

How does inward FDI affect exports of
Chinese domestic firms?

-----An empirical analysis using
regional data

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Abstract:

To estimate the relation between FDI and domestic firm exports, this paper employed several variables, such as domestic firm exports for each province, FDI, GDP, average money wage, the number of labors in manufacturing sector, exchange rate, dummy variable about exports processing zones, lots of time dummies. The panel data about these variables contains 4 municipalities and 23 provinces covering the period 1993/1992 to 2003. The analysis is based on the pooled estimation model, fixed effects estimation model and random effects estimation model, from the result of the fixed effects estimation model, there is not enough evidence to prove that FDI can promote domestic firm exports even if FDI can increase the total exports of China in some previous studies.

Key words: Foreign Direct Investment (FDI); Domestic Firm Exports (DFE); Spillover effects; Multinational Enterprises (MNEs)

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1. Introduction:

China's economy has been growing in a rapid way, and as a main part of “Asian miracle”, the development of China’s economy left a deep impression on the world. Along with the implementation of the policy of reform and opening-up since 1978, the open areas in China spread from coastal region to the inland region, which provides large market for Foreign Direct Investment (FDI) ^①. FDI has played an important supporting role because it helped China to integrate into a regional production network, and speed up China’s technological level to integrate into the world economy (Flassbeck, 2005, p.3). Actually many of the factors that promote economic growth in China are the same with those in many other Asian countries, however, the strong dependence on foreign capital is especially prominent in China.^② After “open door policy^③”, accession to WTO in 2001 optimized the structure and quality of China’s exports, further promoted the process of China going to the world, which provided another opportunity to introducing FDI. From China's Statistical Yearbook 2003, in 1978, China's export was only 9.57 billion U.S. dollars; however, in 2002 it reached 325.57 billion U.S. dollars, which means China's exports increased by 33 times in the short span of 24 years. During

① There are three kinds of ways of utilization of foreign capital by China: Foreign Direct Investment (FDI), Foreign Other Investment (FOI) and Foreign Loans (FL). Foreign Investment (FI) contains Foreign Direct Investment (FDI) and Foreign Other Investment. The ways of FDI includes: Sino-foreign joint ventures, Sino-foreign cooperative enterprises, foreign-funded enterprises (wholly foreign-owned enterprises), foreign-invested joint-stock enterprises and Sino-foreign cooperative development and others, while the ways of FOI contains issuing shares in China, international leasing, compensation trade and processing and assembly. In some China's Statistical Yearbooks, FDI and FOI are shown as a sum, such as the year 1986 and 1992-1996, that means it is hard to get the value of FDI from FI. So in this paper, FDI is actually the sum of FDI and FOI.

② This point was mentioned many times by World Investment Report (WIR), especially WIR 2001.

③ The content of this policy will be discussed in the third part of this paper.

this period 1978 to 2002, the average annual growth rate of total exports is 16.4%, which is more than that of GNP. In 1997 China became one of the world's top ten export trade. In a word, FDI have been increased dramatically over the last three decades in China and definitely improve the export and economy development. It is undoubted that Chinese government would like to attract multinational enterprises (MNEs) to locate and invest in China by using generous tax cutting policy and fiscal supports.^④ The rationale for such enthusiasm is that MNEs can bring some kinds of superior technology and management skills, increase total exports of host country by direct and indirect effects. The indirect effects are defined as the impact of FDI on Chinese domestic exports and the development of local firms, which would be illustrated by several spillover effects (demonstration effect, competitive effect, technology spillover effect and linkage effect). This is also the main question will be discussed in this paper.

On the contrast, there are some negative effects of FDI on host country economy, such as MNCs crowd out host country's companies by competitive advantage of productive efficiency and high-tech. The exports by foreign-invested enterprises (FIEs)^⑤ account for 46% of Chinese total exports (China Economic Review 11(2000), p.386), while in recent years, this percentage was increased to more than 50% by checking China's Statistical Yearbooks 2006 to 2009 and it displayed a huge challenge to

④ Actually not only China, most of governments of both developing and developed countries across the world attempt to attract MNEs to locate in their country by pretty much financial and fiscal incentives (see, for instance, Hanson 2001).

⑤ Foreign-invested enterprise (FIEs) is a general concept, including all the enterprises with the components of foreign capital. FIEs contains Sino-foreign joint ventures, Sino-foreign cooperative enterprises, Foreign-funded enterprises or Foreign-owned enterprises and Foreign investment partnerships.

Chinese domestic companies. So how to make good use of FDI is worthy of serious consideration.

The main purpose of this paper is to examine the effect of FDI on Chinese domestic exports. The sub purposes are as follows:

- Clearly list the impetus from FDI (spillover effects) behind the Chinese domestic exports
- Quantify the impact of FDI on Chinese domestic exports by regression analysis
- Through the regression result, giving some reasons about how the result should be like this

In order to illustrate these arguments, panel data about FDI, Chinese domestic exports, GDP, average money wage, exchange rate, labor in manufacturing sector, dummy variable about exports processing zones and several time dummy variables over the period 1992/1993 to 2003 are employed here to make the empirical analysis on the impact of FDI on Chinese domestic exports. By checking the regression result, we gain the conclusion that there is not enough evidence to prove that FDI can promote domestic firm exports even FDI can increase the total exports of China in some previous studies.

