# THE INFLUENCE OF TRANSPORT AND OTHER URBAN CHARACTERISTICS ON FOREIGN DIRECT INVESTMENT: EVIDENCE FROM CHINA

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**Abstract**

This paper attempts to investigate the influence of transport and other urban characteristics on foreign direct investment (FDI) as well as the difference in location determinants across regions in China. The empirical results indicate that waterway transport, market size, government policies, agglomeration economies and labor cost can influence FDI location significantly. Further analyses reveal that the importance of some factors is quite different for FDI in coastal and non-coastal cities. The urban public transport can only significantly influence foreign investments location in coastal cities. Airway transport plays a significant role in non-coastal but not coastal region. The level of international trade significantly attracts FDI in coastal cities while in western cities, foreign investors put more emphases on local economic growth. The research belongs to the area of regional science and urban economics.

Keywords: Transport; Regional difference; FDI Location; China
Topic Area: E3 Valuation of Internal and External Benefits/ Costs

## 1. Introduction

Since the economic reform and opening policy in the late 1970's, FDI has increased rapidly in China. The share of FDI in China's total social investment in fixed assets increased from 4.2 percent in 1991 to 14.7 percent in 1996 (The People's Daily, overseas edition, 6 October 1997). FDI has played an increasingly important role in economic growth in China.

The massive inflow of FDI into China has recently received large attention from researchers in the field of economics, business and geography. Some of studies are descriptive and anecdotal (Hayter and Han, 1997; Luo, 1997). Much of those based on statistical methodologies focus on the FDI at provincial level (Coughlin and Segev, 2000; Cheng and Kwan, 2000; Sun and Parikh, 2001), while few focus on its location behavior at city level (Head and Ries, 1996; He, 2002).

This paper attempts to investigate the influence of transport and other urban characteristics on FDI location in Chinese cities as well as the determinant differences between coastal (or eastern) and non-coastal (or middle and western) region. In the literature of regional science and economic geography, there is ample evidence for the lack of uniformity of the effects of space, which can be captured by the form of different response functions or systematically varying parameters. For instance, central place hierarchies and the existence of leading and lagging regions may require us to take into account the particular features of each spatial unit (Anselin, 1988).

This topic is particularly interesting in a country like China. One of primary characteristics of China's economy is its uneven economic growth between the coastal and non-coastal regions. Most investments, both domestic and foreign, concentrate in the coastal provinces.

The coastal zone has also clustered the majority of the growth centers in the country while the others relied on the spillover effects of growth of the coastal zones (Yao and Zhang, 2001). The attributes favoring the eastern region in attracting FDI include (1) convenient waterway transport which is crucial to boost international trade in China; (2) many preferential policies are taken special for coastal cities, especially at the early stage of China's open policy; and (3) most of industrial and international trade centers are clustered in eastern region. Previous studies have also revealed that FDI in China has been heavily concentrated in the coastal area (Head and Ries, 1996; Chen, 1996; Wei *et. al.*, 1999; He, 2002). During the period of 1999 to 2001, Chinese cities have got realized foreign investment of 99.60 billion US dollars. Among them, 88.08 percent are concentrated in the eastern cities. As a result, the Chinese policymakers are confronted with two groups of thought regarding the consequences of large spatial gaps in development (Fan, 1992).

## 2. Hypotheses formation

A central presumption in our study is that foreign firms in coastal regions and non-coastal region behave differently since the regional gaps in economic development level, transportation infrastructure and geographic location. Locating in coastal cities eases access to international markets, which is preferred by some type of foreign investors (He, 2003). While in the non-costal area, especially in Chinese western region, since transportation infrastructure is comparatively poor, foreign firms have to focus on the local market. Because of the difference in their market targets, the importance of some other factors may be different accordingly.

There are ample empirical evidences on FDI location determinants in the literature. A large proportion of subsequent research has concentrated on foreign direct investment in U.S., (Coughlin *et al*., 1991; Ondrich and Wasylenko, 1993; Head *et al.*, 1999), while some target at other regions or countries (Hayashi *et al.*, 1986; Hansen, 1987; Mcquaid *et al.*, 1996; Leitham *et al.*, 2000). They agree closely on the statistical significance and economic importance of most location determinants. Land availability and agglomeration economies are positive impacts. Transportation infrastructure in terms of highway, railway and airway attracts foreign investors; higher tax rates deter them while government preferential policy is an attractive factor.

