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Foreign Direct Investment, Domestic Investment, and Economic Growth in China

A Time Series Analysis

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Abstract

In this paper, we investigate the causal link between foreign direct investment (FDI), domestic investment and economic growth in China for the period 1988-2003. Towards this purpose, a multivariate VAR system with error correction model (ECM) and the innovation accounting (variance decomposition and impulse response function analysis) techniques are used. The results show that while there is a bi-directional causality between domestic investment and economic growth, there is only a single-directional causality from FDI to domestic investment and to economic growth. Rather than crowding out domestic investment, FDI is found to be complementary with domestic investment. Thus, FDI has not only assisted in overcoming shortage of capital, it has also stimulated economic growth through complementing domestic investment in China.

Keywords: foreign direct investment, domestic investment, economic growth, multivariate VAR system, error correction model

JEL classification: C32, F21, O1

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Acronyms

DI	domestic investment
ECM	error correction model
FDI	foreign direct investment
FIES	foreign-invested enterprises
GIO	monthly gross industrial output
MNEs	multinational enterprises
WTO	World Trade Organization

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1 Introduction

As one of the world's fastest growing economies, China has attracted a large amount of foreign direct investment (FDI) over the last two decades and, since 1993, has been the largest FDI recipient amongst the developing countries. The amount of FDI inflows into China totalled $US488 billion[1] during the period 1988-2003, with approximately 271,963 multinational enterprises (MNEs) operating in China. Does this enormous amount of FDI in China crowd out domestic investment or complement it? Answering this question is important because a complementing relationship means a beneficial effect of FDI on growth irrespective of time horizons. Otherwise, FDI may be detrimental to economic growth in the long run, if not in the short run.

Despite a large amount of literature on the subject, the role of FDI in economic growth remains highly controversial. The proponents of FDI argue that FDI helps promote economic growth through technology diffusion and human capital development (Van Loo 1977; Borensztein, De Gregorio and Lee1998; de Mello 1999; Shan 2002a; Liu, Burridge and Sinclair 2002; and Kim and Seo 2003). This is particularly the case when MNEs in a host economy have vertical inter-firm linkages with domestic firms or have subnational or subregional clusters of inter-related activities. Through formal and informal links and social contacts among the employees, MNEs diffuse technology and management know-how to indigenous firms. Consequently, economic rents are created accruing to old technologies and traditional management style. Also, FDI helps overcome capital shortage in host countries and complements domestic investment when FDI flows to high risk areas or new industries where domestic investment is limited (Noorzoy 1979). When FDI occurs in resource industries, domestic investment in related industries may be stimulated. Moreover, FDI may result in an increased demand for exports from the host country, helping attract investment in the export industries. Empirical studies supporting these arguments include Sun (1998) and Shan (2002a). Using the conventional regression model and panel data, Sun (1998) finds a high and significantly positive correlation between FDI and domestic investment in China. Shan (2002a) uses a VAR model to examine the inter-relationships between FDI, industrial output growth and other variables in China. He concludes that FDI has a significantly beneficial impact on the Chinese economy when the ratio of FDI to industrial output rises.

To the contrary, opponents of FDI argue that FDI crowds out domestic investment, and has an adverse effect on growth (e.g., Huang 1998, 2003; Braunstein and Epstein 2002). In particular, the industrial organization theory stipulates that FDI is an aggressive global strategy by MNEs to advance monopoly power over and above indigenous firms of the host economy (Hymer 1960 and Caves 1971). The ownership-specific advantages of MNEs (e.g., advanced technologies, management know-how skills, transaction cost minimizing and other intangible advantages) could be transformed into monopoly power. This monopoly power can be further reinforced by the other two advantages of MNEs: the market internalization specific-advantage and the location-specific advantage (Dunning 1981). For example, MNEs could control supplies of inputs in an industry of the host economy and gain the benefits of tax subsidy provided by the host

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[1] All statistics in this section are calculated from *China Statistical Yearbook*, 1980-2004, except the total amount of FDI of the developing countries, which is obtained from *World Investment Report*, 2003.

government. This may strengthen the competitive advantages of MNEs over indigenous firms. Eventually, domestic firms will be forced to exit. Based on this, FDI may substitute for domestic investment in the long run. The substitution effects can also occur when MNEs compete for limited investment opportunities in the host economy. In addition, FDI may disrupt backward linkages through substitution of imports for domestic commodities (Noorzoy 1979). Empirical evidence backing up the views of FDI opponents can be found in Braunstein and Epstein (2002) and Huang (2003). Braunstein and Epstein (2002) fit a regression model to the 1986-99 province-level panel data and find that FDI crowds out domestic investment in China. They point out that the social benefits of FDI are dissipated at least at the provincial level due to intense competition for FDI among the regions in China, which forces regions to reduce taxes, relax regulations on environmental protection, wages and working conditions. Huang (1998, 2003) holds that the Chinese investment policies are more 'friendly' to foreign-invested enterprises (FIEs) than to domestic private firms. As a result, Chinese partners are eager to form FIEs with foreign investors. This type of investment, in which Chinese partners are major investors, occurs just for the FIE status. As a consequence, these FIEs exploit the preferential policies and even possess privileges in competing for local scarce resources. It is from this perspective that FDI crowds out domestic investment.

