Foreign Direct Investment and Economic Growth in China: A Panel Data Study for 1992-2004

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Abstract: The role of foreign direct investment (FDI) continues to be debated and tested in the literature on international economics and development economics. This paper extends the previous empirical studies on the issue by developing a new framework and providing some evidence from panel data of China. We first identify possible channels through which FDI may affect (positively or negatively) the Chinese economy. Then we work on a growth model, in which direct effects and spillovers of FDI are specified. The provincial data over the period of 1992-2004 are used to assess to what extent the remarkable FDI inflows affect China's income growth. The results suggest that FDI seems to promote income growth, and that this positive growth-effect seems to rise over time and to be stronger in the coastal than the inland regions.

JEL Code: F21, F23, and O53.
Key word: Foreign direct investment; economic growth; spillovers.

* This paper is prepared for the conference of "WTO, China and Asian Economies" to be held at University of International Business and Economics (UIBE), Beijing, China in June 24-25, 2006. I am grateful of Yu Chen's research assistant work. The usual disclaim applies.

1. Introduction

China achieved an impressive economic growth with an average rate over 9% in 1978-2005, the highest in the world in that period. The achievement seems to owe much to the adoption of radical initiatives encouraging inward foreign direct investment (FDI). From an almost isolated economy, China has become the largest FDI recipient in the developing world and globally the second largest (next to the US) since 1992. In 2002, China even surpassed the US with FDI inflows of $53 billion. By the end of 2005, the accumulated FDI in China was $622 billion. The contribution of FDI to the Chinese economy seems to be burgeoned in ways that no one anticipated. In 2004, FDI inflows constituted 7% of gross capital formation; 21% of China's tax revenue came from the foreign-invested enterprises (FIEs), 28% of industrial output was produced by FIEs; and more than half of China's exports (57%) were created by FIEs (Table 1).

While there has been an increasing body of the literature on FDI in China (e.g., Lardy 1995; and Pomfred, 1997), systematic treatments of the role of FDI in Chinese economy seem to have been limited. Especially few studies have been devoted to empirically analyzing the impact of FDI on China's income growth.[1] This study attempts to close the gap by providing a quantitatively assessment of effects of FDI on the Chinese economy. We first identify possible channels through which FDI may affect Chinese economy and transition. Then using cross-section and panel data in 1984-98, we estimate a reasonable growth model in which the direct effects (e.g., raising productivity and promoting export) and externality effects (e.g., facilitating transition and diffusing technology) of FDI on the Chinese economy are emphasized.

[1] There are a few exceptions. Using city-level data in 1980-90, Wei (1995) finds positive effects of FDI on the Chinese economy through technology spillovers. A recent study by Zhang (1999) tests the long-run link and short-run dynamics between FDI and Chinese economic growth. Branstetter and Feenstra (1999) provide an empirical analysis with political economy approach toward effects of FDI and trade on the Chinese economy.

Two features characterize this study. First, empirical specifications used in this study not only include direct effects of FDI on China's economic growth, but also enable one to analyze externality effects (spillovers). The importance of FDI in the Chinese economy, combined with China's rapid income growth in the last two decades, seems to suggest that in no other economy has FDI played such a dynamic and significant role (UNCTAD, 2005).

Second, estimations are conducted with both cross-section and panel data at the provincial level for more informative and reliable results. Breaking down the entire period (1992-2004) into three sub-periods allows us to investigate structural changes over time in the impact of FDI and other growth factors on the Chinese economy. The panel approach allows one to capture province-specific differences that are not reflected in cross-section estimates.

The main results may be summarized as follows. The direct impact and spillovers of FDI on income growth are significantly positive, and they seem to increase over time. Regional differences, especially due to biased FDI policies, favor the coastal region. The marginal product of foreign capital seems to be significantly larger than that of domestic capital.

2. The Role of FDI in the Chinese Economy

Positive Effects on Economic Growth

Standard propositions of the neoclassical theories suggest that FDI is likely to be an engine of host economic growth, because (a) inward FDI may enhance capital formation and employment augmentation; (b) FDI may promote manufacturing exports; (c) By its very nature, FDI may bring into host economies special resources such as management know-how, skilled labor access to international production networks, and established brand names; and (d) FDI may

result in technology transfers and spillover effects (Markusen and Venables, 1999; UNCTAD, 1999 and 2004).

