Does China rival its neighbouring economies for inward FDI?*

Chengang Wang, Yingqi Wei and Xiaming Liu **

The current research aims to contribute to the debate on whether China competes with its neighbouring economies for inward foreign direct investment (FDI). Our results indicate that China has not diverted inward FDI from other Asian economies as a whole. If we view FDI inflows in the region as part of systemic globalization strategies adopted by transnational corporations, China may in fact have "crowded in" FDI to the rest of Asia. At the level of individual economies, FDI in China is more likely to have had an FDI creation effect in India and the Philippines, but a diversion effect in Indonesia, the Republic of Korea, Malaysia and Taiwan Province of China, as value creation activities performed by China in international production networks appear to be more complementary to those undertaken by the former two economies than the latter four economies. These relative positions may evolve as Asian economies develop and upgrade their industries.

Key words: Asia, China, FDI, competition

1. Introduction

Since the beginning of the 1990s when China became a major recipient of foreign direct investment (FDI), a heated debate has emerged as to whether FDI has been diverted from other Asian economies to China. FDI is a package of capital, technology and managerial skills, and is often viewed as an important source of both direct capital inputs and technology spillovers (Balasubramanyam *et al.*, 1996; Li and Liu, 2005). Developing countries can benefit from FDI, because it not only brings in foreign capital and creates jobs, but also transfers advanced technologies, know-how and managerial skills, which may be amplified through spillover effects. Therefore, whether

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** Chengang Wang (corresponding author) is at the School of Management, Bradford University, United Kingdom. Contact: tel. +44 (0)1274 234378; fax +44 (0)1274 546866; email C.Wang9@bradford.ac.uk. Yingqi Wei is at the School of Management, Bradford University, United Kingdom and College of Economics and Trade, Hunan University, China. Xiaming Liu is at the School of Management, Birkbeck College, University of London.

or not China's success in attracting FDI is at the expense of its neighbours bears important policy implications for all economies concerned.

In this debate, the Governments of several Asian countries, such as Singapore and the Republic of Korea, have openly voiced their concerns that the emergence of China has diverted FDI away from their economies (Chantasasawat et al., 2005; Mercereau, 2005). Some scholars, such as Felker (2003), take the diversion proposition for granted in their discussions of policy implications. Similarly, Xing and Wan (2006) carry out an analysis of competition for FDI in Asia on an explicit assumption that China diverts Japanese FDI from other Asian economies. Other arguments for supporting the FDI diversion proposition include the existence of "the wage differential between China and the other East Asian countries" (Kiminami and Kiminami, 1999) and the ranking of China by transnational corporations (TNCs) as one of the ten most promising FDI destinations (McKibbin and Woo, 2003).

However, the proposition regarding a diversion effect is not always consistent with theoretical arguments, and the empirical evidence is mixed. Theoretically, China's rise may create both threats as well as opportunities for its Asian neighbours. China's expansion may "suck in" FDI earmarked for some nearby economies. On the other hand, more FDI in China is likely to lead to increased FDI in its Asian neighbours if these economies are complementary in the context of international production networks (IPNs) established by TNCs, which have been increasingly adopting "systemic globalization" strategies (Ernst, 1997). For instance, PSi Technologies, a United States semiconductor firm, has affiliates in both the Philippines and mainland China. Within its IPN, as much as 85% of its output ends up in China at some stage for assembly (*Economist*, 15 February 2003). This is consistent with findings in Lall and Albaladejo (2004) which indicated that China plays the role of final assembler of intermediate products from other Asian economies.

Furthermore, existing quantitative studies focusing explicitly on whether the rise of China crowds in or out FDI in its neighbours tend to show that China does not rival, and may complement, its Asian neighbours *as a whole*. Eichengreen and Tong (2006) find complementarity between inflows of FDI into China and those into other Asian economies, but substitutability for those into OECD countries. Chantasasawat *et al.* (2005) find that the level of inward

FDI in China is positively related to the levels of inward FDI in eight Asian economies.[1] Zhou and Lall (2005) also detect complementarity between inward FDI in China and those in seven Asian economies[2] for the period 1992–2001. Finally, Mercereau (2005) reports that China has not diverted FDI inflows from countries in Asia, with the exception of Singapore and Myanmar.[3]

This study aims to contribute to the debate by providing further empirical evidence, building on the strengths of existing studies while addressing various problems they suffer from. Specifically, following recent developments of FDI theory, we view inflows of FDI in Asian economies as part of what Ernst (1997) calls "systemic globalization" strategies adopted by TNCs and examine how inward FDI is linked to the levels of development in mainland China and nine other Asian economies.

The rest of this article is organized as follows. The next section provides some background information and reviews previous studies. Section three explains our empirical model, data set and methodology. Section four presents empirical results. Finally, section five summarizes the results and discusses policy implications.

2. Background, theory and previous studies

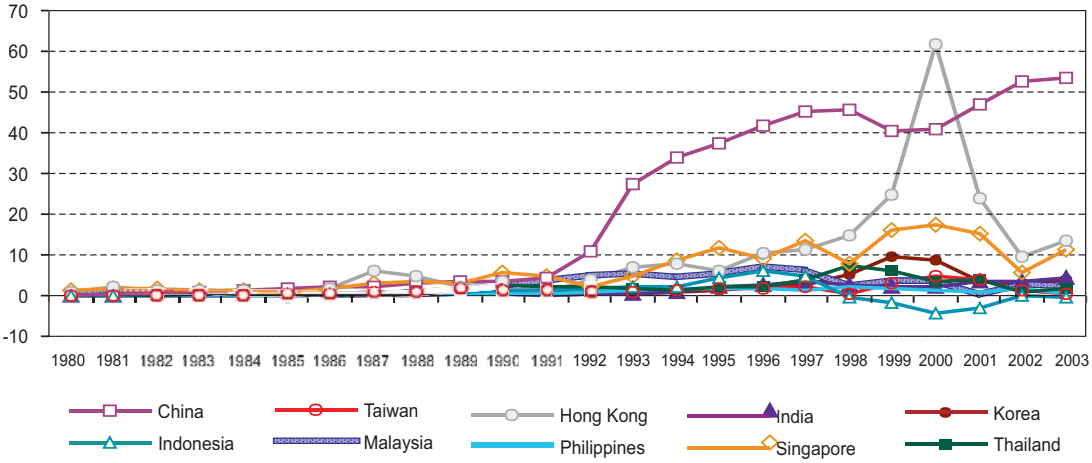
China's decision in 1979 to open up its economy to FDI was a result of a fundamental shift in economic policy. During the 1980s, the policy regarding inward FDI to China changed from the so-called "experimental period" (1979–1983), when a limited amount of FDI was introduced into the four small special economic zones, to the "gradual development period" (1984–1991), when gradually increasing amounts of FDI were attracted to the 14 open coastal cities and three open economic zones (Wei and Liu, 2001). The inflows of FDI to China in the 1980s and early 1990s were comparable to those of Malaysia and Singapore (figure 1).