In this paper, we will focus on the influence of following factors: transportation infrastructure, market size, government policy, agglomeration economies and labor cost. Each group of these variables is discussed below.

### 2.1. Transportation

The impact of transport has been widely studied by previous studies (Bartik, 1985; Woodward, 1992; Smith and Florida, 1994; Mcquaid *et al.*, 1996). It has been suggested that transportation access to raw materials and markets is the central element in location choice. Although most of these researches conclude that transportation is important to industrial location, there are some empirical findings partially beyond expectations (Head and Ries, 1996; Cheng and Kwan, 2000; Bartik, 1985). Moreover, 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 vary with some firm-specific

characteristics, such as firm size, type of industry and ownership (Hayashi *et. al.*, 1986; Button *et. al.*, 1995; Leitham *et. al.*, 2000).

This study will focus on the role of airway, roadway, waterway and urban public transport respectively. Our proposition is that since there is no waterway available, which is crucial for accessing to international market, investors in non-coastal cities may emphasize more on other transport modes. On the other hand, as urban public transport problems become more and more serious in big cities, most of which concentrate in the coastal region, foreign investors may take it as a more important factor there.

**2.2 Market size**

On the revenue side, one primary factor affecting firms' location decisions is market size. Many foreign firms in China aim at international market. Moreover, Chinese government has taken some measures to encourage foreign investors to export their products. As mentioned by Head and Ries (1996), an important motivation for establishing incentive areas along the coast was to facilitate exportation. Therefore, the level of international trade could be an index of market size. A cross-country research by Jeon (1992) has revealed that international trade and FDI are negatively related since they are substitutes in some extent while others have found that they are complementary and positively correlated (Ray, 1989; Liu *et al.*, 1997; Wei *et al.*, 1999).

Growth rate of Gross Domestic Products (GDP) could also be a measure of the development level and potential of a market. GDP growth rates in Chinese cities have been found positively related to the amount of foreign investments (Wei *et al.*, 1999).

**2.3. Government policy**

Since 1978, the Chinese government has taken a series of preferential policies in attracting FDI. In the original act, foreign investment was limited to four Special Economic Zones (SEZs). FDI promotion was broadened in 1984 when 14 coastal cities, known as Open Coastal Cities (OCCs) were opened to FDI. A variety of investment incentives such as tax reduction, market entry and exit and land use were taken in these cities (Cheng and Kwan, 2000). Economic and Technological Development Zones (ETDZs) could be regarded as another extension. Therefore, we include SEZ, OCC and the cities with ETDZ as a group and differentiate them from others by a dummy variable (ETZ).

In addition to preferential policies, government spending policies can also affect the business location decisions of FDI (Coughlin *et al.*, 1991; Ondrich and Wasylenko, 1993). Urban government fiscal expenditure per capita was used to describe this characteristic in our study.

**2.4. Agglomeration 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]. We use foreign output value as an index of foreign-related agglomeration economies and attempt to examine its impact in this paper.

### 2.5. Wage rates

With respect to the cost side, labor market consideration comes to our mind. Higher wage rates are expected to deter foreign investments. Some of previous studies concerning FDI location in China have supported this proposition (He, 2003; Coughlin and Segev, 2000; Wei *et al.*, 1999; Cheng and Kwan, 2000). However, since higher wage rates normally mean higher productivity and hence findings on labor are complicated sometimes (Caves, 1996). Some of previous studies have found that labor cost do not have significant impact (Calton, 1983; Chen, 1996).

## 3. Data and methodology

One of our main objectives is to investigate the difference in locational determinants between foreign investors in Chinese coastal and non-coastal region. Our proposition is that foreign location determinants are different in these two regions. To accomplish this, we classify all Chinese cities at prefectural or above level into two groups: coastal cities and non-coastal cities. Coastal cities cover all cities in coastal provinces, which include Liaoning, Hebei, Beijing, Tianjin, Shangdong, Jiangshu, Shanghai, Zhejiang, Fujian, Guangdong, Guangxi, Hainan. Non-coastal cities cover all cities in western and middle provinces, which include Shanxi, Inner Mongolia, Jilin, Heilongjiang, Anhui, Jiangxi, Henan, Hubei, Hunan, Chongqing, Sichuan, Guizhou, Yunnan and Tibet, Shannxi, Gansu, Qinghai, Ningxia and Xinjiang.