In the case of China, the most prominent contribution of FDI perhaps is expanding China's manufacturing exports.[2] Foreign-invested enterprises not only augment China's export volumes, but also upgrade its export structure.[3] While China's exports were ranked as the 26th in the world in 1980, with the volume of $18 billion and 47% of the exports as manufactured goods, the corresponding numbers in 2005 were the 3rd in ranking, $762 billion, and 93%. The value of exports by FIEs (almost all of them as manufacturing goods) in 2005 was $444 billion, comprising 58% of China's total exports in that year (SSB, 2006).

FDI also has enhanced China's economic growth through raising capital formation, increasing industrial output, generating employment, and adding tax revenue (Table 1). The ratio of FDI flows to gross domestic investment increased from a negligible level in the 1980s to 7% in 1992, and then to 17% in 1996. The share of industrial output by FIEs in the total grew from 7% in 1992 to 36% in 2004. FDI also has reduced China's unemployment pressure and contributed to government tax revenues. By the end of 2004, FIEs employed 23 million Chinese, comprising about 10% of total manufactured employment. Tax contributions from FIEs rose with FDI flows, and its share in China's total tax revenues increased from 4% in 1992 to 21% in 2004.

[2] The view of exports as an engine of growth has been recognized for long time in both academic and policy circles (for example, Feder, 1982).

[3] Naughton (1996) argued that China's dualistic trading regime has led to a "crowding out" of domestic firms exports by FIEs due to more favorable policies for the latter. This may be true in some particular industries to a certain extent, but overall effects of FDI on exports seem to have been positive because of China's export-oriented FDI strategy and the relocation of labor-intensive production from Taiwan and Hong Kong to China (Zhang, 2006; Zhang and Song, 2000; Lardy 1995).

Moreover, FDI seems to have brought extra gains to China in facilitating its transition toward a market system that started in the late 1970s, which may promote income growth. These gains include stimulating the move towards marketization by introducing a market-oriented institutional framework; contributing to changes in the ownership structure towards privatization by promoting competition and facilitating the reform of state-owned-enterprises; and facilitating the integration of China into the world economy.

Negative Effects on Economic Growth

The Marxist and dependency stances may treat FDI made by multinational corporations (MNCs) as one mechanism for exploitation of and gaining controls over developing countries by western industrialized countries.[4] Economic arguments of this view suggest that FDI may be detrimental to Chinese economy, because (a) rather than closing the gap between domestic savings and investment, FDI might actually lower domestic savings and investment; (b) in the long run FDI may be to reduce China's foreign-exchange earnings on both current and capital accounts; (c) contributions of foreign-invested enterprises' public revenue may be considerately less than it should be as a result of transfer pricing and variety of investment allowance provided by the Chinese government; (d) the management know-how and technology provided by MNCs may in fact inhibit developing local sources of these scarce skills and resources due to the foreign dominance in Chinese markets.

The true significant criticism of FDI may be conducted on more fundamental levels of the long-term national welfare. This includes, for example, (a) MNCs may suppress domestic firms and use their advantages in technology to drive out local competitors; (b) MNC activities may reinforce China's dualistic economic structure and exacerbate income inequalities due to their

[4] For more discussions, see Biersteker (1978) and surveys by Helleiner (1989) and Caves (1996).

uneven impact on development (Zhang and Zhang, 2003); (c) MNCs may influence government policies in directions unfavorable to China's development by gaining excessive protection, tax rebates, investment allowances, and the cheap factory sites and social services; and (d) powerful MNCs may gain controls over Chinese assets and jobs such that they could exert considerable influences on political as well as economic decisions at all levels in China.