[1] The eight Asian economies are Hong Kong (China), Indonesia, the Republic of Korea, Malaysia, the Philippines, Singapore, Taiwan Province of China and Thailand.

[2] The seven Asian economies are Indonesia, the Republic of Korea, Malaysia, the Philippines, Singapore, Taiwan Province of China, and Thailand.

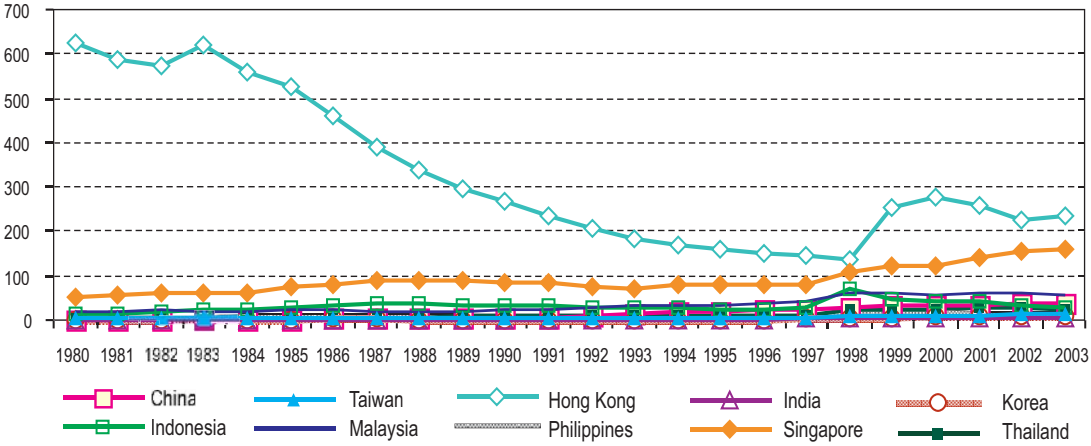
[3] Mercereau's (2005) study includes fourteen Asian economies. In addition to the seven mentioned in footnote 2, they are Bangladesh, India, Myanmar, Papua New Guinea, Sri Lanka and Viet Nam as well as China.

Inward FDI to China surged in the 1990s after the then Chinese leader Deng Xiaoping launched a new wave of economic reforms in early 1992. Realized FDI increased from $4 billion in 1991 to $41 billion in 2000 (figure 1), and FDI stock as a percentage of GDP increased from 6.7% to 32.2% in the same period (figure 2). In response to the rapid increase in inward FDI, China's economy expanded quickly, with the average annual growth rate reaching over 8% over the period. On the other hand, as indicated in table 1, the inward FDI performance indices of Indonesia, Malaysia, the Philippines, Singapore and Thailand in the 1990s were all lower than those in the 1980s, and these economies further suffered the Asian financial crisis in the late 1990s. Against this background, concerns have been raised by government officials of some economies in the region that China has been "sucking in" FDI that would have been earmarked for other Asian economies, and



that this FDI diversion has had a negative impact on their economic development.

Figure 1. FDI inflows in Asian economies



(Billions of dollars)

Source: UNCTAD FDI Statistics.

Table 1. FDI performance index and potential index

	Inward FDI Performance Index			Inward FDI Potential Index		
	1988-1990	1998-2000	2001-2003	1988-1990	1998-2000	2000-2002
China	1.0	1.2	2	0.18	0.25	0.27
Taiwan Province of China	0.9	0.3	0.4	0.31	0.37	0.38
Hong Kong	5.3	6.1	4.8	0.35	0.42	0.41
India	0.1	0.2	0.4	0.12	0.15	0.16
The Republic of Korea	NA	NA	NA	NA	NA	NA
Indonesia	0.8	-0.5	-0.3	0.18	0.18	0.16
Malaysia	4.4	1.3	1.1	0.21	0.30	0.29
Philippines	1.7	0.7	0.7	0.11	0.21	0.21
Singapore	13.6	4.7	6.0	0.40	0.48	0.47
Thailand	2.6	1.4	0.9	0.18	0.22	0.22

Source: UNCTAD FDI Statistics and *World Investment Report*.

Note: FDI performance index is put forward by UNCTAD as an instrument to compare the relative performance of countries in attracting FDI. The index is the ratio of an economy's share of global inward FDI to its share of global GDP.

Figure 2. FDI stock as % of GDP
(Per cent)

Source: UNCTAD FDI Statistics.

The diversion hypothesis is, however, not fully supported for both conceptual and empirical reasons. Recent developments of FDI theory suggest that an increase in inward FDI in a country does not necessarily divert FDI from other countries. As observed by Ernst (1997), leading TNCs have progressively shifted their international strategies towards systemic globalization, which is characterized by international dispersal and integration of potentially all elements of the value chain. In this process, not only manufacturing, but marketing, financing, logistics, design, training, procurement and even R&D functions may be located abroad and coordinated by home country based headquarters (Felker, 2003). To reap the full benefits of systemic globalization, TNCs tend to locate their value-added activities according to industrial structure or specification of host economies involved. Thus, inward FDI in one economy may create inward FDI in another if it creates more opportunities for IPN, or if it raises demand for raw materials, resources and intermediate inputs. Ianchovichina and Walmsley (2005) argue that investment liberalization in China facilitates TNCs' rationalization of their production processes within East Asia, and China's neighbours may receive FDI flows that complement those into China. Of course, if economies specialize in segments of IPN in which China has a

comparative advantage, then there may be FDI diversion as TNCs may have to make a location choice.