The rest of the paper is structured as follows. In the next section, illustrates the theoretical background. Section III describes some facts about FDI and exports of China. Section IV gives the methodology and contains a description of data. Section V presents and discusses the results from regression. Conclusion and suggestions about future study are provided in the last section.

2. Theoretical background

2.1 The basic theory focus on international trade and investment

Kojima (1978) built the model (Kojima model) about the relationship between international direct investment and international trade in his theory of marginal industrial expansion and found that there is a complementary relationship between them. The model considers that the investor can take advantage of host country's comparative advantages by foreign direct investment to create more trade opportunities and expand bilateral trade. The basic meaning of Kojima model is that if some industries in the home country have been or are about to lose their space for development, (they are being or will be at a disadvantage), and become the country's "marginal industries", while the same industries in other countries may be in a dominant position or potential dominance, the state should begin to turn to foreign direct investment of these marginal industries at a disadvantage. The purpose of investment in the host country is obtaining the raw materials and intermediate products, so that the investment can take advantage of home and host countries' comparative advantage to benefit both of them.

Muchielli and Chedor (1999) considers that the direct investment from developed countries to developing countries will make the host country learn more advanced skills about enterprise management and production technology. And make the local firms access to international sales network, thereby expand the scale of export and optimize the export structure.

Wang and Blomström (1992) describes the role of multinationals in shifting production in developing countries toward tradable goods and

among tradables, away from import substitution and toward export markets. Some of the country studies in Dobson and Chia (1997) are summarized as showing that "...Foreign firms...saw a way to integrate these countries into worldwide networks of production.... Foreign companies provide technology and links to other parts of the production networks that completed the set of resources that is necessary for the growth of these industries". (ibid, p. 163) The role of entering into the international networks of parent multinationals in promoting exports by U.S. affiliates in Asia is considered and assessed in Lipsey (2002).

Liu, Wang, and Wei (2001) points out that the net effect of inward FDI was increased by the activities of exports from China to the countries who invested in China. In this paper, the authors displayed that China first imported something from a country, and then stimulated the FDI from that country to enter into China, then the inward FDI would prompted the exports from China to that investing country. Maybe at first China is deficit due to the activity of importing, but after the exporting, China gain the profit, so the net effect is positive to China.

2.2 Direct effect of FDI on host country exports

Direct effect works when foreign affiliates boost host country exports by increasing their own exports, that is, direct effect refers to exports by foreign affiliates themselves.

The mechanism of direct effects contains that exporting foreign affiliates establish backward linkages[Ⓢ] with local firms, which then become "indirect exporters"; Foreign affiliates may also provide useful contacts with other affiliates of the transnational company (TNC) network (Raines,

Ⓢ Backward linkages refer to: Channels through which information, material, and money flow between a firm and its suppliers and create a network of economic interdependence. If the products of B are needed by the production of A, we can say B has a backward linkage with A.

Philip and Brown , 2001) to local firms through so called “reputation effects”. That means if a Chinese local firm do the processing well, and its work is appreciated by at least one foreign affiliate. And this foreign affiliate will tell other assemblers or manufacturers within the same business network or other foreign affiliates that this local firm is good at processing. That will increase this local company's business and export volume. In fact, for example, in the Southern Common Market area in Latin America and in China, Nestlé actively assisted selected suppliers to become regional suppliers to Nestlé; Hitachi’s semiconductor affiliate in Malaysia similarly assisted its vendors by introducing them to other Hitachi affiliates (WIR01); export endeavors of suppliers can also be helped by their gaining access to the knowledge and information controlled by a foreign affiliate such as knowledge of foreign market conditions related to design, packaging and product quality (Blomström et al., 2000). Finally, Zhang and Song (2000) points out working areas about the direct effect, which contain: “labor-intensive processes, local raw materials processing, component specialization within vertically integrated international industries and new labor-intensive final product exports(such as textiles) ”.

2.3 Indirect effect of FDI on host country exports

Indirect effects refer to the impact of FDI on export activities of local firms
The mechanism analysis is as below:

2.3.1 Demonstration effect

Demonstration effect means that local firms can observe and copy the export activities of MNCs to increase their exports. Indirect effects of the presence of export-oriented foreign affiliates occur when local firms

manage to copy the operations of foreign affiliates, employ staff trained by foreign affiliates, and benefit from improvements in infrastructure and reductions in trade barriers undertaken in response to the demands of foreign companies (Blomström et al., 2000). In Mexico, for example, one study found that the probability of a Mexican-owned plant engaging in exports was positively correlated with its proximity to TNCs but not correlated with the concentration of overall exporters (Aitken et al., 1997).

2.3.2 Competitive effect

Competitive effect refers to that MNCs have the advantages in product-process technology and management skills. In short term, they can act as catalyst to stimulate local industry and improve the performance and productivity of local firms. But in long run, the similar local industries will be wiped out or be absorbed by Mergers and Acquisitions. MNCs have firm-specific advantages that enable them to compete with local firms with better knowledge of consumers, factor markets, and the favor of local governments. These firm-specific advantages in product-process technology, management, and marketing competence represent something more than simple input of capital into a host country and may influence both the structure of the host economy and performance of host country firms. By taking their firm-specific assets abroad, MNCs may increase competition in host country markets and in that way, force existing firms to adopt more efficient methods. Such a competition effect is explicitly analyzed in the model by Markusen and Venables (1999). Their results show that FDI may have two main effects on host economies: the linkage effect through intermediate demands as described above and the product competition effect through which multinationals may force domestic firms to exit the market. However, their model suggests that, while multinationals can act as a catalyst to stimulate local industry, local

industry and multinationals do not coexist. One can, however, consider this result as particular case. As noted by Markusen and Venables themselves, “this result comes from the relatively high degree of similarity between local and multinational firms, and it is easy to imagine circumstances which would permit coexistence” (1999, p.351).

