supervisors whose mantra was performance. Many are educated abroad. The 'regional states' are also competing to attract the tens of thousands of Chinese at overseas universities back home by offering them low-cost, fully-equipped office space in prime areas as well as introductions to venture capitalists. Even the much-maligned bureaucratic abyss in China has improved. Within the mega-region, rules and regulations are fewer than those found in places like Japan and many European economies!

However, there are prospective impediments and challenges. Corruption is still rampant and despite its entry to the WTO, it will take a long time to respect copyrights. There are also hidden problems of China's bad debt problems and its state-run enterprises. The widening gap between the small *noveau riche* and the rest of the population and unemployment from SOEs may serve as time bombs slowly ticking away. However, the next 5 to 10 years will continue to see growth at an increasing rate.

TRANSPORT INFRASTRUCTURE

The National Main Trunk Highway System

The Ministry of Communications is responsible for the development of the long-term plan for highway construction and water transport network under the 7th National Five-year Development Plan. The underlying strategies of the transportation plan are best summarized

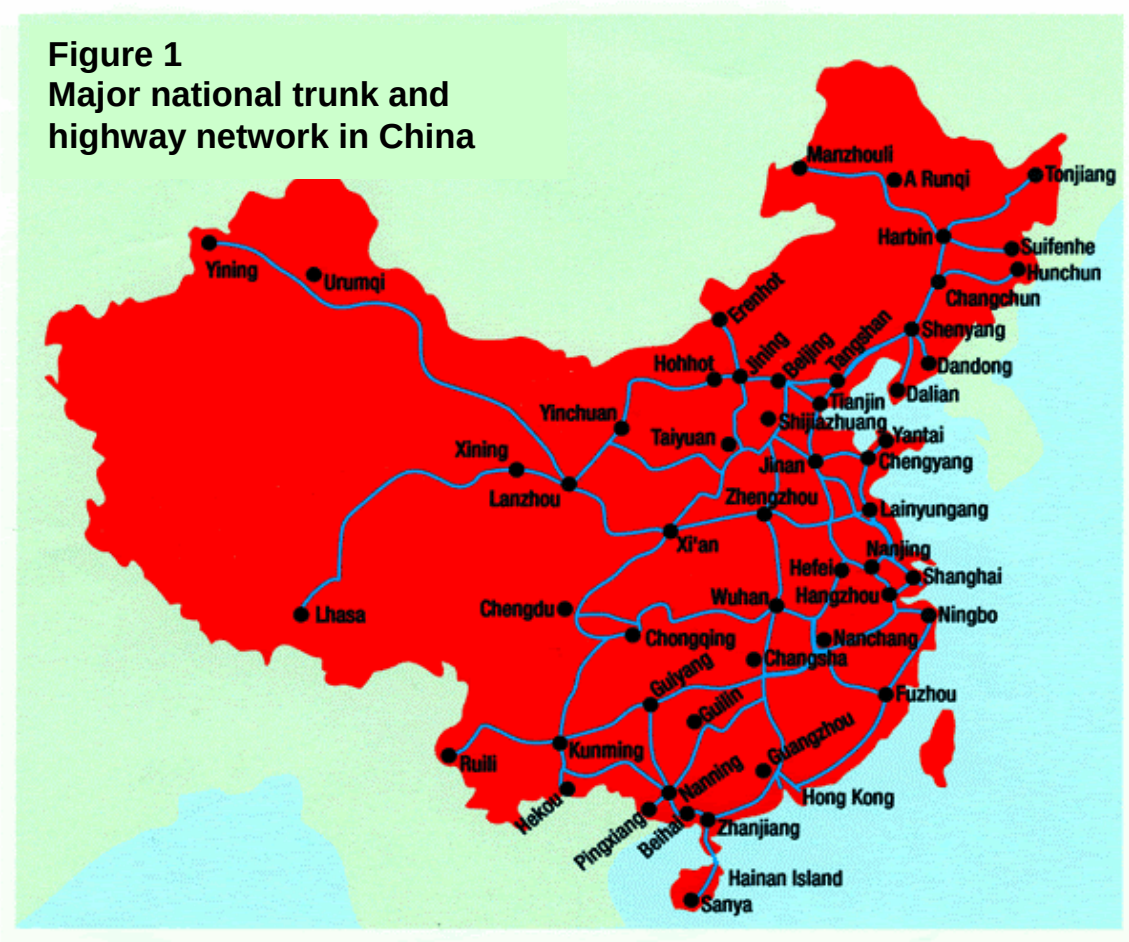
as “The three majors, one support”. The three major strategies are 1) the constructing of main trunk highways; 2) establishment of high-grade roads and 3) development of major transportation hubs, and supported by, 4) efficient administration and operations. These strategies guide the integration with other transportation sectors at every level of government. For example, the auto-only high-grade highway is an important part of highway network but it must complement to the objectives above. The strategic draft plan consisting of 12 main national trunk highways has been coined as the ‘Five-longitudinal-Seven-latitudinal Highway Strategy’ (FSHS) (see Table 1).