In this regard, Roland-Holst and Weiss (2005) argue that the basic problem of the diversion hypothesis is its assumption of fixed global supply of foreign capital for a region in any year. Thus, under this assumption, competition for inward FDI is a "zero-sum game" where the success of one country is achieved at the expense of others, and increased inflows of FDI in China imply reduced inflows of FDI in other economies. However, there is no evidence to suggest that the supply of FDI is fixed.

The FDI diversion hypothesis has also been challenged from an empirical perspective. Using two comprehensive survey data sets for 1995 and 1999, Belderbos and Zou (2006) argue that FDI, divestment and relocation of Japanese electronics firms in Asia are related to these firms' strategy to reconfigure their Asian production networks (APN) in response to changes in firm competitiveness, regional integration and local investment environments. The growing attractiveness of China for inward FDI has not been accompanied by a reduction in employment in Japanese affiliates in ASEAN economies. Using intra-regional trade data, Lall and Albaladejo (2004) and Lall *et al.* (2004) confirm the existence of APN based on the deepening of international division of labour, and China's role in APN is at the end of production processes, assembling intermediate products from other Asian economies.

In recent literature, we have identified four notable econometric studies on the diversion hypothesis: Eichengreen and Tong (2006), Chantasasawat *et al.* (2005), Mercereau (2005) and Zhou and Lall (2005). All four studies have their specific strengths and weaknesses. All adopt a similar approach, i.e. incorporating a variable representing the "China effect" in an FDI determinant equation or a set of FDI determinant equations. But they differ in the measurement of the China effect, the estimation technique and the control variables.

Chantasasawat *et al.* (2005) and Zhou and Lall (2005) use what Mercereau (2005) calls a standard equation with an indicator of FDI flows to China added to the regressors, and with the dependent variable being gross FDI usually expressed in logarithmic terms. Mercereau (2005) argues that such a logarithmic specification is inappropriate because it estimates the impact of China in terms of the rate of change rather than the level of FDI flows. We agree that the coefficients need to be interpreted carefully but a logarithmic specification is widely accepted in econometric analysis as few economic relationships are

linear. A logarithmic specification can also reduce the severity of autocorrelation, heteroscadesticity and outlier problems.

Mercereau (2005) suggests that nominal FDI in China is nonstationary and hence needs to be scaled by the following factors to take into consideration both average and country-specific crowding out: the combined GDP of other countries in the region and total FDI to the region. One potential problem with the first factor is the assumption that FDI "…diversion from country *i* is proportional to the size of its economy relative to the region" (Mercereau, 2005, page 5). As indicated in figure 2, the relative size of inward FDI to GDP varies substantially across the economies in the region. The second factor mentioned by Mercereau (2005) is very similar to the share measure used in Chantasasawat *et al.* (2005) and it is based on – in our view – an unrealistic assumption that the amount of FDI designated for the region is fixed, i.e. the increased receipts of FDI by China is at the expense of other economies.

As for estimation techniques, Eichengreen and Tong (2006) employ a gravity model using bilateral FDI data for 29 sources and 60 recipients for the period 1988–2003. Chantasasawat *et al.* (2005) and Zhou and Lall (2005) estimate random effects and fixed effects models respectively to investigate the China effect on Asian economies. Finally, Mercereau (2005) uses both a fixed effects model and the dynamic panel approach. The strength of Chantasasawat *et al.* (2005) is its proposition that inflows of FDI in China and other Asian economies are simultaneously determined. This approach considers the location determinant of FDI in the context of IPN/APN. TNCs may increase their profitability by reaping the benefit of cost reductions from location economies and specialization. For example, they may invest in assembly plants in China and in raw material processing in the Philippines based on the comparative advantages of these two economies. Similarly, they may also choose between Taiwan Province of China and the Republic of Korea for their R&D activities. Thus, whether inflows of FDI in China are complementary to or substitutable for those in other Asian economies may be simultaneously determined.

All four studies use different sets of control variables. There may be problems associated with the selection of control variables by Eichengreen and Tong (2006), as well as Zhou and Lall (2005) and to a lesser extent with Chantasasawat *et al.* (2005). Although we agree with the research position of controlling standard determinants of FDI in Asian economies and of adding a variable to capture the China effect,

most variables included in Eichengreen and Tong (2006) are important factors affecting trade rather than FDI. It is widely accepted that the relatively low costs of Chinese labour lure certain TNCs away from other Asian economies to China, but this important variable is not included in Eichengreen and Tong (2006) and Zhou and Lall (2005). Instead, they both employ GDP per capita as one of the explanatory variables. Eichengreen and Tong (2006) and Mercereau (2005) use GDP per capita to capture labour costs, while Zhou and Lall (2005) consider GDP per capita as an indicator of the sophistication of markets. We use the approach of Zhou and Lall (2005) in our study. In Chantasasawat *et al.* (2005), the wage rate is included to capture labour costs. However, their measure is the average wage rate without adjusting for the productivity effect. This is problematic, as low wage rates may simply reflect the effect of the poor quality of labour. Hence a more appropriate determinant of FDI is the productivity-adjusted wage rate, i.e. the real effective wage rate.

There are other econometric problems with Zhou and Lall (2005). First, all regression results have a very high R^2, but in most cases, only one or two variables are statistically significant. In one case, only one variable is statistically significant. This is a typical symptom of multicollinearity, but it has not been addressed by the authors. In addition, from the paper, it appears that the variables are measured at current prices, which is also problematic since it implies that inflation is not taken into account.