We employ Tobit estimation techniques to model the FDI location process in all Chinese cities, non-costal cities and coastal cities respectively. Since there are many zero counts observed in the data, Tobit analysis is a satisfactory solution (Maddala 1983; Huallachain and Raid 1997). The basic equation for the model is specified as follows:

$$y^* = \beta' X + u$$
$$y = \max\left[0, y^*\right]$$

Where, y denotes the realized amount of foreign investments in a city (FDIVALUE). X denotes a vector of observable characteristics of the city and u represents the error term. We mainly focus on following urban characteristics: transportation (BUSNUM, AIRWAY, ROADCAP, WATER), market size (GROWTH, OPEN), government policy (FISCAP, ETZ), agglomeration economies (FOROUT) and labor cost (LABCOST). The definitions of these variables are given in Table 1.

Our data mainly come from various versions of the Urban Statistical Yearbook of China and the China Statistical Yearbook. Three types of FDI data are available during the period of 1999 to 2001, these are the number of planned projects, the contractual amount and the realized amount of FDI. However, there is a big difference between the reported contractual amount and the realized FDI since the cancellation of some planned projects and local government's intention of announcing a larger amount (Wei *et al.*, 1999; He, 2002). Therefore, the realized amount of FDI is most appropriate to be taken as the dependent variable in our specification. As Table 1 indicated, the average realized value of FDI (FDIVALUE) in coastal cities is about 10 times of that in non-coastal cities, confirming a concentration of FDI in coastal region.

Table 1. Definition and Descriptions of Variables Used

| Variables | Measurement | MA[1] | MN[2] | WC[3] |
|---|---|---|---|---|
| FDIVALUE | The realized amount of FDI (10,000 USD) | 13053.46 | 2704.70 | 27075.38 |
| BUSNUM | Number of buses per 10,000 persons | 5.65 | 5.17 | 6.30 |
| AIRWAY | 1 for those having airport in the city; 0 for others | 0.31 | 0.25 | 0.40 |
| ROADCAP | Length of road per capita | 5.42 | 4.45 | 6.74 |
| WATER | 1 for seaport cities; 0 for others | 0.21 | None | 0.48 |
| GROWTH | GDP growth rate (Percent) | 9.58 | 7.80 | 11.98 |
| OPEN | Ratio of International trade to GDP in the province where a city is located (percent) | 3 | 0.87 | 6 |
| FISCAP | Fiscal expenditure per capita (Yuan per capita) | 1276.22 | 909.06 | 1773.70 |
| ETZ | 1 for special economic zones, the coastal opening cities or those with national level Economic and Technological Development Zones; 0 for others | 0.24 | 0.16 | 0.36 |
| FOROUT | Foreign output of above designated-size enterprises in a city (10,000 Chinese Yuan) | 395.84 | 70.72 | 836.37 |
| LABCOST | Average wage rate (Chinese Yuan) | 9358.61 | 8173.61 | 10964.22 |

Note: 1. MA denotes the mean of variables in all Chinese cities
2. MN denotes the mean of variables in non-coastal cities
3. MC denotes the mean of variables in coastal cities

Table 2. Correlation Matrix of Explanatory Variables for All Cities

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1.LABCOST | 1.00 | 0.21 | 0.27 | 0.40 | 0.31 | 0.33 | 0.28 | 0.22 | 0.31 | 0.31 |
| 2.GROWTH | | 1.00 | 0.06 | 0.16 | 0.17 | 0.15 | 0.11 | 0.15 | 0.13 | 0.12 |
| 3.OPEN | | | 1.00 | 0.39 | 0.15 | 0.30 | 0.16 | 0.10 | 0.32 | 0.48 |
| 4.FISCAP | | | | 1.00 | 0.37 | 0.51 | 0.81 | 0.28 | 0.51 | 0.36 |
| 5.ETZ | | | | | 1.00 | 0.33 | 0.33 | 0.61 | 0.28 | 0.35 |
| 6.FOROUT | | | | | | 1.00 | 0.35 | 0.26 | 0.19 | 0.29 |
| 7.BUSNUM | | | | | | | 1.00 | 0.23 | 0.44 | 0.15 |
| 8.AIRWAY | | | | | | | | 1.00 | 0.16 | 0.26 |
| 9.ROADCAP | | | | | | | | | 1.00 | 0.33 |
| 10. WATER | | | | | | | | | | 1.00 |