3. Model Specifications

Although further theoretical and qualitative insights about the impact of FDI on the Chinese economy would be valuable, empirical analyses are needed as well for a better understanding of the relationship between FDI and the Chinese economic growth. Adapting the methodology used in Feder (1982) and Levin and Raut (1997), we may estimate the impact of FDI by specifying an aggregate production function as follows:

$$(1) \qquad Y=AL^{\beta_1}K^{\beta_2}, \qquad A=B\left[1+\theta\left(\frac{F}{Y}\right)\right]F^{\alpha}$$

where Y = real output, L = labor input, K = stock of domestic capital, F = stock of FDI, and A = total factor productivity level. This specification permits total factor productivity (A) to be endogenously determined by the stock of FDI and the share of FDI stock in GDP, as well as exogenous influences represented by the residual productivity factor (B). Following the standard procedure in the literature, we take the natural logarithm, then the first difference of this production function, and finally slightly manipulating items in the right-hand side. With the addition of a constant term (β_0) and an error term (ε), we obtain the following expression describing the determinants of the growth rate of GDP:

$$\dot{Y} = \beta_0 + \beta_1 \dot{L} + \beta_2 \left(\frac{I}{Y} \right) + \beta_3 \left(\frac{I_F}{Y} \right) + \beta_4 \Delta \left(\frac{F}{Y} \right) + \varepsilon \quad (2)$$

where a dot over a variable indicates its rate of growth, and I and I_F are domestic investment and FDI flows, respectively. β_1 represents output elasticity of labor, β_2 and β_3 are marginal products of domestic capital and FDI, respectively. Thus influences of externalities of FDI on the transition and technology diffusions are captured by the coefficient of I_F/Y (β_2). The coefficient (β_4) of changes in the ratio of FDI stock to GDP ($\Delta F/Y$) reflects the superior productivity of foreign-invested enterprises.[5]

Two more variables have been suggested in recent growth models as determinants of growth: initial development levels (y_0 as per capita GDP) and human capital (H) (Barro and Sala-i-Martin, 1995). In particular, the models predict a negative link between initial per capita GDP and long-run growth rate of GDP, and the positive impact of human capital on income growth. Then the regression model is expanded as follows.

$$\dot{Y} = \beta_0 + \beta_1 \dot{L} + \beta_2 \left(\frac{I}{Y} \right) + \beta_3 \left(\frac{I_F}{Y} \right) + \beta_4 \Delta \left(\frac{F}{Y} \right) + \beta_5 y_0 + \beta_6 H + \varepsilon \quad (3)$$

Studies of FDI and growth also postulate a positive link between FDI and human capital, since the application of the advanced technology embodied in FDI requires a sufficient level of human capital in host economies (e.g., Borensztein, et al., 1998). We incorporate such complementarities between FDI and human capital by assuming A in the aggregate production function (1) is of the following form:

[5] The major postulates of Feder (1982) are made: (a) the economy consists of two sectors, FDI sector and the rest of the domestic economy; (b) the output of the FDI sector generates an externality effects; (c) labor and capital serve as the conventional inputs in both sectors; and (d) production functions and relative marginal products of the inputs differ across the two sectors.

$$A = B\left[1+\theta_0\left(\frac{F}{Y}\right)+\theta_1 H\left(\frac{F}{Y}\right)\right]F^{\alpha}$$

By applying the same procedure in equation (1) to this function, we have equation (3) to be

$$\dot{Y} = \beta_0 + \beta_1\dot{L} + \beta_2\left(\frac{I}{Y}\right)+\beta_3\left(\frac{I_F}{Y}\right)+\beta_4\Delta\left(\frac{F}{Y}\right)+\beta_5 y_0 + \beta_6 H + \beta_7 H\Delta\left(\frac{F}{Y}\right)+\varepsilon \quad (4)$$

3. The Data and the Main Results

Equation (4) constitutes the basis for our cross-section and panel analyses of growth effects of FDI at provincial levels in 1992-2004. The empirical specifications may be modified slightly based on patterns of FDI and economic growth in China. First, there are significant regional variations in economic performance and distribution of FDI within China (Zhang, 2001). The coastal region enjoys higher growth rate than the inland region by 2-4% during 1992-2004. At the same time, most of FDI (87% of the total) went to the coastal region.[6] To capture the regional differences in the economic performance and the FDI distribution, we include a regional dummy (*D*) in estimates to control policy-induced biases of economic growth.

Second, as shown in Figures 1 and 2, growth rates of GDP and FDI flows changed substantially over the period 1992-2004. To bring out any possible structural variations over time, separate cross-section estimations are conducted for three sub-periods: 1992-96, 1996-2000, and 2000-04.