Table 1 The National Five-longitudinal-Seven-latitudinal Highway Strategy

Main highways	**Name of highways**	**Mileage (km)**
Five-Latitudinal	F1. Tongjiang-Sanya (including Changchun-Yunchun branch)	5200
	F2. Beijing-Fuzhou (including Tianjing-Tanggu branch and Tai’an-Huaiying link road)	2500
	F3. Beijing-Zhuhai	2400
	F4. Erlianhaoti-Hekou	3600
	F5. Chongqing-Zhangjing	1400
Seven-Longitudinal	S1. Seifenghe-Mangzhouli	1300
	S2. Dandong-Lasa(including Tianjing-Tangshan branch)	4600
	S3. Qingdao-Yinchuang	1600
	S4. Lianyungang-Hu’erkuosi	4400
	S5. Shanghai-Chengdu(including Wangxian-Nanchong-Chengdu branch)	2500
	S6. Shanghai-Ruili(including Lingbo-Hanzhou-Nanjing branch)	4000
	S7. Henyang-Hunming(including Nanning-Youyiguang branch)	2000

Source: Anhui Provincial Communications Department, Anhui Province, People’s Republic of China.

Figure 1
Major national trunk and highway network in China



The construction of 'Two-longitudinal-Two' highways (comprising of the Tongjiang-Sanya (F1) and the Beijing-Zhuhai (F2), the Lianyungang-Hu'erkuosi (S4) and Shanghai-Chengdu (S5) highways) together with the Beijing-Shenyang (650km), the Beijing-Shanghai (1330km) and Chengqing-Beihai (1270km) highways (completed before 2000) were given priority by MOC to enhance economic liberalization and the opening of areas in the coast, the Yangtze region and bordering areas. The development of these regions was designed to act as a catalyst to the development of larger economic regions in the hinterland.

The lengths of the seven highways total 17,000 kilometres of which 47% (8,000 kilometres) are expressways. The completion of the whole FSHS (35,000 kilometres) by 2010 will lead to increased accessibility across China and linking 203 of 467 major cities (43%) serving a population of 0.7 billion (55% of the total urban population). All cities with a population of about 1 million and 93 per cent of the cities with a population of 0.5 million people in the country will be linked. The automobile will be able to travel at least 1000 kilometres per day. The enhanced mobility is expected to have a positive impact in economic development and growth.

Railways

Railways are very important for both freight and passenger in China. In the midst of rapid economic growth and reform program Chinese railways has been slow to respond to capacity pressures. Rail has traditionally enjoyed a high modal share for both passengers and freight and thus it plays a vital economic role but is inefficient.

Chinese railways at the crossroads.

Rail transport accounts for almost half of the ton-kilometer and more than one third of passenger kilometer. This situation arises because of the relative poor conditions of roads and highways in the past. Secondly, it is affordable given the modest income levels of most of the population. As rail capacity reaches network capacity it would be difficult to accommodate both types of traffic given high economic growth.

The traffic density of Chinese railway networks about three times the density of traffic on the American railways (class one) and seven times the traffic density on European railways as the French and the German ones. Table 2 shows that productivity of the rolling stock is comparatively higher that the productivity of the employees. This is perhaps an outcome of the past. The weak train kilometer per employee allows much room for improvement.

Table 2 Partial productivity measures of employees and rolling stock (2000).

	Train km. per employee traffic	**Traffic units per employee (million)***	**Pax. km. per unit of passenger rolling stock**	**Ton. Km. per wagon**
US class 1	4.8	12.71	-	3.82
US Amtrack	2.27	0.35	4.74	-
Germany	5.2	0.83	3.53	0.58
France	3.0	0.71	4.44	1.19
UK	n.a.	n.a.	3.94	n.a
Sweden (SJ+BV)	n.a.	2.19	6.0	n.a.
China	0.8	1.16	12.33	3.04

*Pax (passenger) + Ton Kilometers
Source: International Union of Railways 2002, Ministry of Railways.

Major raw material production centers are located far from the fast developing coastal regions. 40% of the coal is shipped from areas outside the coastal region. Further the “floating” population of low-income earners generate much travel as travel tend to be seasonal. Chinese railways, which consist of 14 geographically based bureaus, tend to be more freight oriented that passengers oriented and are about the same size of an European national railways. Passenger trips tend to be longer (more than 400 km) comparable to the US (390). Trips are shorter in the EU (about 40 km for the UK, 80 km for France).

The Ministry of Railway (MoR) operates and regulates the sector! The regulatory system is not geared towards incentives all the revenue from the sub-bureau, the bureau goes to MOR, which in turn distributes the profit, back to bureaux, sub-bureaux, stations and depots. While revenue is accounted for at bureau and sub-bureau level and type of activity, the division of cost is not readily identified. There is no directly link to profit generated and as such no incentive to be efficient. Thus the occurrence of sub optimal cross subsidies between some provinces, freight and passengers. The railway network is a relic of a controlled economy where the railways were the main transportation mode. As freight and passenger increase it

faces competition from air and road. The management and organisation of the sector centralized and directly controlled by the state. This seems to be out of sync market reforms and decentralization in other sectors.