The explanatory variables for site attributes are time varying over the period of 1999 to 2001. Table 1 reports some descriptions and indicates that all variable means in coastal cities are significantly higher than those in non-coastal cities, revealing a big gap in economic development and foreign investment environment between two regions. The correlation matrix of explanatory variables is reported in Table 2. Except FISCAP and BUSNUM, other correlation coefficients among the independent variables are fairly low.

## 4. Empirical results

Given the data structure, an ordinary least square approach is inappropriate and hence we employed a maximum likelihood estimation based on TOBIT modeling. The key empirical results for FDI location determinants in all Chinese cities, non-coastal cities and coastal cities are given in Table 3 respectively.

### 4.1. Location determinants in all Chinese cities

In the equation estimated for all Chinese cities, six of the ten explanatory variables are significant at the ten percent level. These variables, in the order of their sequence in Table 3, are WATER, FISCAP, ETZ, OPEN, FOROUT and LABOCST. On the other hand, the influences of BUSNUM, ROADCAP, AIRWAY and GROWTH are insignificant. Almost all variables have got expected signs.

We have used four variables, BUSNUM, WATER, ROADCAP and AIRWAY to measure urban transport network capacity in terms of public transport, waterway, roadway and airway transport. The results show that only the impact of WATER is significant. It implies that seaport cities have strong advantages in attracting FDI, which is consistent with our observation that foreign investments in China concentrate in the coastal region.

The variable of FISCAP has a positive, statistically significant effect on FDI. This result is consistent with previous finding that local government spending policies can affect the foreign business location decisions (Coughlin *et al.*, 1991). Besides spending policies, the Chinese government has provided some preferential policies in some special sites to attract FDI, which can also significantly influence foreign investors (Wei *et al.*, 1999; He, 2002; He, 2003). This proposition is also confirmed by our results that ETZ has a significantly positive and consistent impact on FDI.

Two variables GROWTH and OPEN are used as the proxies for market size. The results show that the influence of GROWTH is insignificant while the coefficient of OPEN is positive and significant. The coefficient estimates indicate that FDI is sensitive to differences in OPEN across cities. Foreign investors are inclined to favor the locations with higher level of international trade.

The variable of FOROUT has significant impact on foreign investors' location behavior, confirming the significance of foreign-specific agglomeration economies. As previous studies, the average wage rate in a city is used to measure labor cost. The results show that higher wage rates deter FDI. It is expected and consistent with the finding of previous studies (Coughlin and Segev, 2000; He, 2002).

### 4.2. Determinant differences in coastal and non-coastal cities

More interesting findings are revealed when we investigate and compare the importance of transport and other urban characteristics on FDI location in coastal and non-coastal cities. The empirical results in Table 3 show that the influence of location determinants is quite different between coastal and non-coastal cities. The urban public transport in terms of number of buses per 10,000 persons is significantly attractive to foreign investors in coastal but not non-coastal region, reflecting that public transport is a more important consideration in coastal cities where urban public transport is comparatively in a worse situation. On the other hand, better airway transport infrastructure significantly attracts FDI in non-coastal but not costal cities. This has partially supported our proposition that other transport modes in inland areas is more important for foreign investors since there is no waterway as an alternative to access to outside

markets. Another finding is that although waterway transport plays a significant and big role in the model for all cities, its impact is insignificant when foreign investors choose location among cities in the costal provinces. One possible interpretation is that since the FDI in coastal cities can easily get the waterway service even if there is no seaport in the city, the influence of WATER accordingly becomes insignificant.