The present paper contributes to the existing literature by applying a multivariate VAR system with the error correction model (ECM) and time series techniques of cointegration and innovation accounting to explore the possible links between FDI, domestic investment and economic growth in China. Specifically, we use the impulse response function and variance decomposition plus the Grange causality testing procedures to investigate whether:

i) FDI has complementary/substitution effect on domestic investment in China;

ii) there exists any causal relationship between FDI, domestic investment and economic growth;

iii) FDI has played an important role in China's economic growth; and

iv) FDI contributes to growth more than domestic investment.

This paper differs from earlier studies in a number of respects. First, it represents the first attempt to directly identify or test the relationship between FDI and domestic investment in China, offering insights into the extensively-disputed FDI-growth nexus. Second, we use pure time-series data while previous studies use either cross-sectional or panel data (e.g., Sun 1998; Braunstein and Epstein 2002), which are likely to suffer from problems of data comparability and heterogeneity (Srinivasan and Bhagwati 1999; Atkinson and Brandolini 2001). Third, earlier studies do not test for causality between FDI, domestic investment and economic growth. The failure to consider the possible two-way causality between the variables may lead to the simultaneity problem. Finally, our VAR model incorporates long-run dynamics or ECM while others have not. Neglecting these dynamics in the VAR may produce various estimation biases, giving rise to misleading analytical results.

The organization of the paper is as follows. Section 2 offers an overview on FDI inflows, domestic investment and economic growth in China. This is followed by econometric analysis in section 3. The final section of the paper presents the conclusion and some policy implications.

2 An overview of the FDI inflows, domestic investment, and economic growth in China: 1978-2003

Attracting FDI has been a key pillar of China's 'opening up' policies and economic reforms. In the early 1980s, special economic zones were formed with preferential policies including tax concessions and special privileges for foreign investors. During the reform period, the Chinese government has developed various new legislations to improve investment conditions and the business environment in order to attract FDI.

Figures 1(a) and 1(b) show FDI inflows, domestic investment (DI) and GDP in China from 1978 to 2003. At the initial 'opening up' period, FDI inflows were quite low, varying from 0.05 billion Chinese yuan in 1983 to 1.3 billion Chinese yuan in 1984. From 1984 until the early 1990s, FDI increased at an average rate of over 30 per cent per annum. The total amount of FDI was still small and remained as low as 40 billion Chinese yuan until 1992.[2] In 1992, the famous 'southern tour' by the Chinese leader, Deng Xiaoping, led to a new phase of FDI liberalization. During the Asian financial crisis, the Chinese government further liberalized FDI policy. One such change was the abolition of the FDI project approval requirement. In December 2001, China joined the World Trade Organization (WTO), which marked a new era of FDI liberalization. China's FDI inflows increased dramatically from 337 billion Chinese yuan in 2000 to 388 billion Chinese yuan in 2001 and by 2002 China had become the largest FDI host country in the world, attracting 437 billion Chinese yuan of FDI.

As can be seen from Figure 1(b), a similar trend to that of FDI appears in the movement of domestic investment and GDP. China's economic growth has also shown remarkable strength, increasing at an average annual rate of 9 per cent since the economic reforms began in 1978. China has become one of the fastest growing economies in the world, in relation to which, many argue, FDI has played an important role. For example, China's international trade increased dramatically from 36 billion Chinese yuan in 1978 to 5,138 billion Chinese yuan in 2002. This places China as the 32nd and the 5th largest trading nation in the world for 1978 and 2002, respectively. The ratio of international trade to GDP also rose from 10 per cent in 1978 to as high as 49 per cent in 2002. Notably the share of exports by foreign-invested enterprises (FIEs) was only 1 per cent in 1985,

Figure 1(a)
FDI in China, 1978-2003

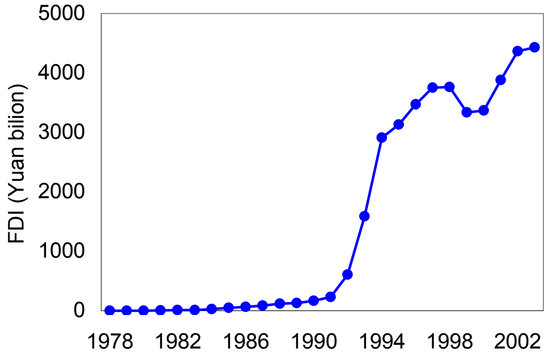
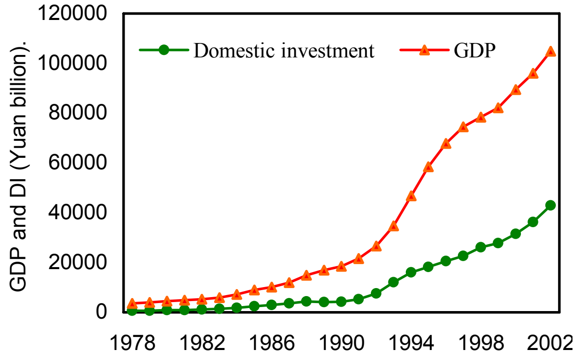


Figure 1(b)
DI and GDP in China, 1978-2003



Source: *China Statistical Yearbook* (various issues).