To empirically determine whether China crowds in or out FDI inflows in other Asian economies, the current study employs a broadly similar approach to the four studies mentioned above with the five special features as described in section 1. We rely on the theoretical discussion in Balasubramanyam and Mahambare (2003) and research findings from Chakrabarti (2001) in selecting FDI determinants used as control variables. Balasubramanyam and Mahambare (2003) argue that the following locational factors are likely to have important effects on FDI inflows: (1) market-related factors such as GDP or GDP per capita (alternatively, GNP or GNP per capita); (2) economic growth related factors such as GDP growth rates; (3) resource endowments of host countries, including natural and human resources; (4) infrastructure facilities, including transportation and communication networks; (5) macroeconomic stability proxied by stable exchange rates and low rates of inflation; (6) political stability in host countries; (7) a stable and transparent policy framework towards FDI; (8) a distortion-free foreign trade regime; and (9) fiscal and monetary incentives in the form

of tax concessions. Chakrabarti (2001) uses extreme bound analysis to examine a range of determinants of FDI and finds that the most robust variable is GDP per capita, followed by openness to trade, wage, net export, growth rate, tax and exchange rates.

Total GDP is often regarded as an important market-related factor for attracting inward FDI. However, Root and Ahmed (1979) argue that total GDP is a relatively poor indicator of the market potential for foreign firms, particularly in many developing countries, since it reflects the size of the population rather than the income level. Instead, GDP per capita may be a better proxy for market potential or attractiveness. Chakarabati (2001) demonstrates that GDP per capita is a more robust variable than total GDP. Hence, the market-related factor in this study is measured by GDP per capita.

The degree of openness positively affects FDI inflows. In the case of efficiency-seeking FDI, for example, it is often the case that foreign affiliates need to import machinery and intermediate inputs to the host economy in order to undertake production for export. Thus, the ease at which foreign affiliates in the host economy can import and export goods is an important determinant of FDI inflows and this is captured by trade openness, i.e. the ratio of trade to GDP.

Wage rates should have an impact on the location of production. Wages are an important part of total costs in labour-intensive manufacturing. As one way of obtaining potential advantages over their competitors, firms undertake FDI to make use of more abundant supplies of low-cost labour in other economies. The standardization of production processes allows highly detailed international division of labour according to the most desirable combination of inputs. This gives firms the opportunity to manage production units across countries to exploit international differences in wage rates. However, wage rates in certain host locations may be low due to lower skill levels of the workforce. Hence, as a determinant of FDI, we use productivity-adjusted wage rates. It is widely accepted that human capital is essential for attracting – and benefiting from – FDI (Borensztein *et al.*, 1998). From the TNC's perspective, local availability of human capital is essential for adapting existing technologies and developing new ones. Thus, the more human capital a country has, the more attractive a country is to foreign investors.

There are several channels through which the exchange rate affects FDI. But most importantly, devaluation of the currency tends to improve the competitiveness of the host economy – at least in the

short run – thus increasing its attractiveness to efficiency- or resource-seeking FDI.

Firms view uncertainty or country risks unfavourably. Political, economic and social instability in the host country and the unfriendly attitude of the host country's government increases uncertainty and thus would have a negative impact on FDI inflows.

3. Empirical model, data and methodology

In the light of the above discussion in previous, we propose the following model for estimation:

$$LFDI_{it} = \alpha_i + \beta_1 LRW_{it} + \beta_2 LGDPP_{it} + \beta_3 HC_{it} + \beta_4 OPEN_{it} + \beta_5 ER_{it} + \beta_6 CR_{it} + \beta_7 LFDS_{it-1} + \beta_8 LFDIC_1 + \varepsilon_{it} \quad , \quad (1)$$

where subscripts *t* and *i* are indices for the year and host economy respectively. *LFDI* denotes the logarithm of FDI inflows; *LRW* is the logarithm of real effective wage rates; *LGDPP* is the logarithm of economy *i*'s GDP per capita, *HC* is human capital; *OPEN* is openness to trade; *ER* is economy *i*'s currency against China's currency the yuan; *CR* is country risk ratings; *LFDS* is the logarithm of FDI stock, which is included to capture the agglomeration effect suggested by Markusen (1991), i.e. the countries with more FDI stock a year ago tend to attract more FDI inflows during current year. *LFDIC* measures the effects of FDI in China. The variable measurement and data sources are listed in the appendix. Variables, FDI flow, FDI stock, real effective wage rates and GDP per capita are measured in constant dollar prices with 2000 as the base year.

In contrast to Eichengreen and Tong (2006), Chantasasawat *et al.* (2005) and Zhou and Lall (2005), but similar to Mercereau (2005), our sample includes India as well as another eight Asian economies, i.e. Hong Kong (China), Indonesia, the Republic of Korea, Malaysia, the Philippines, Singapore, Taiwan Province of China and Thailand. In recent years, India has emerged, alongside China, as an important economic power as well as FDI recipient. The degree of competition and cooperation between China and India is another heated debate in the literature. Other Asian economies are excluded from this study because of the lack of data and the fact that they are relatively unimportant as recipients of FDI.

Data are available for each included economy annually for the period 1980–2003. We exclude data prior to 1980 because FDI in China was virtually zero for those years. The correlation matrices of FDI in these ten Asian economies indicate that, historically, FDI in China from various sources is either positively correlated or uncorrelated with FDI in each of the other Asian economies. The question is whether these apparent correlations still hold once we control for the domestic drivers of FDI.

As part of the data analysis the order of integration of variables is examined first in order to avoid possible spurious regression. It is well-documented in econometric literature that some popular univariate unit root tests, such as the augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests, have low power against the stationary alternative when the time series is short (Maddala and Kim, 1998). More recently, researchers tend to favour panel data unit root tests because extra information can be gained by using this type of data. It is often argued that panel data unit root tests are more powerful because of increased sample size and the inclusion of heterogeneous cross-sectional information which is not available in univariate tests. We use the panel data unit root tests advocated by Maddala and Wu (MW) (1999) and Im *et al.* (IPS) (2003).[4] Both MW and IPS tests specify the null hypothesis of the unit root and test a heterogeneous alternative in which at least one series in the panel is stationary. Maddala and Wu (1999) show that the MW test is more powerful than the IPS test. However, both tests give us consistent results, as indicated in the next section.

Before presenting the empirical results, it is in order to mention three technical notes regarding the estimation of the model and the use of variables.