Table 3. Estimation Results of FDI Determinants in All Chinese Cities, Non-coastal Cities and Coastal Cities Respectively

| | All cities | | | Non-coastal cities | | Coastal cities | | |
|---|---|---|---|---|---|---|---|---|
| Variables | Model 1 | Model2 | Model3 | Model1 | Model2 | Model1 | Model2 | Model3 |
| BUSNUM | | 6.59 | 4.79 | | -3.88 | | 639.62*** | 542.7*** |
| | | (0.32) | (0.23) | | (-0.82) | | (3.07) | (2.75) |
| WATER | | | 5539** | | | | | 629.80 |
| | | | (2.52) | | | | | (0.18) |
| ROADCAP | | -305.81 | | | 6.07 | | -552.16 | |
| | | (-1.50) | | | (0.07) | | (-1.46) | |
| FISCAP | 3.39*** | | | 0.96* | | 3.93*** | | |
| | (5.17) | | | (1.93) | | (3.92) | | |
| AIRWAY | -401.42 | 374.68 | 27.84 | 1386** | 1377** | -2978 | -976.09 | -1829 |
| | (-0.20) | (0.19) | (0.01) | (2.35) | (2.31) | (-0.69) | (-0.22) | (-0.42) |
| ETZ | 7873*** | 9829*** | 8351*** | 2087*** | 2388*** | 11109** | 11889** | 11166** |
| | (3.50) | (4.29) | (3.62) | (2.70) | (3.11) | (2.42) | (2.55) | (2.35) |
| GROWTH | 3.64 | 5.23 | 4.32 | 2.45 | 3.31* | -1.45 | 1.40 | -0.24 |
| | (0.74) | (1.00) | (0.83) | (1.57) | (1.93) | (-0.14) | (0.14) | (-0.02) |
| OPEN | [1]1.2E5*** | 1.5E5*** | 1.2E5*** | -1.3E5*** | -1.5E5*** | 7.6E4*** | 1.1E5*** | 9.7E4*** |
| | (6.68) | (8.32) | (6.50) | (-2.29) | (-2.60) | (2.82) | (4.01) | (3.51) |
| FOROUT | 17.03*** | 17.71*** | 17.69*** | 22.10*** | 21.94*** | 16.38*** | 16.66*** | 16.84*** |
| | (37.16) | (39.84) | (39.98) | (21.19) | (20.97) | (24.23) | (24.77) | (25.36) |
| LABCOST | -0.26** | 0.10 | -0.04 | 0.006 | 0.12 | 0.19 | 0.38* | 0.27 |
| | (-2.26) | (0.75) | (-0.35) | (0.07) | (1.53) | (0.91) | (1.71) | (1.22) |
| Observation. | 763 | 763 | 763 | 439 | 439 | 324 | 324 | 324 |
| Log Likelihood | -7978 | -7990 | -7988 | -3793 | -3795 | -3717 | -3720 | -3721 |

Notes: 1. 1.25E5 = $1.25\times10^5$

* p < 0.10; ** p<0.05; *** p<0.01

t statistics are given in parentheses.

The empirical results also reveal that the importance of OPEN and GROWTH is different between investors in coastal and non-coastal region. The level of international trade has significant and positive impact on FDI location in coastal cities. This is understandable since most of international trade hubs locate in the east, especially in seaport cities. Therefore, they are attractive to foreign investors who target at international market. On the other hand, GROWTH attracts foreign investments in non-coastal cities while has no significant impact on FDI in coastal cities. This confirms our proposition that foreign firms in coastal and non-coastal areas may have different market targets and behave differently. The former put more emphases on international market while the latter focus on the local market.

## 5. Conclusion

Using the data of all Chinese cities at prefecture or above level during the period of 1999 to 2001, this research reveals that waterway transport, government spending and preferential policy, market size, agglomeration economies and labor cost play significant roles in attracting FDI in Chinese cities. Accessibility to waterway transport is an attractive factor. Higher wage rates deter foreign investments while bigger market size and agglomeration economies attract them. Foreign investors also tend to favor locations with higher government fiscal expenditure and more preferential policies.

Moreover, the importance of location determinants is quite different for foreign investors in coastal and non-coastal cities. The urban public transport can significantly influence FDI location decision only in coastal region. Airway transport plays a significant role in non-coastal but not coastal cities. The level of international trade has significant and positive impact on FDI location in coastal cities while in inland cities, foreign investors put more emphases on local economic growth.

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