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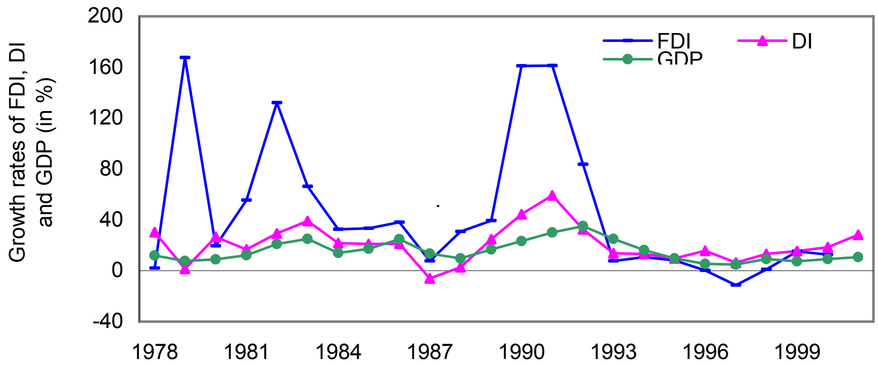
2 Calculated from various issues of *China Statistical Yearbook*.

while in 2001, the contribution of FIEs to export rose to 52 per cent in 2002. This suggests that in China, the expansion in exports has been associated with large inflows of FDI, and this in turn affects economic growth. In line with the rapid growth in GDP and FDI, domestic investment[3] in China demonstrated a significant increase with an average rate of 20 per cent per annum from 1978 to 2003.

Figure 2
Growth rates of FDI, DI and GDP, 1978-2003



Source: *China Statistical Yearbook* (various issues).

Table 1
The ratios of FDI to GDP, DI to GDP and FDI to DI (%)

Year (1)	FDI/GDP (2)	DI/GDP (3)	FDI/DI (4)
1978	0.01	18.45	0.07
1979	0.06	17.32	0.36
1980	0.06	20.16	0.28
1981	0.14	19.02	0.74
1982	0.15	22.10	0.70
1983	0.21	22.98	0.93
1984	0.41	24.57	1.66
1985	0.54	27.35	1.99
1986	0.63	29.24	2.16
1987	0.72	30.18	2.38
1988	0.80	29.33	2.71
1989	0.75	24.36	3.10
1990	0.90	22.82	3.94
1991	1.08	24.40	4.41
1992	2.28	28.57	7.98
1993	4.58	34.99	13.09
1994	6.22	34.34	18.12
1995	5.36	31.17	17.19
1996	5.11	30.36	16.83
1997	5.04	30.32	16.62
1998	4.80	33.31	14.42
1999	4.07	33.81	12.03
2000	3.77	35.12	10.73
2001	4.04	37.79	10.70
2002	4.17	41.00	10.16
2003	3.82	47.56	8.04

Source: NBS, various issues.

3 The domestic investment in this paper is the aggregate investment which excludes all types of foreign investments.

Figure 2 shows the growth rates of FDI, DI and GDP in China during 1978-2003. Clearly, FDI growth reached multiple peaks of 168 per cent, 132 per cent and 161 per cent in 1980, 1983 and 1991-92, respectively, while domestic investment growth peaked in the same or subsequent years but well below the FDI growth rate until 1994. GDP also showed a similar growth trend to FDI and domestic investment, reaching its peaks in 1984, 1987 and 1993. Overall, Figures 1 and 2 demonstrate that both FDI and domestic investment display an upward trend, matching the economic growth trend of GDP during the period 1978 to 2003.

Table 1 presents the ratios of FDI to GDP, DI to GDP and FDI to DI from 1978 to 2003. As can be seen, the proportions of FDI to GDP (column 2) were quite low and less than 1 per cent until 1990. It increased to a peak value of 6.2 per cent in 1994 and then steadily decreased to 3.8 per cent in 2003. The proportion of DI to GDP was 18.5 per cent in 1978 and increased steadily to 47.6 per cent in 2003. The proportion of FDI to DI has increased dramatically from 0.1 per cent in 1978 to 1.7 per cent in 1984, and by 1994 it has reached an all time high of 18.1 per cent, after which, it gradually decreased to 8.0 per cent in 2003.