First, we pool the data and then estimate the system of equations simultaneously, using the seemingly unrelated regression (SUR) approach. This is based on the assumption that there exist common (but unmeasured) influences on FDI in different economies and these induce contemporaneous correlation among the error terms of the individuals. Economy-specific fixed effects are included to control for factors that vary by economy but are not included in the model, for example, culture, institution and policy effects.

[4] For a survey, see Maddala and Kim, 1998; the 1999 supplement of *Oxford Bulletin of Economics and Statistics* (volume 16, issue 1, pp. 603–767); and Baltagi, 2001.

Second, to test the possible effects of FDI diversion or FDI creation due to China's FDI inflows, we estimate a model in which a variable capturing the effects of China's FDI inflow is introduced to act as an explanatory variable along with locational factors of the host economy. We first assume that FDI in China has the same effect on FDI in all other Asian economies. Then, we relax this assumption of common coefficient to see whether the effect of FDI in China varies across economies. Eichengreen and Tong (2006), Chantasasawat *et al.* (2005) and Zhou and Lall (2005) assess the China effect on other Asian economies as a whole, but this aggregate picture hides the story for individual economies.

Finally, we use four different variants of the model to examine the China effect. The variations of the first three models concern the measurement of the China effect. The fourth variant adopts different estimation techniques. One way of measuring the China effect is to use China's aggregate FDI inflows directly. Zhou and Lall (2005) argue that "absolute FDI inflows would give a distorted picture as it would be dominated by the size of the economy, a particular problem when comparing relative small countries with a giant like China". They choose to use FDI per capita instead. However, FDI per capita may also give a distorted picture, as this measure is significantly influenced by the size of population. Our strategy here is therefore to use both measures to see whether the same conclusion is reached. We also make use of inflows of FDI into China, excluding those from Hong Kong (China), since there is a suspicion that a large amount of FDI from Hong Kong is actually "round-tripping" investment. Aggregate FDI data with Hong Kong as a source economy may exaggerate the impact of China as a magnet of FDI. The fourth variant takes into account the possible endogeneity of China's FDI inflows. FDI inflows in China and those in other Asian economies may influence each other. To solve the problem, we adopt the two-stage least square approach. In the first step, we pool all economies together including China to estimate the system of equations using SUR and find the predicated values of China's FDI inflows, which are then used in the second stage.

4. Empirical Results

Table 2 presents the descriptive statistics and panel data unit root test results for the variables for ten economies for the period 1980–2003. Because all variables exhibit a clear trend, the panel data unit root tests have included an intercept and a trend. The results of IPS and MW panel unit root tests suggest that the null hypothesis of a unit

Table 2. Panel data unit root test

	LFDI	LGDPP	LRW	HC	OPEN	ER	CR	LFDS	LFDIC
Descriptive Statistics									
Mean	7.487	7.713	-1.560	83.897	79.294	40.982	1.123	10.070	9.315
Median	7.721	7.604	-1.391	87.550	4.387	39.800	0.782	9.698	9.347
Maximum	11.034	10.152	-0.156	98.100	1239.672	81.600	3.702	13.228	10.863
Minimum	0.000	5.154	-3.774	41.000	0.170	12.200	0.125	7.482	5.182
Std. Dev.	1.912	1.450	0.666	13.184	201.242	14.839	0.906	1.499	1.511
Panel Data Unit Root Tests									
IPS Statistics	-2.391	1.771	-0.233	2.181	-1.003	3.277	0.564	0.225	
p-value	0.008	0.962	0.408	0.985	0.158	1.000	0.714	0.589	
MW Statistics	41.359	17.486	27.629	20.485	23.955	3.901	13.676	17.037	
p-value	0.003	0.621	0.119	0.428	0.244	1.000	0.847	0.651	
Order of integration	I(0)	I(1)	I(1)	I(1)	I(1)	I(1)	I(1)	I(1)	
Correlation Coefficient Matrix									
LFDI	1.000	0.251	0.002	0.142	-0.484	-0.391	0.285	0.417	0.337
LGDPP	0.251	1.000	0.378	0.634	-0.187	-0.674	0.792	0.381	0.224
LRW	0.002	0.378	1.000	0.168	-0.376	-0.381	0.204	-0.243	-0.409
HC	0.142	0.634	0.168	1.000	0.048	-0.245	0.383	0.284	0.277
OPEN	-0.484	-0.187	-0.376	0.048	1.000	0.366	-0.213	0.181	0.022
ER	-0.391	-0.674	-0.381	-0.245	0.366	1.000	-0.557	-0.188	0.031
CR	0.285	0.792	0.204	0.383	-0.213	-0.557	1.000	0.448	0.120
LFDS	0.417	0.381	-0.243	0.284	0.181	-0.188	0.448	1.000	0.353
LFDIC	0.337	0.224	-0.409	0.277	0.022	0.031	0.120	0.353	1.000

Source: authors' analysis.

root can be rejected at the conventional significance levels only for the dependent variable, *LFDI*. In other words, all potential explanatory variables are non-stationary. More specifically, *LGDPP*, *LRW*, *HC*, *OPEN*, *ER*, *CR* and *LFDIS* are I(1) (integrated of order one). We also examine the variable, TELE, which measures the infrastructure of the country and it is I(2) (integrated of order two). Following this result, we do not include *TELE* in our estimations as it would otherwise make cointegration impossible. When all I(1) variables are included in the regressions, panel data cointegration tests suggest that the variables are cointegrated.

Table 3 presents the estimation results. Specification (I) uses the whole set of panel data and include all potential determinants of FDI except FDI in China as an explanatory variable. Results from specification (I) suggest that locational factors (GDP per capita, real effective wage rate, human capital, openness, exchange rate, country risk and previous year's FDI stock) account for a large part of inter-economy variation in FDI. The results confirm that our choice of the determinants of FDI is appropriate.