Haaland and Wooton (1999) have a similar theoretical setting, though they focus on the rationale for financial incentives. The authors argue that this case corresponds to the experience of some countries in East Asia where multinationals have served as catalyst for industrial development and, after a certain period of time, have been wiped out because of the strong competition they ended-up facing on their own product market.

2.3.3 Technology spillover effect

Technology spillover effect means that through the technology diffusion, FDI can change the structure of host country exports. Under the effects of FDI in those industries referred in the part of 2.2 in this paper, China had moved on in the road of attracting and improving technology.

In recent years, many local governments and firms, especially along with the coastal regions such as Jiangsu, Fujian, Guangdong, and Zhejiang Provinces have made big efforts to build clusters of suppliers working together with TNC in some specific industries. Xian and Zhang (1997) displayed that the share of high-technology industries in total FDI has increased rapidly inducing an industrial upgrading of the country. Most of the 100 R&D centers had been set up by High-technology TNCs before 2002 located in Shanghai and Beijing (WIR01, p. 26). For example, among the R&D centers about electronics, there were 18 centers were set up by Motorola, while 3 were founded by Microsoft. Hu (2002) points out that “the availability of a large pool of hard and soft R&D infrastructure (particularly well-qualified researchers) has attracted R&D centers.” So

these R&D centers have played a significant role in enhancing the innovative capability of foreign affiliates and upgrading their activities^⑦. Since the 1980s, China's FDI policies about both at the central level and local level are active. A set of industrial guidelines was set up, which contains the specific areas, in which FDI is encouraged, restricted or prohibited, and pretty of incentives, especially focus on prompting high-technology and export-intensive industries were founded too. Lots of export processing zones (EPZs), development zones, industrial parks, and science and technology zones were formed according to these policies. China now has 49 national zones, complemented by literally hundreds of EPZs, the establishment of which definitely attracted more and more foreign investors as well as domestic firms.

2.3.4 Linkage effect

Linkage effect works by intermediate demands. The activity of purchasing of inputs from the local firms by a foreign affiliate can improve the host country's trade balance.

In the channels of interaction between MNEs and domestic firms mentioned in Barrios, Görg and Strobl (2004), the author points out that there are several ways in which MNEs may assist the development of host country firms. In particular, "multinationals' demand for intermediate inputs, some of which will be sourced on the domestic market" that can induce changes in the structure of domestic industrial and can kick-start the development of local industry. At the same time, China undoubtedly has the advantage of the size and growth of its domestic market and the abundant availability of intermediate products. In addition, numerous clusters of domestic and foreign firms set up in recent years could provide

^⑦ At the same time, local firms are becoming more export-oriented and are moving up the technology ladder. In fact, a large number of high-technology export oriented foreign affiliates are joint ventures with local firms, having in this manner a sort of "crowding in" effect (Hu, 2002)

a great scope of services to foreign affiliates as well as domestic firms, which would facilitate the process of technology transferring from foreign affiliates to Chinese domestic firms and domestic industrial upgrading.

3. Overview of inward FDI and exports of China:

After the “open door policy^③”, a huge change of the structure of exports and inward FDI happened in China. There are some stylized facts about them as follows:

3.1. The development of exports in China

Table 1 shows the values of total exports and exports by FIEs measured by millions of dollars. Obviously, both the values of total exports and exports by FIEs have been gone through huge changes year by year. Both of the average annual growth rates existed in them is more than 100% respectively. A decline of the share of exports by FIEs in total exports happened in 1984, and then this percentage was increased steadily. In 1986, the share of exports by FIEs in total exports was 1.88%. In 2001, the

③ In 1980, Special Economic Zones were set up in Shenzhen, Zhuhai, Shantou and Xiamen, which began the era of reform and opening up in the coastal cities of China. In 1984, further open up 14 coastal cities which contain Dalian, Qinhuangdao, Tianjin, Yantai, Qingdao, Lianyungang, Nantong, Shanghai, Ningbo, Wenzhou, Fuzhou, Guangzhou, Zhanjiang and Beihai. Since 1985, Economic Open Zones were set up successively in Yangtze River Delta, Pearl River Delta, eastern and southern of Fujian province, and Bohai Rim region. In 1988, Hainan Special Economic Zone was found and became the largest special economic zone in China. In 1990, the decision of setting up and developing Shanghai Pudong New Area was implemented, which forms a new situation of China's opening up. The western development strategy went into effect in 2000, covering 12 provinces, autonomous regions and municipalities, three minority autonomous prefectures. All of them are in the middle or west of China. There are Shaanxi, Gansu, Qinghai, Ningxia Hui Autonomous Region, Xinjiang Uygur Autonomous Region, Sichuan, Chongqing, Yunnan, Guizhou, Tibet, Inner Mongolia Autonomous Region, Guangxi Zhuang Autonomous Region, Xiangxi in Hunan, Enshi in Hubei, Yanbian in Jilin, etc.

percentage was increased to 50.07%. It is the first breakthrough in 50%. In 2008, the value of the exports by FIEs was about 790492.70 million USD, and it accounted for 55.25 percent of the total exports. The exports by foreign-owned enterprises (FOEs) accounted for 1.98 % in 1990, after 10 years, the percentage was increased to 23.76% in 2000 and 33.33% in 2003. All these percentages and trends indicate an increasing dependence of Chinese exports on FDI, and the high percentage of exports by FOEs in total exports provides huge pressure on Chinese domestic firms and huge risk when foreign investment move out of China some day in the future.