Figures 3(a)-3(c) plot DI against FDI, GDP against FDI, and GDP against DI, respectively. They clearly depict positive relationships between FDI and DI, FDI and GDP, and GDP and DI. It appears that FDI inflows to China have had complementary

Figure 3(a)
DI versus FDI

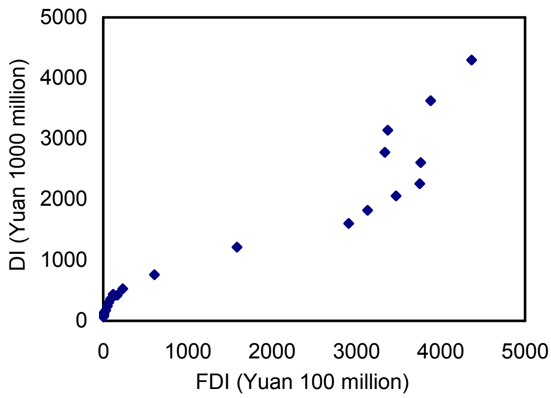


Figure 3(b)
GDP versus FDI

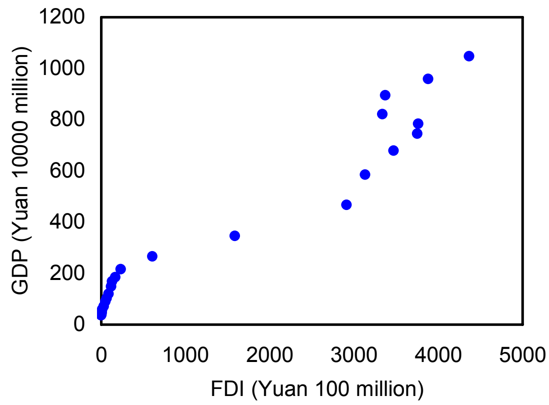
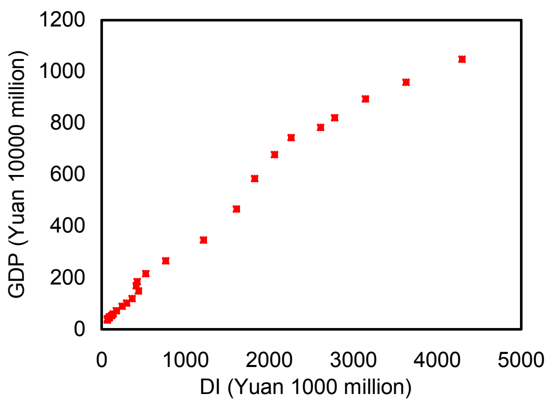


Figure 3(c)
GDP versus DI



Source: *China Statistical Yearbook* (various issues).

effects on domestic investment hence spurring economic development and growth. However, such a scatter plot is far from being conclusive in drawing any causal relationship. Thus, a formal econometric analysis is required which is performed in the next section.

3 Empirical analysis and findings

3.1 Data and unit root test

Quarterly time series data (1988:1 to 2003:4) for FDI, DI and GDP are available and all in current prices of the Chinese currency (yuan). They are compiled from *China Monthly Statistics* (1987:1-2004:3), *Comprehensive Statistical Data and Materials for 50 Years of New China* and various issues of *China Statistical Yearbook,* all published by the National Bureau of Statistics (NBS) of China. GDP quarterly time series is constructed on the basis of the monthly gross industrial output (GIO) and the yearly GDP statistics due to lack of quarterly and monthly GDP statistics. It is found that the annual growth pattern of GDP is similar to that of GIO, and following Liu, Song and Romilly (1997) and Liu, Burridge and Sinclair (2002), quarterly GDP is estimated by using the relationship:

$$GDP_{t,q} = g_t \times GIO_{t,q} \qquad q = 1,\ldots,4 \qquad t = 1988, 1989,\ldots, 2003$$

where g_t is the annual GDP/GIO ratio and $GIO_{t,q}$ is the quarterly value of GIO.