PREVIOUS STUDIES

The massive inflow of FDI into China has spawned a wealth of studies and received much attention from researchers in economics, business and geography. Few deal with the issue of location choice as these firms are assumed to respond to largely to investment and fiscal incentives rather than local factors. Some of studies of location are descriptive and anecdotal (Hayter and Han, 1997; Luo, 1997) while those based on statistical methodologies focus largely on the FDI location at the provincial level (Wei *et al.*, 1999; Coughlin and Segev 2000; Chen, 1996; Cheng and Kwan, 2000; Sun and Parikh, 2001)). Fewer still focus on location behavior at city level (Head and Ries 1996; He 2002; He 2003).

However, there is no research investigating the location behavior of service oriented firms to the best of our knowledge. Building on previous theoretical and empirical findings on manufacturing firms, an attempt will be made to determine the location behaviour of foreign firms in the logistics sector. Dunning (1989) reviewed the conceptual and theoretical issues in applying the eclectic theory of international production to explain the international behavior of service MNCs. Some researchers have also argued that the theories of multinational corporations and FDI can be applied to service multinationals, bearing in mind some distinctive characteristics of international services (Boddewyn, Halbrich and Perry 1986). Empirically, efforts have been made to apply the FDI theory for manufacturing industry to service industries (Dunning and McQueen 1982; Terpstra and Yu 1988; Li and Guisinger 1992). The results have been encouraging in that many of the theories about the locational determinants of manufacturing FDIs are also applicable to the locational decisions of service oriented FDIs.

The logistics sector was the focus of our study for the following reasons. First, between 1993 to 2001, the contribution of the transportation, storage, post and telecommunications sector to the GDP grew from RMB17 billion to RMB522 billion. Hong, Chin and Liu (2004) observed that although logistics market in China is still in its infancy, the speed and potential of development has made it attractive to investors. Second, the government has recognized the sector as one of important driving forces for national economy and business (Wu[3] 1999). Cities such as Beijing, Tianjin, Shanghai, Shenzhen and Guanzhou aspire to be regional or international logistics hubs and have strategically adopted preferential investment and fiscal policies in attracting logistics FDI. Finally, foreign investments will continue to play an increasingly important role in the sector since 1990's. From 1996 to 2001, the foreign capital invested in the area of transportation, storage, post and telecommunications increased from USD6.96 billion to USD15.16 billion.

MODEL SPECIFICATION

The multinomial logit model is employed. Each firm is assumed to locate where expected profits are highest from a range consisting of N cities. Thus city *j* is chosen by the firm *i* if and only if

[3] B. G. Wu was one of vice premier of the State Council, the People's Republic of China.

$$\Pi_{ij} = \max\left\{\Pi_{in}; n = 1, \ldots N\right\} \quad (1)$$

Where, Π_{ij} denotes the profit of the firm *i* at location city *j*. Following Bartik (1985) and Chen (1996), we assume that the profit is a function of the characteristics of the location and a disturbance term:

$$\Pi_{ij} = c + X_j \beta + \varepsilon_{ij} \quad (2)$$

Where *c* is a constant, X_j is a vector of observable characteristics of city *j* and ε_{ij} denotes error term. If ε_{ij} are independently, identically distributed as Weibull density function, and the alternatives are assumed to satisfy the "independence of irrelevant alternatives (IIA)" property, the probability of firm *i* choose city *j* can be described by the following formulations:

$$p_{ij} = \exp(X_j \beta) / \sum_{n=1}^{N} \exp(X_n \beta) \quad (3)$$

Based on the principle of utility maximization, the advantages of a simple mathematical structure and ease in estimation, multinomial logit models have been widely used in the study of industrial location (Coughlin et al. 1991; Woodward 1992; Chen 1996; Head and Ries 1996; Head et al. 1999; and Cheng and Kwan 2000).

Data source and model rationalisation

Data is drawn from "The Second Census on All Basic Units in the People's Republic of China". The "logistics firms" is defined as those conducting logistics services, including all modes of freight transport, warehousing, and arrangement of freight (or cargo) transportation etc.

To treat all cities as alternatives is impractical given that there are more than 200 Chinese cities at prefecture level or above. Fortunately, McFadden (1978) suggests some methods to limit the number of alternatives considered while obtain consistent estimates of the parameters. One of these is to choose a fixed sample from the full choice set independent of the observed choice. In this study to make data collection and estimation manageable, following Head and Ries (1996), only those cities that received at least five foreign logistics investments during the period of 1992 to 2001 are chosen. Based on these criteria, 1175 foreign-funded logistics firms were chosen and distributed across 40 cities.