Third, panel analyses are to be employed to control for province-specific effects, since the fixed-effects estimation enables us to focus on relationships within provinces over time. To

[6] Researchers have identified various factors to explain the skewed geographic pattern of FDI within China. Among them are government's biased open-door policy toward the coastal region, higher development levels in the coastal region, and historical and cultural links between provinces and FDI sources (e.g., Guangdong-Hong Kong and Fujian-Taiwan). See Zhang (2001).

avoid potential problems of time-series data with non-stationarity, cointegration, and autocorrelation, we use average values of all variables for three sub-periods, rather than 15 years of time series (Macnair, et al., 1995).

The data were collected for 28 regional units for 1992-2004, since the most of FDI (95% of the total) China received so far is in the period since 1992. In addition to 21 provinces, the sample includes three municipalities (Beijing, Tianjin, and Shanghai) and four autonomous regions (Inner Mongolia, Guangxi, Ningxi, and Xinjiang) that have provincial status. The province of Qinghai, the autonomous region of Tibet, and the newly established municipal city of Chongqing are dropped from the sample due to unavailability of the data.

All data on variables used in the estimations are taken from or calculated based on *China Statistical Yearbook* (various years of 1993-2005) and *China Regional Economy* (1996) by State Statistical Bureau (SSB) of China. The growth rate of real GDP for each province is taken as a proxy for $\dot{Y}$. The growth rate of population is used in place of $\dot{L}$, and human capital (H) is measured by shares of secondary school enrollments in total population.[7] The domestic investment-output ratio (I/Y) is computed as nominal gross fixed capital formation divided by the nominal GDP. The FDI-output ratio (I_F/Y) is computed as the ratio of nominal realized FDI flows (in U.S. dollars) to nominal GDP that is converted into U.S. dollars. Data on changes in the ratio of FDI stock to GDP ($\Delta(F/Y)$) are calculated in a two-step procedure. First, data on nominal realized FDI stock in each province are obtained by accumulating over years, with adjustments based on data on nominal national FDI stock, which are from *World Investment Report* (UNCTAD, various years from 1992 through 1999). Second, we compute the ratio of nominal

[7] There is a concern about growth rate of population as measurement of $\dot{L}$ due to inter-province floating population. Unfortunately, no accurate figures on such persons are available. Similarly, data on schooling years of labor forces at provincial levels are incomplete, although they are better proxy of human capital (H) than student enrolment shares in population.

FDI stock to nominal GDP and then take differences of the ratio. Per capita real GDP levels in 1984, 1989, and 1994 are used as the initial levels of economic development (y_0) for the three sub-periods. The regional dummy (D) takes value of one if the province is located in the coastal region and zero for others. For cross-section estimations, growth rates over the relevant periods are obtained by fitting exponential trend equations, and the ratios are computed by taking mean values of the basic variables over the relevant periods.

We estimate two variants of equation (4) for the purpose of comparisons: one without FDI variables and the other with FDI variables. The main regression results of the two specifications with the cross-section and panel data are presented in Tables 2 and 3, from which the following points are easily discerned.[8] First, in all relevant cases, the comparison of results from the two models highlights the superior explanatory power of the model with FDI variables over the model without FDI variables. In particular, the adjusted R^2 increases by 23-25% (from 0.58-0.61 to 0.73-0.78) in the cross-section and panel estimations when the specifications including FDI as independent variables are used. The finding suggest that FDI seems to be one of factors that affected the Chinese economy

Second, the variable of $\Delta(F/Y)$, which indicates the superior productivity of foreign-invested enterprises, has significantly positive coefficients in all relevant estimates. The overall picture of cross-section estimates in Table 2 is similar to that of panel estimates in Table 3. The results are consistent with the widespread belief that more productive foreign capital seems to enhance China's economic growth (Lardy, 1995; and Pomfret, 1997).

[8] The estimates reported here might be troublesome due to the feedback from the dependent variable. A full-scale treatment of the issue requires causality tests with reasonable long time-series data, which is impossible for the present work due to limited years covered. Instead, we can test, based on the approach suggested by White (1980), at a simple level whether there are specification errors of the kinds mentioned. The result of White test indicates that the values of the test statistic are too small to justify non-acceptance of the null hypothesis of correct model specifications, suggesting absence of the feedback.