Table 1
Total exports, and exports by FIEs 1980-2008, exports by FOE 1981-2003

Year	Total exports (millions of US\$)	Exports by FIEs (millions of US\$)	Share of exports by FIEs in total exports (%)	Exports by FOEs (millions of US\$)	Share of exports by FOEs in total exports (%)
1980	18119.00	8.24	0.05		
1981	22007.00	32.35	0.15	2.13	0.01
1982	22321.00	52.87	0.24	23.62	0.11
1983	22226.00	330.36	1.49	292.21	1.31
1984	26139.00	68.94	0.26	9.00	0.03
1985	27350.00	296.70	1.08	78.45	0.29
1986	30942.00	582.03	1.88	103.38	0.33
1987	39437.00	1208.09	3.06	170.16	0.43
1988	47516.00	2456.42	5.17	302.51	0.64
1989	52538.00	4913.20	9.35	682.54	1.30
1990	62091.00	7813.79	12.58	1228.39	1.98
1991	71910.00	12047.25	16.75	2471.62	3.44
1992	84940.00	17356.19	20.43	4276.92	5.04
1993	86164.13	25243.91	29.30	7242.47	8.41
1994	121006.32	34712.97	28.69	11283.10	9.32
1995	148189.74	46875.87	31.63	17396.06	11.74
1996	151047.53	61506.36	40.72	23807.05	15.76
1997	182791.66	74899.86	40.98	31230.91	17.09
1998	183809.07	80961.89	44.05	36662.44	19.95
1999	194930.87	88627.66	45.47	43360.27	22.24
2000	249202.55	119441.21	47.93	59200.93	23.76
2001	266098.23	133235.06	50.07	68964.70	25.92
2002	325595.98	169935.63	52.19	96213.51	29.55
2003	438227.75	240337.55	54.84	146048.63	33.33
2004	593325.58	338607.15	57.07		
2005	761953.41	444209.30	58.30		
2006	968935.60	563827.79	58.19		
2007	1217775.76	695370.77	57.10		
2008	1430693.07	790492.70	55.25		

Sources: 1. National Bureau of Statistics of China 2009 and China Foreign Economic Statistical Yearbook 2003. 2. Zhang and Song, (2000)

3.2. The change of inward FDI in China

Table 2 provides the information of the annual values about the inward FDI

and total investment in fixed assets. Specifically, in 1992, realized FDI was 11008 millions of dollars and the percentage of it in total investment in fixed assets is 7.51%. This percentage kept increasing until 1994, after 1994, the percentage began to go down. Especially, in 2007, the amount of FDI was increased to 83521 millions of US dollars but only accounted for 4.63% of total investment in fixed assets. This declined percentage from 1994 means that the role of FDI in boosting Chinese economy become less significant, as referred in Dullien, (2005, p.127), “FDI only became highly significant for the Chinese economy until the mid-1990s; it began to grow strongly after a number of bilateral investment treaties were signed in 1992^⑨.” It is also easy to find out the changes of the role of FDI in boosting Chinese economy through checking the relation between the percentage of FDI in the country’s gross fixed capital formation and GDP growth rate. Specifically, from 1992 to 1994, the share of FDI in the country’s gross fixed capital formation increased from 7.51% to more than 17% and the percentage of FDI in GDP also grew largely from less than 2% to more than 6% over the same time period, while the growth rate of FDI from 1994 to 2002 (40%) is obviously lower than that of GDP (90%). As Dullien, (2005) pointed out that the declined percentage of FDI in gross fixed capital formation after 1994 was not due to the absolute fall in FDI, but a strong increase of Chinese domestic investment.

⑨ These treaties include the important memorandum of understanding with the United States on a number of issues ranging from market access to intellectual property rights protection. (Dullien, 2005, p.127)

Table 2
Realized FDI and total investment in fixed assets 1992-2007

Year	Realized FDI (100 millions of US\$)	Total investment in fixed assets (100 millions of US\$)	Share of realized FDI in total investment in fixed assets (%)
1992	110.08	1,465.22	7.51
1993	275.15	2,268.71	12.13
1994	337.67	1,977.34	17.08
1995	375.21	2,397.23	15.65
1996	417.26	2,763.22	15.10
1997	452.57	3,059.97	14.79
1998	454.62	3,437.29	13.23
1999	403.18	3,608.00	11.17
2000	407.15	3,944.26	10.32
2001	468.46	4,458.11	10.51
2002	527.43	5,223.94	10.10
2003	535.05	6,664.81	8.03
2004	606.30	8,466.20	7.16
2005	724.06	10,816.30	6.69
2006	727.15	13,782.51	5.28
2007	835.21	18048.26	4.63