The explanatory variables for location attributes are obtained primarily from the Urban Statistical Yearbook of China and the Statistical Yearbook of China. The definitions and descriptions of these variables are given in Table 3 The influence of transport, market size, labor market, government policy, privatization and structure of urban economy, information cost, agglomeration and urbanization economies will be analysed.

Transportation infrastructure

The impact of transport has been widely studied by previous studies (Bartik, 1985; Coughlin *et. al.*, 1991; Woodward, 1992; Smith and Florida, 1994; Chen, 1996; Head and Ries, 1996; Mcquaid *et al.*, 1996; Cheng and Kwan, 2000; Coughlin and Segev, 2000). It has been suggested that transportation access to raw materials and markets is the central element in location choice. Although most conclude that transportation is important for industrial location, some found it was very important element in choice (Head and Ries, 1996; Cheng and Kwan, 2000; Bartik, 1985). Recent conceptual and empirical research suggests that the importance of transportation may diminish due to the rise of new transportation and

communication technologies and the globalization of the world economy (Glickman and Woodward, 1989). Previous studies have also revealed that the impact of transport on location decision varies with firm-specific characteristics, such as firm size, type of industry and ownership (Hayashi *et. al.*, 1986; Button *et. al.*, 1995; Leitham *et. al.*, 2000). To understand the influence of transport network capacity, this study will investigate the influence of each mode of transport, including waterway, airway, road and railway transport respectively (BERTHDUM, AIRDUM, LROADEN, LROADEN1, LRIADEN1).

Market size

Given revenue considerations, one primary factor affecting firms' location decisions is the size of the market. Local authorities in China concerned with local economic growth often impose barriers to keep out goods and services from competing provinces through the imposition of employment and tax revenues quotas, tariff and non-tariff barriers (Jiang and Prater 2002). We employ two variables as a proxy for demand for logistics services at the provincial level. These are provincial foreign industrial output (LFORALL1) and provincial overall industrial output (LINDOUT1). The market size is expected to have a positive effect on firms' location.

Level of privatization

In a period of transition the level of privatization may reflect a city's degree of marketization and openness. The percentage of employment in private enterprises used as a measure of privatization level (LPRIVATE1). It is expected to be positively correlated to logistics FDIs. The variable LSEC, the employment percentage of the secondary industry has been used as an index of the development level of secondary industry in an urban economy. The impact remains uncertain.

Government policy

Government's tax and land use policy do impact FDI location. Since 1978, the Chinese government has taken a series of preferential policies in attracting FDI. In the original Act pertaining to FDI, foreign investment was limited to four Special Economic Zones (SEZs). FDI promotion was broadened in 1984 to include 14 coastal cities or Open Coastal Cities (OCCs). A variety of investment incentives such as tax reduction, market entry and land- introduced. SEZs and OCCs are thus included as a group where OCC is a dummy. The government has also set up free trade zones (FTA), where some preferential policies are taken to attract foreign logistics firms. Finally, provincial capital cities offer a number of inducements to foreign investments (CAPITAL).

Labor market

While China is often perceived as a low-wage economy, disparities exist across cities and provinces. Higher wage rates are expected to deter foreign investments. Previous studies on FDI location in China confirmed this proposition (He, 2003; Coughlin and Segev, 2000; Wei *et al.*, 1999; Cheng and Kwan, 2000). However, it must be noted that higher wage rates and greater productivity are correlated. Further as noted by Caves (1996) empirical studies on wage returns to labor are sometimes complicated by the lack of data. Labor cost sometimes does not have significant impact (Carlton, 1983; Chen, 1996). Two variables, LWAGE and LTECHPOP are used to measure the labor cost and quality respectively and study their impacts.

Information cost

The availability and processing of information is increasingly important in location choice and this is shown by the response of MNCs' while in their countries in the 1990's (Dunning, 1998). Foreign investors in China may encounter external uncertainties and business risks caused by uncertainties of an economy undergoing transition. Asymmetric information leads to high costs (He 2002). The number of telephones per 100 people (TELEPH) was used to measure the quality of information infrastructure in this study.

Table 3 Definition and description of explanatory variables

Symbol	Definition	Mean	Min.	Max
LFORALL1	Natural logarithm of provincial foreign and HMT output	6.72	1.67	9.11
LINDOUT1	Natural logarithm of provincial industrial output	8.55	4.64	9.55
LPRIVATE1	Natural logarithm of provincial percentage of private employment	0.98	-1.83	3.38
LPOPDEN	Natural logarithm of urban population density	0.37	-4.43	3.18
LTECHPOP	Natural logarithm of urban percentage of technical workers	-3.80	-6.50	0.00
LTELEPH	Natural logarithm of number of telephones of 100 persons	2.56	-0.11	4.89
LWAGE	Natural logarithm of average wage rate	8.95	7.77	10.04
LFDI	Natural logarithm of number of FDI	5.75	1.79	8.66
LSEC	Natural logarithm of employment percentage of the secondary industry	3.64	2.07	4.23
BERTHDUM	1 for the city has deep-water seaport; 0 for others	0.50	0.00	1.00
AIRDUM	1 for the city has airport; 0 for others	0.66	0.00	1.00
LROADEN	Natural logarithm of urban roadway density	1.00	-7.21	5.57
LROADEN1	Natural logarithm of provincial road density	3.47	0.30	4.36
LRAIDEN1	Natural logarithm of provincial railway density	-0.23	-2.52	1.92
OCC	1 for SEZ or OCC; 0 for others	0.38	0.00	1.00
FTA	1 for the city has free trade zone; 0 for others	0.23	0.00	1.00
CAPITAL	1 for Beijing or the capital of a province	0.53	0.00	1.00