Third, externality effects of FDI (measured by coefficients of (I_F/Y)) are significantly positive in all relevant cases except the sub-period of 1992-2004. This finding thus lends a support to the observation that the presence of multinational corporations themselves may not only result in technological diffusion and transfers, but also facilitate China's transition toward a market economy. Moreover, significantly positive coefficients of the interaction variable ($H\Delta(F/Y)$) in most relevant cases suggest that there might exist complementary effects between FDI and human capital.

Fourth, effects of three FDI variables on the Chinese economy increase over time, as suggested in Table 2. The coefficient of $\Delta(F/Y)$ rises from 0.16 to 0.23 in the three sub-periods, representing an increase of 44%. The coefficient of I_F/Y goes up as well over time from 0.21 to 0.28 (rising by 33%). The same story may be found for the interaction variable ($H\Delta(F/Y)$). The result is anticipated from the consideration that the substantial increase in FDI flows over time might have led to a growing role of FDI in the Chinese economy.

Fifth, the result of the regional dummy (D) in both the cross-section and panel estimations shows that favorable FDI policies and natural resource conditions are beneficial to economic growth in the coastal region. Rising values of the coefficient of D and its significance over time suggest that growth effects of FDI induced by policies and regional differences seem to be larger in the coastal region in the period. This point is consistent with findings of recent studies that FDI contributed China's widening regional income-gap (Zhang and Zhang, 2000).

Finally, the coefficients of Δ (F/Y) are numerically larger than those of domestic investment (I/Y) in the panel estimates as well as the cross-section estimates, with a greater differential in 1992-2004. This result thus supports predictions of FDI theories that marginal product of FDI should be greater than that of domestic capital, because a multinational firm must

possess some special advantages such as superior technology to overcome inherent disadvantages and high costs of foreign production (Caves, 1996; Zhang and Markusen, 1999).

In summary, overall effects of FDI on the Chinese economy seem to be positive and not negligible. This finding confirms the Chinese government's perception about the role of FDI in the Chinese economy. According to the Chinese official estimations (SCI, July 31, 2001), out of 9.7% of the average growth rate of real GDP in 1980-99, 2.7% came from direct and indirect contributions of foreign-invested enterprises, which constitutes more than a quarter (28%) of total growth rate in that period.

Tow points are worth notice. First, other factors that affect China's economic growth may exist but were excluded from this investigation. This work, therefore, should not be treated as an exhaustive study of economic growth in China but, rather, as a narrowly focused investigation of the merits of FDI. Second, perhaps the case of China is somewhat unique in the sense of its advantages in large country-size, strong government, massive FDI from overseas Chinese, and effective FDI strategy, all of which seems to be lacking in many other developing countries and transitional economies. These advantages provided China with a great bargaining power over multinational corporations such that China could be able to maximize gains from FDI and to minimize negative effects of foreign-invested enterprises (Zhang, 2000).

4. Concluding Remarks

The main purpose of this study is to test empirically the widespread belief about the beneficial growth-effects of increased foreign direct investment in China. An effort has been made to base the present work on reasonable empirical and theoretical foundations. Besides the discussions of potential positive and negative effects of FDI on the Chinese economy, a

reasonable growth model is specified, and cross-section and panel data for a recent period have been used. Subject to the caveats that are appropriate for studies with aggregate data, the most notable aspect of the regression estimates is a favorable effect of FDI on growth rate of real Chinese GDP. FDI seems to contribute to China's economic growth through direct effects (such as raising productivity and promoting export) and positive externality effects (such as facilitating transition and diffusing technology). The effects of foreign-invested enterprises in the Chinese economy seem to increase with FDI inflows from 1992 to 2004, and to be larger in the coastal region than that in the inland region. Finally, the marginal product of foreign capital seems to be larger than that of domestic capital.