Sources: 1. National Bureau of Statistics of China 1993-2008. 2. Invest in China, http://www.fdi.gov.cn/pub/FDI_EN/

3.3 Sectoral changes on FDI and Chinese exports

As mentioned above there was a decline trend of the share of FDI in gross fixed formation, but it can't illustrate a decline role of FDI in some sectors, such as manufacturing and real estate and so on. In MOFCOM FDI Statistics, (2007), as to 2007, FDI was concentrated on the sectors of manufacturing and real estate. The two FDI values cumulatively accounted for 62.28% and 16.47% of all the FDI values respectively. In 2007, the industrial outputs by foreign-invested enterprises accounted for 30.91% in Chinese total outputs. Among the commodities exported by FIEs, mechanical electrical products and new and hi-tech products (For example, automatic data processing equipment and components) captured up almost all of the exports by FIE in 2007. Due to FDI was invested into

high-tech areas, so the share of exports by foreign affiliates in technology-intensive industries also rose correspondingly from 59 per cent in 1996 to 81 percent in 2000 (wir2002, p. 163). For instance, in the production of automatic data-processing machines, the exports alone from IBM worth over 1 billions of US dollars, and the whole foreign affiliates captured up more than 80% of the exports of this products. Mobile phone was also the main product which was mainly focused on by FDI, many famous foreign companies invested in this business in China, such as, Motorola, Nokia, Ericsson, Siemens and so on.

The following table 3 displays the exports by sector. In this table, primary goods contain food, non-edible raw materials, mineral fuels and related materials etc, while manufactured goods include chemicals, light textiles, industrial products, and machinery and so on. In 1980, the value of exports from manufactured goods was 9005 millions of US dollar, and accounted for less than 50 percent of total exports value. Since 1985, the percentage changed largely, from 49.44% in 1985 to 74.41 in 1990. In 2001, this percentage exceeded 90%, and in 2008 it reached to 94.55%. The value of exports from manufactured goods is far more than that from primary goods. The structure of Chinese exports had been gone through a huge change. Specifically, Chinese Statistic Yearbook 2009 points out, in manufactured goods, the exports value of machinery and transport equipment accounted for most of that of total manufactured goods, for instance, this proportion was 9.31% in 1980, and it reached to 49.8% in 2008, while the percentage of exports value of light textile in exports value of total manufactured goods was less than 44.4% in 1980 to less than 19.4% in 2008. So the traditional pattern of Chinese exports that was mainly focus on clothing and textile has been changed, even if as mentioned above, in some high-tech sectors such as automatic data-processing machines and mobile phone, the exports mainly come from foreign companies.

Table 3
Exports Value by sector (USD 100 million)

Year	Total	Primary Goods	Manufactured Goods	The percentage of exports value from manufactured goods in total exports value (%)
1980	181.19	91.14	90.05	49.7
1985	273.50	138.28	135.22	49.44
1990	620.91	158.86	462.05	74.41
1995	1487.80	214.85	1272.95	85.56
1996	1510.48	219.25	1291.23	85.48
1997	1827.92	239.53	1588.39	86.9
1998	1837.09	204.89	1632.20	88.85
1999	1949.31	199.41	1749.90	89.77
2000	2492.03	254.60	2237.43	89.78
2001	2660.98	263.38	2397.60	90.1
2002	3255.96	285.40	2970.56	91.23
2003	4382.28	348.12	4034.16	92.06
2004	5933.26	405.49	5527.77	93.17
2005	7619.53	490.37	7129.16	93.56
2006	9689.36	529.19	9160.17	94.54
2007	12177.76	615.09	11562.67	94.95
2008	14306.93	779.57	13527.36	94.55

Sources: Chinese Statistic Yearbook 2009.

4 Methodology

This paper exams the relationship between performance of domestic firm exports and the FDI for provincial level. The domestic firm exports would be explained by FDI and other variables mentioned above and linear model is employed here to specify the model, so the dynamic model would be designed as follows:

$$\text{LogDFE}_{it} = \beta_1 + \beta_2 * \text{LogFDI}_{i(t-1)} + \beta_3 * \text{LogGDP}_{it} + \beta_4 * \text{LogAMW}_{it} + \beta_5 * \text{LogER}_t + \beta_6 * \text{LogLM}_{it} + \beta_7 * \text{EPZD} + \beta_8 * \text{TD}_{1994} + \beta_9 * \text{TD}_{1995} + \dots + \beta_{17} * \text{TD}_{2003} + \mu_i + \varepsilon_{it}$$

where μ_i represents the specific effects (i.e. fixed or random effects), which refers to the model selecting and will be discussed below, and ε_{it} is the random errors.

The whole model selects the form of logarithms; the variables

$\text{LogFDI}_{i(t-1)}$, LogLMGDP_{it} , LogAMW_{it} , LogER_t and LogLM_{it} ,

reflect the short run elasticity of domestic firm exports to each of these variables, the subscript i stands for each province or city among the total 27 provinces and cities selected to use in the model and t means each year among the year 1993 to 2003. Among these variables, FDI received special attention and be analyzed as a main variable due to the purpose of this paper. The value of the coefficient about $\text{LogFDI}_{i(t-1)}$ reflects the relation between the current performance of domestic firm exports and the FDI in previous periods. The lag form of FDI covers a relatively longer period, which illustrate the impact of FDI on exports doesn't work immediately, because something like infrastructure construction, experience gaining, and spillover effect of technology requires lots of time.