Agglomeration and urbanization economies

Agglomeration economies are important in attracting foreign investments. Foreign investors may be attracted to areas with existing concentrations of foreign-owned firms in order to reduce uncertainty as well as share spillovers from the local foreign agglomeration (Guimaraes *et al.*, 2000). The number of FDIs in the corresponding year is used as an index of foreign-related agglomeration economies.

Urbanization has effect on firms' location through following ways. Firstly, urbanization economies yield positive external benefits in the area through scale economies, better

infrastructure etc. However, this may lead to higher factor costs, which deters foreign investment. Previous studies reveal that service firms tend to cluster in large metropolitan (Harrington and Warf, 1995), which imply that urbanization has a positive effect on logistics firms' location. Urban population density (LPOPDEN) is taken as a measure of urbanization degree.

EMPIRICAL RESULTS

The key empirical results using NLOGIT 3.0 are reported. Estimation proceeds by maximizing the likelihood of the alternative choices made by the 1175 firms in the sample. Overall, these models perform well. Since the underlying profit function is log-linear, the coefficients of the explanatory variables can be roughly interpreted as elasticities.

Results from generic models

The results are presented in the tables below. Recognizing the large number of potential independent variables and possible problem of multi-co linearity, the results of four models are finally chosen.

Roadway and railway density are positive and statistically significant. In addition, BERTHDUM and LROADEN, measures of urban sea and road capacity are positively correlated and significant as well. The presence of an airport (AIRDUM) was not an important consideration. These findings in some extent support the proposition that transportation network capacity does matter in attracting logistics FDI. Foreign and industrial outputs, the proxies for market demand are positive and important. The coefficient estimate of 0.40 for LINDOUT1 and 0.10 to 0.31 for LFORALL1 suggest that logistics FDI is very responsive to market demand.

The results show that higher wage rates deter FDI with the elasticity –0.52. This wage elasticity is lower than the –0.9 estimate by Bartik (1985) and substantially lower than –4.4 by Coughlin et al. (1991). As expected, higher labor quality attracts foreign investment. We use the proportion of technical staff (LTECHPOP) as a measure of labor quality in the city and found the impact to be positive and significant.

Previous studies show that foreign investors are inclined to favor the locations that offer a variety of agglomeration economies (Head et al. 1999; Guimaraes 2000; He 2002). The number of FDI in a city was used in this study to capture foreign-specific agglomeration. The impact of this variable is significant with elasticity of between 0.47 to 0.64. Since FDI location decisions are made under the conditions of uncertainties, investors would tend to locate in a city with a large number of existing FDI to take advantage of information exchange and gain access to a ready common pool of skilled work force. As with previous studies, population density is used as an index of urbanization. The results show positive influence. Uncertainties and information asymmetry faced by foreign investors, push firms to locate in a city where information costs are minimized (He 2002). Number of telephones per 100 people in a city was used as a proxy for information infrastructure and this was found to exert a positive influence the location decision.

This study used three dummy variables in an attempt to capture the influence of government policy (OCC, FTA and CAPITAL). Logistics FDI are more likely to locate in the city with

free trade zone and choose locating in provincial capitals or major cities. However, the preferential policies provided through OCC have no significant impact.

LSEC and LPRIVATE1, measuring the proportion of secondary industry in the whole economy and the degree of urban economic privatization level respectively. The first variable is found to significantly deter FDI while the latter attract it. In big cities, The LSEC could be taken as a counter of the proportion of tertiary industry in an economy. Concentration of business service is another type of agglomeration economies that may attract FDI - service agglomeration as mentioned by Guimaraes (2000). The level of economic privatization is also important for foreign investor in transitional economy such as China. Obviously, foreign investors prefer the location with higher degree of privatization.

Table 2 indicates that model 2 and 3 give best estimation in terms of the adjusted R square. For simplicity, we study the competitiveness of a city in attracting logistics FDI based on model 2. The competitiveness in this study is defined as the probability that a city was chosen by representative foreign logistics firms. The ranking of 40 Chinese cities' competitiveness in 2001 are reported in Table 3. The top six cities, Shanghai, Tianjin, Shenzhen, Guanzhou, Beijing and Qingdao receive almost 70 percent of all logistics FDI. This figure is quite consistent with our observation based on the census data (73 percent). The variation of competitiveness of these six cities during the period of 1995 to 2001 has been given in Figure 1. It reveals that the competitiveness of Shanghai is highest and still increasing while that of Tianjin and Guanzhou decreases. The competitiveness of Shenzhen decreased after 1998 while that of Beijing and Qingdao kept almost unchanged during the period.