Figure 1 China's Real GDP and Growth Rate in 1992-2005

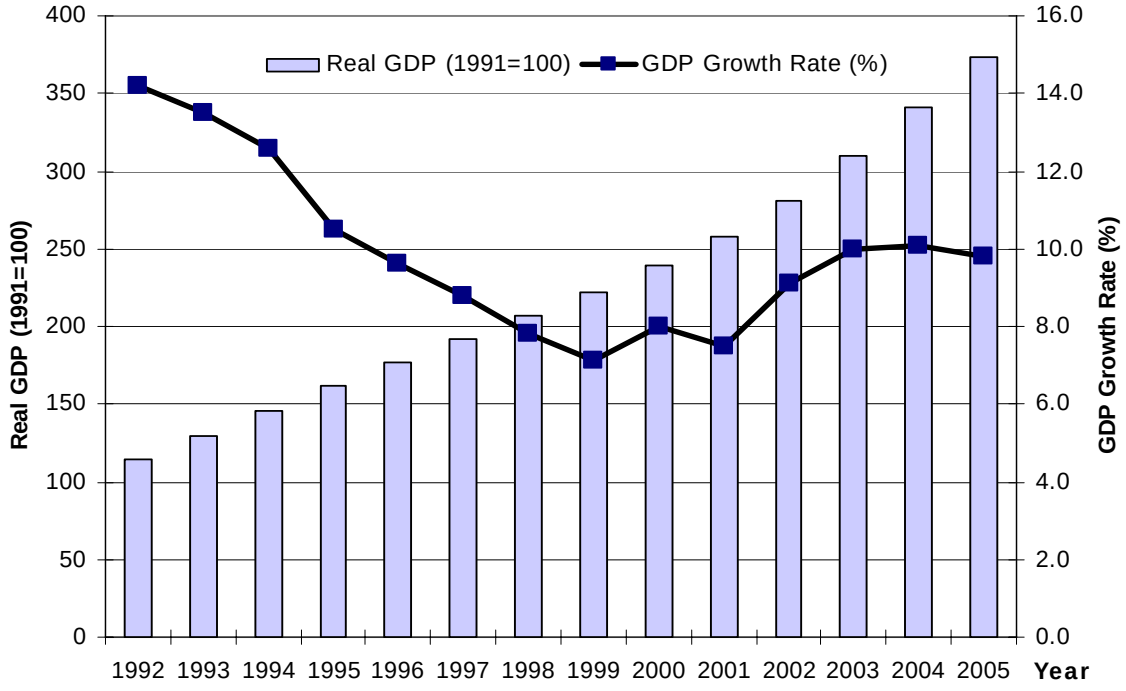

Figure 2 Inward FDI Flows and Cumulative FDI in 1992-2005

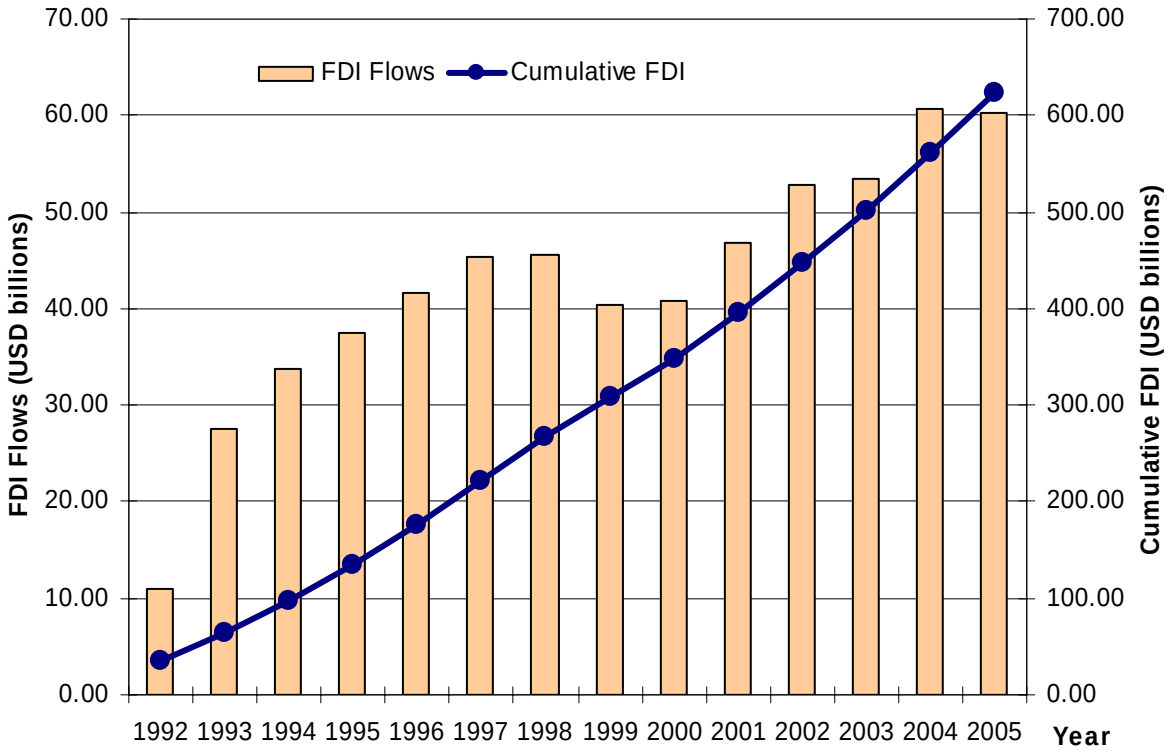

Table 1 The Role of FDI in the Chinese Economy

	1992	1996	2000	2004
FDI share in gross capital formation (%)	7.4	17.0	10.3	8.2
Share of exports by FIEs in total (%)	20.4	41.0	47.9	57.1
Share of industrial output by FIEs in total (%)	7.1	15.1	22.5	35.9
Number of employees in FIEs (million persons)	6.0	17.0	20.1	23.0
Share of tax contributions from FIEs in total (%)	4.3	11.9	17.5	20.9

Notes: FIEs = foreign-invested enterprises.
Sources: Computed from *China Statistics Yearbook* by SSB (2005), *China's FDI Statistics* by China's Ministry of Commerce (2001 and 2004), and *World Investment Report* by UNCTAD (1993, 1997, 2001, and 2005).

Table 2 Results of Cross-Section Estimations: 1992-2004

Independent	1992-96		1996-2000		2000-2004	
Variables	Without FDI	With FDI	Without FDI	With FDI	Without FDI	With FDI
$\dot{L}$	0.73*	0.77**	0.71**	0.69*	0.68	0.63
	(1.88)	(2.33)	(2.26)	(1.84)	(1.49)	(1.67)
I/Y	0.12**	0.13**	0.14*	0.12*	0.12*	0.13*
	(2.87)	(2.28)	(1.77)	(1.88)	(1.72)	(1.91)
y_0	-0.16*	-0.14*	-0.12	-0.11	-0.09	-0.08
	(-1.79)	(-1.85)	(-1.50)	(-1.58)	(-1.25)	(-1.47)
H	0.01	0.008	0.009	0.01	0.01	0.01*
	(1.20)	(1.17)	(1.35)	(1.35)	(1.60)	(1.79)
D	0.16*	0.18**	0.17**	0.21***	0.20**	0.27***