Figure 4(a)
The original series of FDI 1988:1-2003:4

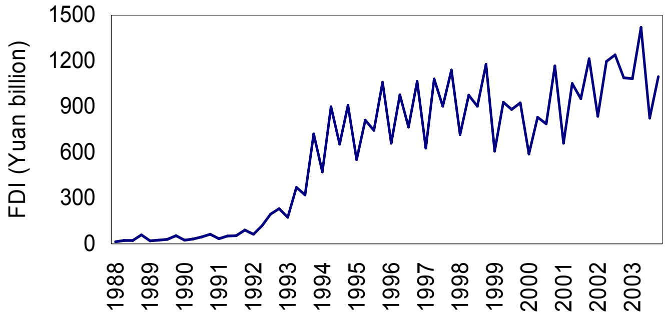


Figure 4(b)
The original series of DI 1988:1-2003:4

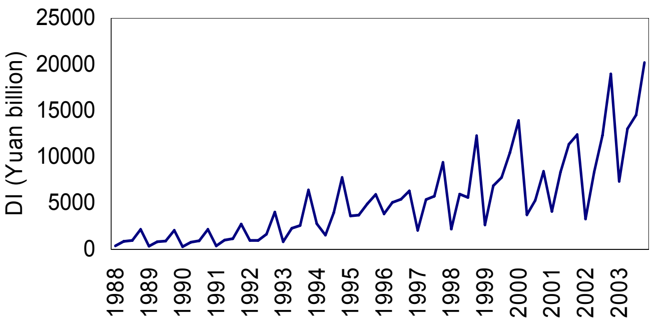
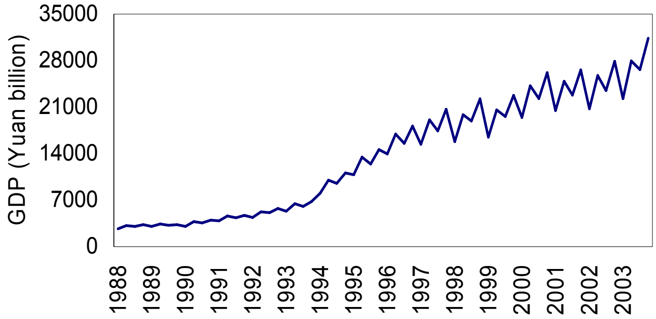


Figure 4(c)
The original series of GDP 1988:1-2003:4



Source: *China Monthly Statistics* (1987: 1; 2004: 3) and *Comprehensive Statistical Data and Materials* (1999).

Due to China's centrally planned economic regime, many time-series from China display a regular pattern of large seasonal fluctuations (Rawski 2002). This is indeed the case for the FDI, DI and GDP (see Figure 4). To permit seasonality when conducting cointegration analysis and model estimation, a variable of centred (orthogonalized) seasonal dummies is incorporated. The standard 0-1 seasonal dummy variables will affect both the mean and the trend of the level series in a VAR system but the centred seasonal dummy variable only shifts the mean without contributing to the trend (Johansen 1995).

In this paper, we employ the augmented Dickey-Fuller (ADF) test to test the stationarity of the three time series FDI, DI and GDP. As can be seen from Figures 4(a) to 4(c), the three series appear to be non-stationary in level form. Therefore, we investigate the stationarity of the first difference of the three series by testing for unit roots. The ADF tests are performed on both the level and first differenced observations by estimating the following three models:

No constant and no trend model:

$$\Delta y_t = \gamma y_{t-1} + \sum_{i=1}^{k} \beta_i \, \Delta y_{t-i} + \varepsilon_t \qquad (1)$$

Constant and no trend model:

$$\Delta y_t = \alpha_0 + \gamma y_{t-1} + \sum_{i=1}^{k} \beta_i \, \Delta y_{t-i} + \varepsilon_t \qquad (2)$$

Constant and trend model:

$$\Delta y_t = \alpha_0 + \alpha_2 t + \gamma y_{t-1} + \sum_{i=1}^{k} \beta_i \, \Delta y_{t-i} + \varepsilon_t \qquad (3)$$

where $\Delta y_t = y_t - y_{t-1}$ is the first difference of the series yt; $\Delta y_{t-1} = (y_{t-1} - y_{t-2})$ is the first difference of y_{t-1}, etc.; α, γ and β_i are parameters to be estimated, and ε_t is a stochastic disturbance term. The number of lagged terms is chosen to ensure that the errors are uncorrelated. The difference among the three regressions (1)-(3) lies at the inclusion or exclusion of the deterministic elements α_0 and α_2t. Equation (1) does not include the drift α_0 and time trend α_2t, equation (2) includes α_0 but no time trend and equation (3) includes both α_0 and α_2t.

The results of the ADF test are reported in Table 2. They show that the null hypothesis of a unit root is: (i) accepted for the level series of FDI in all three models; (ii) rejected for the level series of DI in model (3), and (iii) rejected for the level series of GDP in model (1). The results based on the first differenced data indicate that all three series are stationary. Therefore, we conclude that the three time series are all integrated of order one, I(1).

Table 2
ADF test for a unit root

Variables	Model (1) No constant & no trend	Model (2) Constant & no trend	Model (3) Constant & trend
1. ADF test for unit root on the level series			
FDI	0.43	-1.24	-1.84
DI	0.09	-1.40	-5.40***
GDP	4.17***	0.94	-2.38
2. ADF test for unit root on the first differenced series			
FDI	-7.26***	-7.46***	-7.44***
DI	-8.40***	-8.49***	-8.53***
GDP	-4.71***	-5.60***	-6.12***

Note: *** denotes significance at the 1 per cent levels.