Table 2 Results for cities with at least 5 logistics FDIs

	Model 1		Model 2		Model 3		Model 4	
	β	t stat.	β	T stat.	β	T stat	β	T stat
LFORALL1	0.10***	2.49	0.28***	8.79	0.31***	9.15		
LINDOUT1							0.40***	7.43
LPRIVATE1	0.47***	8.68	0.30***	5.39	0.32***	5.81	0.31***	5.46
LPOPDEN			0.11***	3.47	0.09***	2.76	0.05	1.57
LTECHPOP	0.29***	5.29	0.33***	6.37	0.3***	5.72	0.33***	6.42
LTELEPH			0.12*	1.68	0.11	1.57	0.30***	4.10
LWAGE	-0.52***	-2.95						
LFDI	0.64***	14.16	0.5***	11.08	0.48***	10.59	0.47***	9.87
LSEC	-0.36**	-2.47	-0.45***	-3.3	-0.43***	-3.1	-0.54***	-3.79
BERTHDUM	0.67***	6.12	0.49***	4.5	0.54***	4.92	0.47***	4.14
AIRDUM	0.10	0.84	0.12	1.05				
LROADEN	0.20***	7.43						
LROADEN1	0.78***	6.76						

LRAIDEN1			0.46***	11.08	0.46***	10.95	0.58***	10.89
OCC	0.10	1.25						
FTA	0.35***	3.44	0.7***	7.1	0.55***	5.16	0.90***	8.07
CAPITAL					0.38***	3.04	0.12	0.98
Observations	1775		1775		1775		1775	
Log-L	-4621		-4579		-4575		-4588	
Res. Log-L	-6548		-6548		-6548		-6548	
R^2 Adj.	0.294		0.301		0.301		0.299	

Table 3. Competitiveness of Chinese Cities in Attracting Logistics FDI

City	Probability	City	Probability	City	Probability
Shanghai	0.365764	Zhuhai	0.013805	Hefei	0.002084
Tianjin	0.100674	Yantai	0.010984	Zhanjiang	0.001880
Shenzhen	0.090942	Hangzhou	0.008419	Chendu	0.001623
Guanzhou	0.052600	Foshan	0.008359	Qingyuan	0.001400
Beijing	0.042986	Zhenjiang	0.008277	Shaoguan	0.001166
Qingdao	0.042474	Nantong	0.007368	Chongqing	0.001133
Ningbo	0.033192	Haikou	0.007022	Chaozhou	0.000963
Zhongshan	0.028238	Lianyungang	0.005971	Heyuan	0.000695
Dalian	0.023652	Yingkou	0.005529	Kunming	0.000148
Xiamen	0.022250	Jinan	0.005090	Wulumuqi	0.000143
Shenyan	0.018714	Dongguan	0.004252		
Suzhou	0.018674	Shantou	0.004162		
Fuzhou	0.018163	Wuhan	0.004009		
Nanjing	0.017464	Rizhao	0.002932		
Wuxi	0.014439	Jiangmen	0.002360		

Figure 2 Urban competitiveness in attracting logistics FDI (1995 to 2001)