	(1.80)	(2.22)	(2.34)	(3.35)	(2.51)	(3.97)
I_F/Y		0.21		0.25**		0.28**
		(1.63)		(2.66)		(2.46)
$\Delta(F/Y)$		0.16**		0.20***		0.23***
		(2.24)		(4.25)		(4.05)
$H \cdot \Delta(F/Y)$		0.06		0.07*		0.08**
		(1.14)		(1.87)		(2.48)
Adjusted R^2	0.59	0.73	0.60	0.74	0.58	0.73
F-Statistic	12.89	9.46	11.56	16.13	12.45	15.78

Notes: The number of observation is 28 for all estimations. The coefficient estimates of constant terms are omitted to save the space. The dependent variable is average rate of growth of real GDP (%). The asterisks ***, **, and * indicate levels of significance at 1%, 5%, and 10%, respectively.

Table 3 Results of Panel Estimations: 1992-2004

Independent Variables	Model without FDI		Model with FDI	
	Coefficients	*t*-Statistics	Coefficients	*t*-Statistics
$\dot{L}$	1.06*	1.95	0.98	1.57
I/Y	0.13**	2.30	0.12**	2.89
y_0	-0.14*	-1.93	-0.12*	-1.81
H	0.004	0.74	0.005	0.97
D	0.24**	2.66	0.26***	5.07
I_F/Y			0.31**	2.90
$\Delta(F/Y)$			0.22**	2.53
$H \cdot \Delta(F/Y)$			0.07*	2.07
Adjusted R^2	0.61		0.78	
F-Statistic	31.38		35.60	

Notes: The number of observation is 84 (28 provinces and 3 periods). The coefficient estimates of constant terms are omitted to save the space. The dependent variable is average rate of growth of real GDP (%). The asterisks ***, **, and * indicate levels of significance at 1%, 5%, and 10%, respectively.

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