Specifications (II) – (IV) estimate inflows of FDI to nine Asian economies, excluding China but including FDI in China as an explanatory variable, along with all potential determinants of FDI. For the purpose of comparison, specification (II) uses FDI in China; specification (III) uses FDI inflows in China excluding those from Hong Kong; and specification (IV) uses predicted FDI in China obtained from the estimation of specification (I). Specification (V) estimates inflows of FDI to ten Asian economies including China simultaneously, but in the equation for China, FDI in China and the exchange rate are excluded from the right-hand side. The results of specifications (II), (III) and (V) show that, when the endogeneity of China's inward FDI in relation to inward FDI in other economies is not considered, FDI in China turns out to have a "neutral" effect after the appropriate FDI determinants are controlled. However, the results from specification (IV) show that, when it is considered, FDI in China has a positive effect on FDI in other Asian economies. That is, FDI in China has "crowded in" FDI to Asian economies.

Table 3. Panel regression, 1980–2003
(Dependent variable: log of FDI inflows)

	(I)	(II)[a]	(III)[b]	(IV)[c]	(V)[a]
LGDPP	0.694***	0.068	0.099	-0.107	0.605***
	(0.238)	(0.203)	(0.198)	(0.221)	(0.232)
LRW	-0.332***	-0.185***	-0.185***	-0.184***	-0.328***
	(0.080)	(0.071)	(0.069)	(0.072)	(0.081)
HC	0.040*	0.028	0.024	-0.010	0.042
	(0.022)	(0.035)	(0.036)	(0.038)	(0.028)
OPEN	0.333**	0.345*	0.368*	0.253*	0.236
	(0.167)	(0.184)	(0.192)	(0.148)	(0.187)
ER	-0.009***	-0.009***	-0.009***	-0.009***	-0.009***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
CR	-0.022***	-0.033***	-0.034***	-0.031***	-0.023***
	(0.008)	(0.008)	(0.008)	(0.009)	(0.009)
LFDIS(-1)	0.203*	0.197	0.182	0.135	0.225**
	(0.111)	(0.121)	(0.122)	(0.136)	(0.111)
LFDIC		0.137	0.114	0.432**	0.010
		(0.095)	(0.080)	(0.205)	(0.051)
Country dummies	Yes	Yes	Yes	yes	Yes
R^2	0.692	0.651	0.650	0.676	
Test for country dummies	F(9,223)= 18.157***	F(8,199)= 14.448***	F(8,199)= 15.089***	F(8,199)= 13.929***	$\chi^2(10)$= 171.584***
No. of Countries	10	9	9	9	10

Source: authors' analysis.

Notes: ***, **, * indicate significance level at 1%, 5% and 10%, respectively. Figures in parentheses are standard errors.

[a] LFDIC = Log of China's FDI inflows

[b] LFDIC = Log of FDI inflows in China excluding FDI inflows from Hong Kong

[c] LFDIC = Log of FDI inflows in China predicated from Model (I)

The basic message from table 3 is that China does not appear to compete with its Asian neighbouring economies as a whole for inward FDI. If we view inflows of FDI in Asian economies as part of systemic globalization strategies adopted by TNCs, the results from specification (IV) is more appropriate, i.e. FDI in China is significantly complementary with FDI in other Asian economies as a whole. China has different comparative advantage *vis-à-vis* other Asian economies in general, and China and other Asian economies are largely in the complementary segments of the IPN/APN.

Table 4. Panel regression, 1980−2003
(Dependent variable: log of FDI inflows)

	(VI)[a]	(VII)[b]	(VIII)[c]	(IX)[a]
LGDPP	2.518***	2.397***	2.474***	2.830***
	(0.468)	(0.426)	(0.390)	(0.387)
LRW	0.061	0.134	0.556**	-0.194
	(0.137)	(0.146)	(0.236)	(0.141)
HC	-0.035	-0.025	-0.006	-0.023
	(0.041)	(0.037)	(0.036)	(0.034)
OPEN	0.491**	0.820***	0.715***	0.375*
	(0.251)	(0.277)	(0.143)	(0.213)
ER	-0.009***	-0.010***	-0.009***	-0.010***
	(0.001)	(0.001)	(0.001)	(0.001)
CR	0.007	0.012	0.032***	0.006
	(0.010)	(0.011)	(0.013)	(0.009)
LFDIS(-1)	-0.080	-0.159	0.147	-0.126
	(0.175)	(0.169)	(0.181)	(0.175)
LFDIC*Hong Kong	-0.006	-0.106	-0.031	0.050
	(0.151)	(0.101)	(0.275)	(0.254)
LFDIC*India	0.437**	0.409***	0.914***	0.277*
	(0.185)	(0.162)	(0.329)	(0.163)
LFDIC*Indonesia	-0.230*	-0.194*	-0.376	-0.434**
	(0.130)	(0.108)	(0.318)	(0.220)
LFDIC*South Korea	-0.509***	-0.356***	-0.758***	-0.638***
	(0.163)	(0.116)	(0.185)	(0.116)
LFDIC*Malaysia	-0.174*	-0.213***	-0.675***	-0.303***
	(0.099)	(0.080)	(0.220)	(0.113)
LFDIC*Philippines	0.829***	0.610**	1.139***	0.666***
	(0.295)	(0.249)	(0.419)	(0.188)
LFDIC*Singapore	0.102	0.153	-0.132	0.097
	(0.113)	(0.104)	(0.214)	(0.087)
LFDIC*Thailand	-0.100	-0.058	-0.298	-0.207***
	(0.074)	(0.056)	(0.183)	(0.083)
LFDIC*Taiwan	-0.686***	-0.480***	-1.131***	-0.865***
	(0.147)	(0.124)	(0.324)	(0.143)
R^2	0.709	0.705	0.707	
Test for country dummies	F(8, 191)= 10.753***	F(8, 191)= 11.879***	F(8, 191)= 11.584***	$\chi^2(10)$= 127.172***
No. of Countries	9	9	9	10

Source: authors' analysis.

Notes: ***, **, * indicate significance level at 1%, 5% and 10%, respectively. Figures in parentheses are standard errors.

[a] LFDIC = Log of China's FDI inflows

[b] LFDIC = Log of FDI inflows in China excluding FDI inflows from Hong Kong

[c] LFDIC = Log of FDI inflows in China predicated from model (I) in table 3.