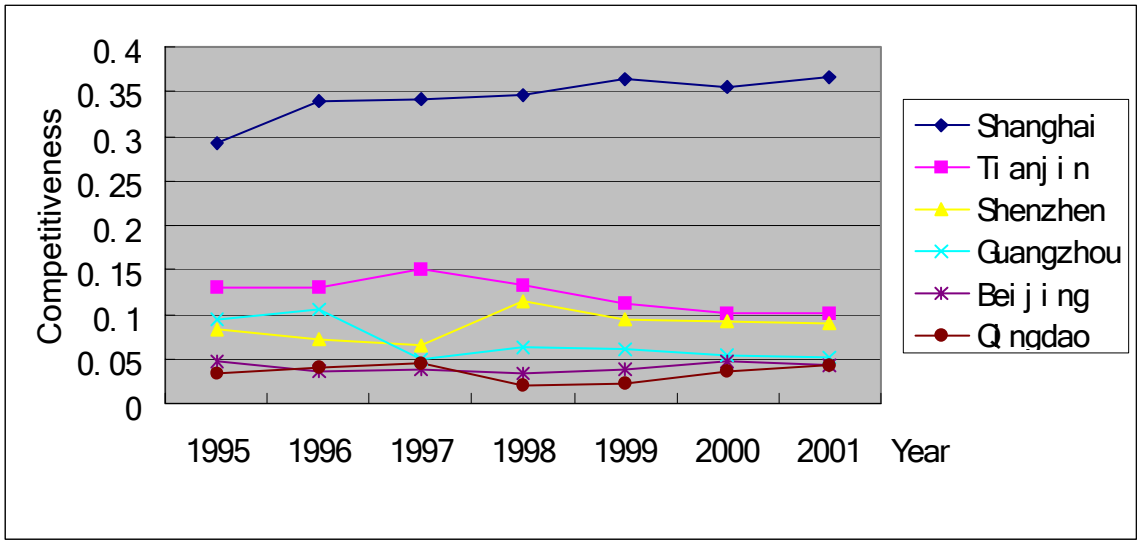


Table 4 Results for cities with at least 7 logistics FDIs

	Model 1		Model 2		Model 3		Model 4	
	β	**T stat.**	**β**	**T stat.**	**β**	**T stat**	**β**	**T stat**
LFORALL1	0.19***	3.92	0.31***	8.39	0.32***	8.53		
LINDOUT1							0.36***	5.85
LPRIVATE1	0.48***	8.12	0.35***	5.98	0.37***	6.17	0.36***	5.93
LPOPDEN			0.09**	2.18	0.08*	1.87	0.07	1.62
LTECHPOP	0.39***	5.69	0.44***	6.80	0.41***	6.34	0.45***	6.99
LTELEPH			-0.02	-0.26	-0.01	-0.12	0.15*	1.85
LWAGE	-0.86***	-4.50						
LFDI	0.73***	13.67	0.57***	10.48	0.57***	10.11	0.59***	9.84
LSEC	-0.60***	-3.32	-0.49***	-2.94	-0.47***	-2.79	-0.46***	-2.68
BERTHDUM	0.75***	6.36	0.57***	4.58	0.59***	4.75	0.46***	3.73
AIRDUM	-0.16	-1.14	-0.13	-0.93				
LROADEN	0.17***	4.43						
LROADEN1	0.69***	5.56						
LRAIDEN1			0.41***	8.77	0.41***	8.83	0.48***	8.12
OCC	0.19**	2.10						
FTA	0.28***	2.62	0.58***	5.54	0.51***	4.57	0.84***	7.25
CAPITAL					0.07	0.51	-0.20	-1.58
Observations	1710		1710		1710		1710	
Log-L	-4114		-4084		-4084		-4103	
Res. Log-L	-5698		-5698		-5698		-5698	
R^2 Adj.	0.278		0.283		0.283		0.280	

Table 5 Results for cities with at least 10 logistics FDIs

	Model 1		Model 2		Model 3		Model 4	
	β	T stat.	β	T stat.	β	T stat	β	T stat
LFORALL1	0.20***	4.08	0.29***	7.80	0.28***	7.40		
LINDOUT1							0.45***	7.04
LPRIVATE1	0.52***	8.55	0.39***	6.34	0.38***	6.05	0.35***	5.62
LPOPDEN			0.09**	2.04	0.08*	1.91	0.07	1.52
LTECHPOP	0.42***	6.09	0.43***	6.67	0.44***	6.70	0.46***	6.95
LTELEPH			-0.07	-0.86	-0.06	-0.79	0.15*	1.72
LWAGE	-0.87***	-4.30						
LFDI	0.62***	10.46	0.50***	8.23	0.52***	8.53	0.42***	6.15
LSEC	-0.75***	-4.10	-0.46***	-2.66	-0.51***	-2.83	-0.58***	-3.21
BERTHDUM	1.08***	8.29	0.74***	5.66	0.77***	5.80	0.67***	5.07
AIRDUM	-0.11	-0.70	-0.17	-1.06				
LROADEN	0.09**	2.13						
LROADEN1	0.78***	6.11						
LRAIDEN1			0.39***	7.95	0.40***	8.03	0.56***	8.52
OCC	0.35***	3.74						
FTA	0.13	1.19	0.52***	5.00	0.54***	5.05	0.91***	8.09
CAPITAL					-0.21	-1.37	-0.48***	-3.30
Observations	1656		1656		1656		1656	
Log-L	-3720		-3700		-3699		-3701	
Res. Log-L	-5042		-5042		-5042		-5042	
R^2 Adj.	0.262		0.266		0.266		0.266	

The robustness of our specifications has been tested by applying the same specifications to sub-samples of the data set. The test concerns the possible different logic in FDI location when they face different alternative sets. We adjust our alternatives by define them as those who received foreign logistics investors no less than 7 and 10. The results for the regressions computed on the sub-samples are reported in Table 4 and 5. Despite the smaller dimension of the samples, the magnitudes of the coefficient estimates are remarkably consistent across sample sets. This, combined with the near unanimity of the signs and statistical significance of the coefficients estimated, leads us to conclude that our results are robust, and not merely a result of our sample chosen. One interesting finding is that with the number of choice alternatives decreases, open coastal cities (OCC) become more attractive while capital cities (CAPITAL) lose their advantages in attracting logistics FDI gradually.