3.2 Testing for cointegration of variables

Now, the cointegration test is performed to investigate any long-run equilibrium relationships among the three variables of FDI, DI and GDP. After a careful search and trial, a model with 6 lags, constant and centred seasonal dummy variable was chosen. The result of the Johansen cointegration rank test is summarized in Table 3, which indicates the presence of two cointegrating vectors at 1 per cent and 5 per cent levels of significance, respectively (i.e., the null hypotheses of no cointegration is rejected for rank of zero and less than or equal to (2). This means that there exists a long-run relationship among the three variables.

Table 3
Johansen cointegration tests

Null (H_0)	Alternative (H_1)	λ_{max}	95% CV	λ_{trace}	95% CV
Rank = 0	r ≥ 1	30.02**	23.78	46.01**	34.55
Rank ≤ 1	r ≥ 2	10.06	16.87	15.99	8.17
Rank ≤ 2	r ≥ 3	5.94*	3.74	5.94*	3.74

Note: * and ** denote rejection of the null hypothesis at the 5 per cent and 1 per cent significance levels, respectively.

3.3 The error correction model

To analyse the causal relationship between the three variables FDI, DI and GDP, we use an error correction model (ECM) of the following VAR system:

$$\Delta FDI_t = \alpha_1 + \alpha_{fdi}\,\hat{e}_{t-1} + \sum_{i=1}^{k} \alpha_{11}(i)\,\Delta FDI_{t-i} + \sum_{i=1}^{k} \alpha_{12}(i)\,\Delta DI_{t-i} + \sum_{i=1}^{k} \alpha_{13}(i)\,\Delta GDP_{t-i} + \beta_1 D_t + \varepsilon_{fdit} \quad (1)$$

$$\Delta DI_t = \alpha_2 + \alpha_{di}\,\hat{e}_{t-1} + \sum_{i=1}^{k} \alpha_{21}(i)\,\Delta FDI_{t-i} + \sum_{i=1}^{k} \alpha_{22}(i)\,\Delta DI_{t-i} + \sum_{i=1}^{k} \alpha_{23}(i)\,\Delta GDP_{t-i} + \beta_2 D_t + \varepsilon_{dit} \quad (2)$$

$$\Delta GDP_t = \alpha_3 + \alpha_{gdp}\,\hat{e}_{t-1} + \sum_{i=1}^{k} \alpha_{31}(i)\,\Delta FDI_{t-i} + \sum_{i=1}^{k} \alpha_{32}(i)\,\Delta DI_{t-i} + \sum_{i=1}^{k} \alpha_{33}(i)\,\Delta GDP_{t-i} + \beta_3 D_t + \varepsilon_{gdpt} \quad (3)$$

where

FDI_t = FDI inflows in China in year t;

DI_t = gross capital formation represents domestic investment in year t but excludes any forms of foreign investment;

GDP_t = gross domestic product in year t;

$\hat{e}_{t-1}$ = the error-correction term;

D_t = the centred seasonal dummy variable;

α_i, α_{ij} (i) and β_i = the parameters;

ε_{fdit}, ε_{dit} and ε_{gdpt} = white-noise disturbance terms that may be correlated with each other.

When fitted to the Chinese data, the VAR system performs quite well. As reported in Table 4, none of the diagnostic statistics are significant at the 95 per cent critical value. Therefore, there is nothing to suggest that the system model is misspecified. The R^2-values are 76 per cent, 83 per cent and 96 per cent for equations (1), (2) and (3), respectively. Based on the Akaike (1974) and Schwartz (1978) information criteria, the number of lags is chosen as six.

Table 4
VAR model diagnostics

	ΔFDI_t	ΔDI_t	ΔGDP_t
Adj-R^2	0.76	0.83	0.96
Autocorrelation test for the model			
LM (1), χ^2_9 = 15.061, *P*-value = 0.09; LM (8), χ^2_9 = 11.47, *P*-value = 0.24			
Normality test for the model			
$\chi^2_3 = 5.55$, *P*-value = 0.06			

3.4 Innovation accounting and Granger causality test

The innovation accounting (variance decomposition and impulse response function) technique can be utilized to examine the relationships among economic variables (e.g., Jin and Yu 1996; Kilian 1998; Borensztein, De Gregorio and Lee 1998; Shan 2002a, 2002b; Zhang, Bessler and Leatham 2006). Relying on this technique, Kim and Seo explore the complementary or substitution relationship between FDI and domestic investment, and analyse the impact of FDI on economic growth in Korea. On the other hand, the forecast error variance decomposition allows us to make inference over the proportion of movements in a time series due to its own shocks versus shocks to other variables in the system (Enders 1995: 311). For example, if ε_{gdpt} shocks explain none of the forecast error variance of FDI_t at all forecast horizons, we can say that the FDI_t sequence is exogenous. In such a circumstance, the FDI_t sequence would evolve independently of the ε_{gdpt} shocks and the GDP_t sequence. The impulse response function analysis is a practical way to visualize the behaviour of a time series in response to various shocks in the system (Enders 1995: 306). For example, plotting the impulse response function can trace the effects of shocks to ε_{fdit} or ε_{gdpt} on the time paths of the GDP_t or FDI_t sequences.