The question then is whether FDI in China has the same impact on FDI in all other Asian economies under study, i.e. how FDI in China affects that in other Asian economies on an individual basis. Table 4 presents the results of the estimation when the coefficient representing the China effect is allowed to vary across economies. Specifications (VI) – (VIII) use different measures of FDI in China. Specification (VI) uses FDI in China, specification (VII) uses inflows of FDI in China excluding those from Hong Kong (China) and specification (VIII) uses predicated FDI in China obtained from the estimation of specification (I) in table 3. Specification (IX) estimates ten Asian economies including China simultaneously, excluding the exchange rate from the equation for FDI in China. Specifications (VI) to (IX) provide quite consistent results: there has been significant crowding in of FDI in India and the Philippines by FDI in China, but crowding-out of FDI in Indonesia, the Republic of Korea, Malaysia and Taiwan Province of China. A significant substitution effect between China and Thailand is identified by specification (IX) only. In addition, FDI in China has no significant effect on Hong Kong and Singapore. Again, if we accept the view that FDI in China and in the other Asian economies may influence each other, then the results of specification (VIII) are the most appropriate, although they are very similar to those from the other specifications.

The results show that China seems to complement some Asian economies while competing with others, presumably on the basis of their comparative advantages within the IPN. China appears to complement two relatively low-income economies but, at the same time, to compete with three other low-income economies. China appears to compete with two of the four relatively high-income (newly-industrialized) economies. In other words, the China effect does not appear to depend on the income level.

What are the relative competitive positions of India and the Philippines which make inflows of FDI to China complementary to inflows to these economies? As discussed in Balasubramanyam and Mahambare (2003), the composition of FDI in India in general is substantially different from China. A substantial proportion of FDI in India is located in the high-tech end of the spectrum and in services, whereas investment in China is mostly located in the low-tech end of the spectrum, often in assembly manufacturing. In India, more than 50% of FDI inflows in the reform period (1991–2000) were in services, such as call centres, insurance, database management, medical transcript processing and financial services, and the rest were in fuels, electrical, telecommunications, transportation, chemicals and food processing

industries (Sahoo and Mathiyazhagan, 2003). In contrast, 59% of FDI inflows in China from 1979 to 1998 were in manufacturing and only 3.8% in services (Wei and Liu, 2001, p. 28). Within manufacturing, large amounts of FDI were attracted to textiles, garments, electronics and transportation equipment.

This difference in sectoral distribution may reflect differences in factor endowments, the stage of industrialization and local market conditions in India and China. India has a large low-cost and skilled labour base, and has first mover and agglomeration advantages in services. As indicated in UNCTAD (2004), India is the preferred destination for offshoring of a wide range of services. The growing technological capabilities of Indian firms and their rising exports, particularly in information technology (IT) services, are driving the FDI growth. FDI in services and most of the manufacturing industries in India seem to be complementary to the large part of manufacturing FDI in China within the IPN/APN. For example, as discussed by Patibandla (2007), in the IT industry, even though China has a large domestic market with six million PCs sold and about 16 million people subscribing to the Internet in 2000, China has never attracted much FDI in the software industry, probably because of weak intellectual property protection and under-developed industrial clusters. On the other hand, China does attract a large amount of FDI (about $6 billion) in production of hardware. In contrast, India has attracted a larger amount of FDI into the software industry. Almost all large United States and European IT firms have a presence in India, including Texas Instruments, Microsoft and Apple. In this connection, Engardio (2005) notes, "… multinationals are having their goods built in *China* with software and circuitry designed in *India*. As interactive design technology makes it easier to perfect virtual 3-D prototypes of everything from telecom routers to turbine generators on PCs, the distance between *India's* low-cost laboratories and *China's* low-cost factories shrinks by the month". It suggests some complementarity between inward FDI in the Chinese computer industry and inward FDI in the Indian software industry.

The Philippines has a relatively large services sector (53.2% of GDP) and a small manufacturing sector (31.9% of GDP). There are not enough data available to verify whether FDI inflows are consistent with the economic structure of the country. However, there are two indirect pieces of evidence to support the view that inflows of FDI in the Philippines are complementary to those in China. First, Lall and Albaladejo (2004) conducted an exercise to analyze the degree of threat posed by China to Asian economies using trade data over the 1990s

and found that the Philippines has only 5.8% (and decreasing) of its exports in categories in which China has an increasing world market share. Abola and Manzano (2004) also suggest that the Philippines and China are more complementary than competitive in the world market. Trade data reflect countries' respective comparative advantages which play an important role in attracting FDI. For example, PSi Technologies continued its expansion in the Philippines and one important reason is that many Filipino workers speak at least basic English (*Economist*, 15 February 2003). It is likely that FDI has helped the boom of the electronics industry in China. However, as mentioned in the introduction of this paper, 85% of PSi Technologies' output ends up in China at some stage for final assembly of mobile phones, computers and other appliances. Therefore, "the boom in China, far from destroying the local electronics industry [in the Philippines] through cheap competition, is helping to keep it afloat amid a global downturn" (*idem*).

Secondly, as shown in UNCTAD (2004), due to a highly skilled workforce in accounting, software writing, architectural services, telemarketing and graphic design, and its cultural affinity to the United States and American-style English speakers, the Philippines has already become an attractive country for offshoring of business processes. AIG, Caltex, Procter & Gamble and HSBC all operate the largest shared service or call centres in the country. Foreign companies have in this way created many new jobs for college graduates and boosted the country's exports of services. Such FDI again seems to be complementary with the FDI in manufacturing in China within the IPN/APN.

There are different reasons for the existence of competition effects between China and Indonesia, the Republic of Korea, Malaysia and Taiwan Province of China. Tiwari *et al.* (2003) argue that Indonesia is at the lowest level of economic development in the ASEAN countries and most FDI has been targeted to take advantage of cheap labour and local resources. As a result, FDI in Indonesia had previously been centred in basic metal sectors (43.4% of total FDI inflow in 1980), followed by textiles. However, Indonesia began to attract FDI in electronics and the share of this industry in total FDI was 45.5% in 1994. Dhanani and Hasnain (2002) also show that after liberalization in 1985, new foreign firms entered mainly export-oriented and labour-intensive industries. By 1997, foreign firms were playing significant roles in three industries: textiles, chemicals, and fabricated metal and machinery (19–30% of the total each). As much of FDI in China is in the textile, general metal and machinery and electronics industries, it seems that Indonesia and China are seen by TNCs as two alternative locations for their value creation

activities in these industries. Therefore, there appears to be competition for FDI in these industries between the two economies.