Determinant Differences between Foreign and Oversees Chinese Firms

In order to study country of origin effects, the observations are classified into two groups: foreign owned firms and those from Hong Kong, Macao and Taiwan (HMT). Previous studies have shown that the location behaviors may be different between foreign-funded and HMT firms. There exist widespread use of "shell" of Hong Kong companies by mainland companies in order to receive preferential policies provided to foreign investor by Chinese government. Moreover, HMT firms are more likely to locate in southern China, especially Guangdong and Fujian province, since they share similar language and culture and also value proximity to their parent company.

The locational determinants of foreign owned firms and HMT firms are given in Table 6 and 7 respectively. The results indicate that their location behaviors are different in some aspects. Foreign firms favor the location with higher population density, lower labor cost, convenient airway transport and capital cities. It is surprise that better communication infrastructure (LTELEPH) deter foreign firms. One possible interpretation is that the variable of LTELEPH captures some effect of wage rates. Better communication infrastructure is normally

accompanied with higher wage rates. The results have also revealed that firms from Hong Kong, Macao and Taiwan put more emphases on communication infrastructure.

Table 6 Results for foreign-owned firms

Foreign firms	Model 1		Model 2		Model 3		Model 4	
	β	T stat.	β	T stat.	β	T stat	β	T stat
LFORALL1	0.09	1.54	0.21***	4.12	0.24***	4.42		
LINDOUT1							0.35***	4.02
LPRIVATE1	0.44***	5.57	0.28***	3.57	0.29***	3.69	0.26***	3.26
LPOPDEN			0.32***	5.67	0.32***	5.57	0.29***	4.82
LTECHPOP	0.29***	3.37	0.39***	4.42	0.36***	4.08	0.40***	4.58
LTELEPH			-0.21*	-1.89	-0.22**	-1.98	-0.04***	4.58
LWAGE	-1.46***	-5.57						
LFDI	0.87***	11.99	0.62***	8.19	0.59***	7.80	0.56***	6.98
LSEC	-0.53**	-2.39	-0.31	-1.48	-0.32	-1.51	-0.40*	-1.85
BERTHDUM	0.79***	5.07	0.55***	3.55	0.59***	3.76	0.55***	3.49
AIRDUM	0.48**	2.51	0.39**	2.13				
LROADEN	0.34***	7.34						
LROADEN1	0.77***	4.70						
LRAIDEN1			0.49***	7.62	0.50***	7.66	0.61***	7.28
OCC	0.20	1.62						
FTA	-0.10	-0.69	0.32**	2.36	0.23	1.61	0.49***	3.24
CAPITAL					0.45	2.52**	0.28	1.64
Observations	863		863		863		863	
Log-L	-2164		-2119		-2119		-2119	
Res. Log-L	-3184		-3184		-3184		-3184	
R^2 Adj.	0.32		0.33		0.33		0.33	

Table 7 Results for Hong Kong, Taiwan and Macao (HMT) owned firms

	Model 1		Model 2		Model 3		Model 4	
	β	**T stat.**	**β**	**T stat.**	**β**	**T stat**	**β**	**T stat**
LFORALL1	0.12**	1.99	0.32***	7.74	0.34***	7.89		
LINDOUT1							0.43***	6.02
LPRIVATE1	0.42***	5.53	0.26***	3.23	0.29***	3.61	0.29***	3.57
LPOPDEN			0.007	0.17	-0.02	-0.54	-0.06	-1.40
LTECHPOP	0.27***	3.90	0.30***	4.72	0.27***	4.16	0.30***	4.64
LTELEPH			0.29***	3.11	0.28***	2.96	0.47***	4.75
LWAGE	0.16	0.65						
LFDI	0.49***	8.35	0.43***	7.50	0.43***	7.37	0.43***	7.03
LSEC	-0.25	-1.31	-0.54***	-2.99	-0.51***	-2.76	-0.63***	-3.33
BERTHDUM	0.61***	3.82	0.49***	3.03	0.51***	3.20	0.41**	2.49
AIRDUM	-0.27	-1.64	-0.17	-1.03				
LROADEN	0.12***	3.59						
LROADEN1	0.84***	5.00						
LRAIDEN1			0.41***	7.20	0.40***	7.03	0.53***	7.36
OCC	-0.003	-0.03						
FTA	0.80***	5.18	1.12***	7.57	0.95***	5.73	1.36***	7.86
CAPITAL					0.22	1.15	-0.12	-0.68
Observations	912		912		912		912	
Log-L	-2397		-2391		-2391		-2403	
Res. Log-L	-3364		-3364		-3364		-3364	
R^2 Adj.	0.287		0.289		0.289		0.285	

CONCLUSION

This study investigates the location determinants of logistics FDI as well as country (or region) of origin effects. Multinomial logit model was employed and the results indicate that the location of logistics FDI depends on transport infrastructure, market size, labor quality and cost, agglomeration economies, communication cost, economic privatization degree, as well as government policy incentives. Moreover, the importance of above determinants varies with source of country or region. The results indicate that their location behaviors are different in some aspects. Foreign firms favor the location with higher population density, lower labor cost, convenient airway transport and capital cities while logistics firms from Hong Kong, Macao and Taiwan put more emphases on communication infrastructure.

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