Within a ten-year forecasting horizon, the variance decomposition results are reported in Table 5. In the case of China, the innovations in FDI are explained largely by its own past values (90.8 per cent), only 2.4 per cent due to past domestic investment, and 1.9 per cent to past GDP. The innovations in DI are mainly explained by its own past values (80.0 per cent), followed by GDP (40.8 per cent) and FDI (3.5 per cent). The innovations in GDP also are mainly explained by its own past values (57.3 per cent), followed by DI (17.6 per cent) and FDI (5.7 per cent).

These results suggest the strength of the relationships between FDI, domestic investment and economic growth are different. FDI plays an important role in China's economic growth but its influences are less than that of domestic investment (5.7 per cent versus 17.6 per cent). GDP shows stronger influences on China's domestic investment than FDI does (40.8 per cent versus 3.5 per cent). The influences of DI and GDP on FDI are relatively low (2.4 per cent and 1.9 per cent, respectively). But the relationship between GDP and DI is strong, with 40.8 per cent influence from GDP to DI and 17.6 per cent in reverse. It is noted that each of the three variables explains the preponderance of its own past values (forecast error variances). This means that the current/past FDI, DI and GDP have strong influences on their own future/current trends.

Table 5
Variance decomposition percentage of ten-year error variance

Per cent of forecast error variance in:	Typical shock in: FDI	DI	GDP
FDI	09.8	3.5	5.7
DI	2.4	80.0	17.6
GDP	1.9	40.8	57.3

Table 6
Results of Granger causality test among FDI, DI and GDP

Dependent variables	ΔFDI_t	ΔDI_t	ΔGDP_t
ΔFDI_t		3.98	4.38
ΔDI_t	24.63**		26.06**
ΔGDP_t	20.15**	16.20*	
Conclusion	FDI $\Rightarrow$ DI		
	FDI $\Rightarrow$ GDP	DI $\Rightarrow$ GDP	GDP $\Rightarrow$ DI

Note: * and ** reject null hypothesis at 5 per cent and 1 per cent, respectively.

Table 6 presents the Granger causality test results for the three variables. The results show that: (i) the effects of DI and GDP on FDI are not statistically significant; (ii) the effects of FDI and GDP on DI are statistically significant; (iii) the effects of FDI and DI on GDP are statistically significant. Thus, FDI affects DI and GDP but not the reverse, whereas, the causal links between GDP and DI are bi-directional. These findings confirm the results of the variance decomposition analysis.

We now use the impulse response function to reveal the dynamic causal relationships between FDI, domestic investment and economic growth. Figure 5 presents impulse responses to a shock in FDI. Clearly, the impact of the shock on FDI itself is strong. FDI has reverted to its mean level after an immediate sharp decline. This confirms that FDI level in China depends very much on its past values. The effect on DI is to cause a moderate immediate decrease, then some rises, even outweighing the initial decrease. It is interesting to note that the peaks and troughs of FDI are almost always at the opposite positions of DI. Overall, the shock causes an upward and slight shift in the mean of DI. This confirms that FDI does not crowd out domestic investment in China. It also implies that metaphorically, a shortage of domestic investment in China did call for FDI, and the larger FDI the more domestic investment. The upward movement of GDP due to a shock to FDI indicates that FDI has a positive impact on China's economic growth.

Figure 6 presents the impulse responses of a shock in DI. The impact of DI on itself is strong. It has reverted to its mean level after an immediate drop. The shock in DI has a more moderate impact on GDP. GDP has reverted above its original level after an initial decrease but its mean level has remained unchanged. The impact of the shock on FDI is minimal. These findings are consistent with the variance decomposition analysis and the Granger causality test that DI is determined very much by its own past values, domestic investment plays a crucial role in China's economic growth, and there is not much effect of domestic investment on FDI.