In this paper, pooled estimation model, fixed effects estimation model and random effects estimation model are employed to make the analysis about the impact of several factors on domestic firm exports. Pooled estimation model works when data is no significant difference from the view of time and cross-section; it uses OLS to make the regression about mixed panel data. If the intercepts of model are different from the view of time or cross-section, fixed effects estimation model is better selected to use. The values of μ_i means the heterogeneity at the provincial level that is not captured by the other explanatory variables in fixed and random estimation models respectively. Compared with fixed effects estimation model, random effects estimation model is equivalent to be that divide the intercept of fixed effects estimation model into two random variables. This paper attempts to find which model is better by hausman test, but from the result of this test, the difference between the estimated covariance matrices from the fixed effects and random effects models was not a positive definite matrix, which

means hausman test cannot be used to draw conclusions about which model should be used. Taking into account that fixed effects estimation model is easy to analyze the difference in the mean level of the dependent variable corresponding to arbitrary cross section and all cross sections. In addition, fixed effects estimation model need not to make the individual effect components in error be not relevant with explanatory variables, and the fixed effects estimator is always consistent, thus the result and conclusion would be mainly based on the result of fixed effects estimation model.

Most of data used in this paper come from China Statistical Yearbook 1994 to 2004. The style of the data used in this paper is panel data, which is provincial level and contains 4 municipalities and 23 provinces covering the period 1993/1992 to 2003. Totally, this paper employed one dependent variable (Chinese domestic firm exports) and several independent variables which contain: FDI, exchange rate, GDP, labor in manufacturing sector, average money wage and several dummy variables. Due to many missing data on FDI for Chongqing Qinghai, Xinjiang and Tibet, the four provinces are excluded from regression analysis, which results in a total panel observation number of 297. The name and definition of these variables can be found in the table below:

Table 4

Discription of dependent and independent variables	
Variable	Discription of variable
DFE	Domestic Firm Exports,the value of DFE is equal to the difference between the value of Exports by Region and the value of Exports of Foreign-funded Enterprises by Region
FDI	Foreign Direct Investment, FDI is actually the sum of Foreign Direct Investment and Foreign Other Investment
GDP	Gross Domestic Production
AMW	Average Money Wage
ER	Exchange Rate, U.S. dollar-denominated method is used here, that means how much RRB (yuan) is equal to one U.S. dollar
LM	The total number of labors in manufacturing sector by region
EPZD	Dummy Variable of Export Processing Zones
TD	Time dummies, i.e. dummy variables for every year except the first to control for business cycle

Domestic firm export is the dependent variable in this paper which main purpose is to estimate the effect of FDI on Chinese domestic firm exports. MNCs always be thought to bring some advanced technologies and management skills into the countries which were invested by them (Zhang and Song, 2000). FDI has a significant impact on China exports through direct and indirect channels as referred in the theoretical part of this paper. The impact of FDI on domestic firm exports comes from indirect effects (Caves,1996; Helleiner,1989). As mentioned in the theoretical part of this paper, demonstration effect, technology spillover effect and linkage effect can improve the Chinese domestic exports, and in the short run competitive effect can promote the exports from Chinese domestic firms too. Therefore, the variable FDI is selected to put in the model that will be established below. The hypothesis about FDI here is that when FDI increased, domestic firm exports increased. In this way, one or more channels from demonstration effect, technology spillover effect and linkage effect even competitive effect works well^⑩, thus FDI work well overall in promoting

⑩ Because it is hard to find different variables to divide the channels of indirect effects into demonstration effect, technology spillover effect, linkage effect and competitive effect, so in this

Chinese domestic exports.

GDP reflects the overall performance of a province and exports. Increase in GDP means the increase in output, if domestic production grows faster than domestic demand; the company is bound to sell their products to foreign countries, which means the domestic exports would be increased. So, GDP is expected that having positive relation with domestic firm exports. Average money wage is another variable employed in the model, and compared with GDP which indicates the size of the province's economy, Average money wage illustrates the income level per person in each province which is observed here. Wage is an important incentive to promote production and exports, so the average money wage is expected positively related with domestic firm exports.

Exchange rate is another factor affecting export performance. In the course of trade between countries, the price plays an important role. When the price of a country is lower than that of another country, its product will have an advantage. In the transactions of products, the exchange rate also plays an integral role. After reform and opening up, China changed the unchanged exchange rate that had existed for several decades and made it declined according to the inflation rate, the cost of exchange when exports and the international balance of payments. After the adjustment of the exchange rate of Chinese Yuan, the lever of exchange rate began to work in the activities of importing and exporting. In theory, depreciation of exchange rate has a positive relation with export growth, that is, the export will increase when the exchange rate becomes from 1 U.S. dollar = 8.28 Yuan to 1 U.S. dollar = 9 Yuan. Because it means that from the perspective of foreigners, Chinese goods become cheaper and the demand of Chinese

paper, demonstration effect, technology spillover effect, linkage effect and competitive effect can be viewed as a whole and be reflected by FDI. So if FDI is proved to have positive relation with Chinese domestic exports, we can't say which specific one works. The reason why describing them separately in the theoretical part is to make the channels how FDI can affect Chinese domestic exports more clearly understood.

goods will increase, so China's exports will grow. Thus, the negative relation is expected to exist between the exports and exchange rate.