Figure 5
Impulse responses to a shock in FDI

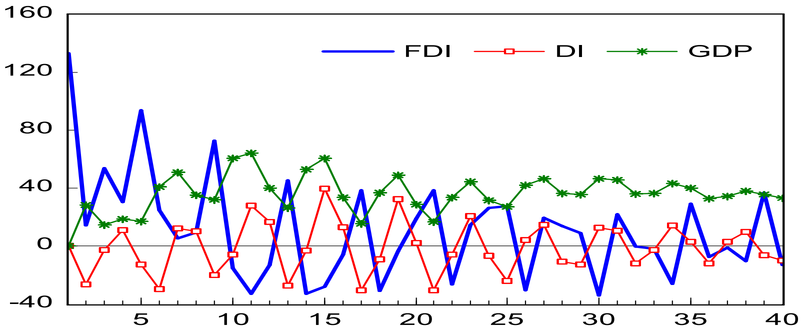


Figure 6
Impulse responses to a shock in DI

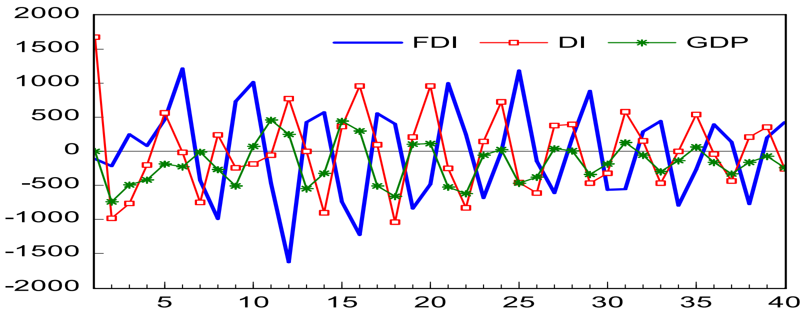
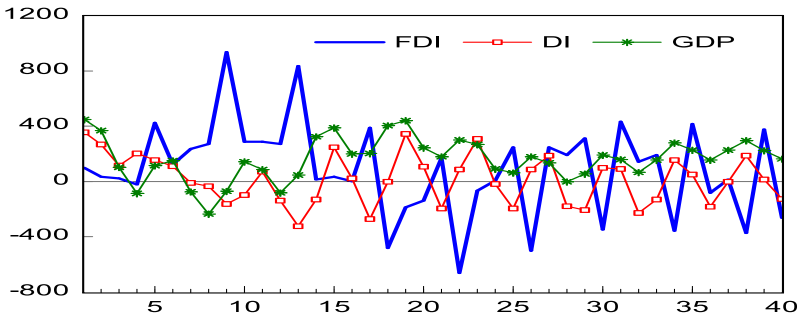


Figure 7
Impulse responses to a shock in GDP



Source: *China Monthly Statistics* (1987: 1; 2004: 3) and *Comprehensive Statistical Data and Materials* (1999).

Figure 7 shows the impulse responses of a shock in GDP. A shock in GDP results in a strong impulse response from GDP itself. GDP has reverted to its original level after an initial decline, but resuming afterwards its fluctuation pattern. The shock in GDP has a more moderate impact on domestic investment. DI declines continuously, and then reverts back to its original level.

It is useful to point out that the fluctuations of DI coincide almost with those of the GDP—the higher level of DI, the greater GDP. The impact of GDP on FDI is small—FDI reverts to its mean level after some fluctuation. These results suggest that GDP is strongly influenced by its own past values, the causal link between GDP and domestic investment is strong, but the impact of GDP on FDI is minimal.

3.5 Empirical findings

Using a VAR system with ECM, we find that:

i) FDI plays an important role in complementing domestic investment in China, the larger FDI the greater the domestic investment. Further, FDI has a significant effect on China's economic growth;

ii) China's domestic investment and economic growth are positively correlated; great economic growth spurs large domestic investment, and vice versa;

iii) China's domestic investment and GDP do not have much impact on FDI inflows in the long run. The causal link between GDP and DI is bi-directional, but there is only a one-way directional causality from FDI to DI and FDI to GDP;

iv) China's domestic investment has a greater impact on growth than FDI. These lend some support to the theoretical view that FDI has complementary effects on domestic investment, and that long-run economic growth is positively associated with FDI.

4 Conclusions and policy implications

Based on the empirical analysis and findings, we conclude that FDI—rather than crowding out domestic investment—has a complementary relationship with domestic investment. FDI has not only assisted in overcoming shortage of capital, it has also stimulated economic growth through complementing domestic investment in China.

The findings of this study do have some important implications for policymakers in China and elsewhere. Since FDI complements domestic investment, less-developed countries ought to encourage and promote FDI inflows, for which appropriate FDI policies and regulations are required. For example, the host governments should not only encourage FDI inflows, they should also impose regulations on MNEs to urge them to undertake export obligations or encourage direct foreign investors to invest in high risk areas or in resource industries where domestic investment is limited. In the case of China, particularly, quality FDI should be encouraged to invest in the primary and secondary industries, and in the less-developed western regions. Since an important channel of technology diffusion and spillover of management know-how by MNEs is vertical inter-firm linkages with domestic firms, host governments could impose regulations on MNEs to intensify generation of local linkages. Moreover, no y host government should not blindly reduce taxes, environmental protections, wages, working conditions and change regulations in exchange for FDI. Such a practice may create adverse FDI externalities on growth. With large FDI inflows, China has enjoyed economic growth prosperity during the last 30 years, however, vigilance and alertness are required if FDI inflows plateau in the future. This implies that China may face capital shortages in high risk areas or new industries where FDI was a complement to domestic investment and domestic investment was limited and demand for exports may decrease, especially, the ratio of FIEs exports to total exports could decline significantly. These in turn will slow down China's economic growth. Therefore, we strongly recommend that, given that China's domestic investment exerts much greater contributions to growth than FDI, encouraging and promoting domestic savings should take precedence over attracting FDI in designing and executing investment strategies and investment policies in China.

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