The total number of labors in manufacturing sector by region is also a significant variable used in empirical model to explain domestic firm exports. Capita and labor resources are main factors to promote production and exports. In addition, as mentioned in the second part of this paper, manufacturing products account for a big percentage of total exports. So the number of labors is reasonable to be concentrated on manufacturing sector, and the data about this labor here is provincial level that is a reflection of overall economic performance about production and exports for each province. Therefore, the total number of labors in manufacturing sector by region seems having an incentive to promote exports and be assumed to be positively related with the exports by Chinese domestic firms.

Since the 1950s, EPZs have become increasingly significant in both developed and developing countries as a policy instrument for the promotion of export-oriented FDI. EPZ contains many different types of zones (e.g. free-trade zones, duty-free zones, free-investment zones, offshore zones), reflecting the variety of activities performed in the zones.

One possible definition of EPZ is that “EPZs as fenced-in industrial estates specializing in manufacturing for export and offering their resident firms free-trade conditions and a liberal regulatory environment” (World Bank, 1992). Another is to describe them as industrial zones with special incentives set up to attract foreign investors, in which imported materials undergo some degree of processing before being re-exported (ILO, 1998). In any case, EPZs are clearly delimited and enclosed areas of a national customs territory, often at an advantageous geographical location (Madani, 1999) with an infrastructure appropriate for carrying out trade and industrial operations and subject to the principle of customs and fiscal segregation. In this paper, the variable EPZ is seen dummy variable. If a

province owns one or more EPZ, the dummy variable of this province is equal to 1, while zero means there is no EPZ in this province. Thus, the province with one or several EPZs is expected to have a positive relation with the performance of domestic firm exports.

Time dummy variables are employed here to control for business cycle effects, i.e. macroeconomic booms and busts that affect all provinces and companies, except the first year 1993. So there are 10 time dummies covering the period 1994 to 2003. Take 1994 for example, the time dummy variable takes the value one for all observations in 1994, regardless of which province the observation is from. Another dummy taking the value one for all observations in e.g. 1995, regardless of which province the observation is from and so on.

5. Result

In this part, the regression results would be represented in table 5 as below.

Table 5
Determinants of Chinese domestic firm exports (Dependent variable: LDFE)

Independent varia	Model 1		Model 2		Model 3	
	Coefficients	t-value	Coefficients	t-value	Coefficients	z-value
Constant	(-5.588815)***	-6.13	0.457652	0.27	-0.3492148	-0.29
LFDI(-1)	0.1992204***	7.26	0.0490567	1.43	0.0954659***	2.97
LGDP	0.7791988***	7.25	1.11579***	4.47	0.8203187***	6.43
LAMW	1.414149***	12.43	0.3786048**	2.17	0.7063247***	4.57
LLM	-0.1163679	-1.45	0.315477	0.33	(-0.0443941)	-0.49
ER	(-0.1717075)***	-4.72	-0.0422472	-1.25	(-0.0642359)**	-2.18
EPZ	0.4132037***	5.8	----	----	0.8162232***	5.62
td_1994	----	----	----	----	----	----
td_1995	(-0.3695993)***	-3.75	(-0.1684214)*	-1.94	(-0.1837491)***	-2.43
td_1996	(-0.8459013)***	-7.99	(-0.5649091)***	-4.84	(-0.5748686)***	-6.33
td_1997	(-0.915953)***	-8.12	(-0.5759483)***	-4.11	(-0.5839625)***	-5.63
td_1998	(-1.310627)***	-10.33	(-0.8095879)***	-4.95	(-0.8587249)***	-6.82
td_1999	(-1.524025)***	-11.18	(-0.9244673)***	-5.13	(-0.9955229)***	-7.08
td_2000	(-1.502129)***	-10	(-0.8351244)***	-4.06	(-0.909962)***	-5.7
td_2001	(-1.759173)***	-10.62	(-0.9744336)***	-4.19	(-1.069397)***	-5.88
td_2002	(-2.008054)***	-8.99	(-0.9746991)***	-3.37	(-1.1558)***	-4.71
td_2003	(-2.04191)***	-8.5	(-0.9096536)***	-2.83	(-1.097223)***	-4.1
sigma μ_i	----		0.59537576		0.27179466	
sigma ϵ_{it}	----		0.23215761		0.23215761	
Adjusted R	0.9168		0.7466		0.8997	

Model 1 is the pooled estimation model; Model 2 is the Fixed effects estimation model; Model 3 is random effects estimation model; *** represents significant at 0.01; ** represents significant at 0.05; * represents significant at 0.1.

The equation is estimated with the method of pooled estimation model, fixed effects estimation model and random effects estimation model respectively. By checking the t-value and p-value of the estimated coefficients, if a p-value is larger than 0.1, this illustrates that there is not enough evidence to prove the relationship between the independent variable and the dependent variable. If looking at the regression results of full sample in the column 2 in table 2 (Model 1), the estimated coefficient of $\text{LogFDI}_{(t-1)}$ is about 0.20 with a small p-value that is smaller than 0.01, which means that the statistic value of the variable FDI is significant and FDI has a significant effect on increasing domestic firm exports. Because the value of FDI and DFE is in the form of log, so the coefficients 0.20 in the model 1 means that when FDI of a province in previous period is increased by 1%, current domestic firm exports in this province would be increased by 0.2%. In the same way, the previous FDI in model 3 is also significantly positive and can increase domestic firm exports in current period. But in the model 2, there is not enough evidence to prove that FDI has any relation with domestic firm exports. As mentioned in the part of methodology, the conclusion should based on model 2, so this paper points out that FDI is not necessarily to be seen as an incentive to improve domestic firm exports even FDI can increase the total exports of China. The reason is that foreign investment in China is mainly the capita, foreign affiliates prefer to use Chinese cheap labors, and the purpose of this investment is to gain profits not spill over technology. The advanced production technology China can introduce is not enough to improve the level of national production technology, let alone the adjustment and upgrading of industrial structure. So, the four channels of indirect effects of FDI on Chinese domestic exports can't be said that they have worked.

As the analysis of FDI, the analysis of other independent variables should also base on the results from model 2. The positive and significant values of coefficients about LogGDP_t in these three models, especially in the model 2 illustrate that GDP are strongly positively related with domestic firm exports. The result on GDP represents that a better performance on overall economic of a province, a better performance on

exports of this province. The same result happen in the variable average wage for each province, which means higher average wage, larger Chinese domestic exports in that province.

The result on labor in manufacturing sector is not significant in these three models. Labor as a factor of production, is not so significant to modern production. The production now is more focus on high-tech and advanced equipment. More workers are not necessary to produce more products, let alone high-tech and high profit products. Thus more labors in the manufacturing sector is not necessary related with more domestic firm exports either. The variable of average money wage is significant in these three models. So wage level is a significant variable to control domestic firm exports. For example, in model 2, 1% increase in wage can bring about 0.4% increase in domestic firm exports, thus higher wage more domestic firm exports.

Change in the exchange rate is significant related with domestic firm exports in the model 1, but there is not significant relation between these two variables in the model 2 and 3. From a general point of view of international economics, exchange rate movements has been able to play a significant role in regulating exports, because it changes the relative prices of a country's exports, so it should affect performance of domestic firm exports, but because there is a delay in the decision-making about changing the volume of importing and exporting when a change of exchange rate occurs. In addition, there is not an obvious change in exchange rate from 1993 to 2003. So based on the result of model 2, exchange rate is an insignificant variable to affect domestic firm exports.

The regression result on the dummy variable of export processing zone is positively and significantly related with the performance of domestic firm exports of provincial level in model 1 and model 3, but not in model 2. So based on the insignificant statistic value of this dummy variable in model 2, which illustrates that domestic firm exports from export processing zone is not necessary more that those from other place. Most of time dummies are significant independent variables which can explain the

dependent variable, and most of the p-values of them are also smaller than 0.01, that means time dummies efficiently control the business cycle.

In addition, the value of $\sigma^2_{\mu_i}$ in fixed effects model is about 0.60 and the fraction of variance due to μ_i is equal to about 87% ($\sigma^2_{\mu_i}/(\sigma^2_{\mu_i}+\sigma^2_{\varepsilon_{it}})$), which means fixed effects model control for 87% heterogeneity that is not captured by the other explanatory variables. In the random estimation model, this percentage can be calculated in the same way and it is equal to about 58%, which means there is 58% heterogeneity that is controlled by random effects and is not captured by the other explanatory variables employed in this model.

6. Conclusion

To estimate the relation between FDI and domestic firm exports, this paper employed several variables, such as FDI, domestic firm exports, GDP, average money wage, the number of labors in manufacturing sector, exchange rate, dummy variable about exports processing zones and lots of time dummies. The panel data about these variables contains 4 municipalities and 23 provinces covering the period 1993/1992 to 2003. The analysis is based on the pooled estimation model fixed effects estimation model and random effects estimation model, but conclusion should based on fixed effects estimation model as mentioned above. So from the result of the fixed effects estimation model, there is not enough evidence to prove that FDI has any relation with domestic firm exports, that is to say FDI is not necessary to be seen as an incentive to improve domestic firm exports even FDI can increase the total exports of China. So, the four channels (demonstration effect, technology spillover effect and linkage effect even competitive effect) of indirect effects of FDI on Chinese domestic exports can't be said that they have worked.

The reasons for this result may come from two aspects. On the one hand, there are some problem in Chinese domestic firms on absorbing

advanced tech from foreign companies, like the technological level of technical staff is too low to understand high-tech products from foreign companies, and Chinese local companies can't afford the pressure of competition from foreign high-tech industries, thus foreign affiliates can crowd out the domestic firms in the same industry. On the other hand, foreign investment in China is mainly the capita, foreign affiliates prefer to use Chinese cheap labors, and the purpose of this investment is to gain profits not spill over technology. The advanced production technology that Chinese domestic firms can introduce is not enough to improve the level of national production technology, let alone the adjustment and upgrading of industrial structure.

This paper points out the indirect effects of FDI did not work well, but not mention which part of indirect effects did not work well. Because as mentioned in the theoretical part of this paper, the channels of indirect effects of FDI contains demonstration effect, competitive effect, technology spillover effect or linkage effect, to define each part of them and make a analysis of each of them to find out the more specific reason why Chinese FDI can't improve Chinese domestic firm exports. More hard work will worthy to do about this.

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