Malaysia is one of the most developed economies in South-East Asia and its technological capabilities are also superior to other ASEAN countries apart from Singapore. The electronics and electric industries are major recipients of FDI inflows. However, Malaysia also has some lower-cost labour and natural resources such as rubber. Between 1988 and 1999, in addition to large inflows to the electronics and electrical industry, much FDI went to machinery, textiles, food processing, wood as well as rubber industries (Ramasamy, 2003). It appears that Malaysia is competing for FDI mainly in the electronics industry and to a lesser extent the machinery and textile industries.

The Republic of Korea and Taiwan Province of China are two of the four mature Asian newly industrialized economies (NIEs). It is generally thought that China has a strong advantage in low-tech products while the Republic of Korea and Taiwan Province of China, as well as Singapore, are better-placed in terms of technological capabilities (Lall and Albaladejo, 2004). Therefore, Ianchovichina and Walmsley (2005) argue that there is more scope for export specialization in China *vis-à-vis* the NIEs than *vis-à-vis* the developing East Asian economies. However, both Lall and Albaladejo (2004) and Ianchovichina and Walmsley (2005) observe that China's advantages are not confined to cheap labour, but it is upgrading its industrial capabilities rapidly.

Export data indicate that the Republic of Korea has a comparative advantage in semiconductors, wireless telecommunications equipment, motor vehicles, computers, steel, ships and petrochemicals, while Taiwan Province of China has an equivalent advantage in computer products and electrical equipment, metals, textiles, plastics and rubber products and chemicals. China has already begun to develop and export some of these products. Between 1990 and 2000, the Republic of Korea increased its share of high-tech products in total exports from 21.6% to 37.1%, while the corresponding share for Taiwan Province of China increased from 25.7% to 46.3%. On the other hand, the share of high-tech products in China's exports increased from 6.9% to 24.4% during the same period. China has been catching up. In the 1980s and 1990s, electronics exports by the Republic of Korea and Taiwan Province of China showed negative growth of -20.0% and -28.4% respectively, while those by China increased at the rate of 6.6% (Felker, 2003). During the 1990s, China substantially gained a larger world market share in high-tech products (from 0.7% to 4.1%), a much greater gain than the Republic of Korea (from 2.8% to 4.5%) and Taiwan Province

of China (from 3.4% to 4.9%) (Lall and Albaladejo, 2004). As Felker (2003) notes, in the second half of the 1990s, China's export profile came to include not only labour-intensive products like textiles, toys, plastic items, and electrical items but also a growing share of own-design and own-brand manufacturing in white goods and consumer electronics, along with aggressive thrusts into high-tech industries such as wafer fabrication. As indicated in UNCTAD (2001, p. 26), Chinese exports of high- and new-technology products rose from $7.7 billion in 1996 to over $37 billion in 2000, with foreign-invested firms accounting for 81% of the total. For this reason, Felker (2003) does not treat China's recent success as the take-off of the latest member of East Asia's "flying geese", but "the cross-wind of an entirely new flock". This indicates that China may be regarded by TNCs as an alternative location for their high-tech activities in the international segmentation of certain production process.

Sensitivity analysis

The potential sensitivity of the empirical results to the choice of an alternative measurement of FDI in China and to the econometric methods has been partly dealt with above. In this subsection, we perform a few more robustness checks. First, as noted above, Zhou and Lall (2005) assert that FDI per capita rather than aggregate FDI should be used. Our results are essentially the same as those in tables 3 and 4.[5] Second, after removing Hong Kong (China) from the sample to avoid the "round-tripping" issue, the results change slightly. The negative coefficients of China's FDI inflows on Indonesia are now only statistically significant in one of the four specifications. On the other hand, the impact of China's FDI inflows on Singapore turns out to be statistically significant in three out of the four specifications. Third, we introduced two time dummies into the regressions. One is to take into account of the possible structural changes in FDI inflows in China. As discussed in section two, China experienced a surge of FDI in 1991. Since then, the shares of FDI from Hong Kong (China), Taiwan Province of China and Macao (China) have decreased and the share of OECD countries has increased. It is widely accepted that FDI from the former group of economies tends to concentrate in labour-intensive low-tech manufacturing, while FDI from the latter group of countries is in capital-intensive high-tech industries. The second time dummy is included to capture the changes in Asian economies due to the 1997 Asian Financial Crisis. The econometric results again are similar to

[5] The results are available upon request.

those in tables 3 and 4. In most cases, the two dummies appear to be insignificant. These results are consistent with Zhou and Lall (2005).

5. Conclusions

The current research builds on existing studies to analyze how FDI in China has affected those in other Asian economies – Hong Kong (China), India, Indonesia, the Republic of Korea, Malaysia, the Philippines, Singapore, Taiwan Province of China and Thailand. We carried out panel data unit root tests, controlled for important determinants of FDI, used different measures of the China effect, and compared whether this effect is different when inflows of FDI in China and the nine Asian economies are assumed to be simultaneously, rather than individually, determined. Our results indicate that locational factors, including market potential, effective wage rates, human capital, openness, exchange rate, country risk, investment environment and agglomeration effects are all important determinants of FDI inflows. Once these factors are controlled for, China does not appear to be competing with its neighbouring economies as a whole for inward FDI. Furthermore, when FDI inflows are viewed as part of systemic globalization, FDI in mainland China is likely to have crowded in FDI in its neighbouring Asian economies as a whole because there seems to be a high degree of overall complementarity between them within the IPN established by TNCs.

We believe that the simultaneous determination approach is more appropriate for the analysis undertaken in this study as it is more consistent with the recent developments of TNCs' global value creation activities and of FDI theory. Following this argument, we have also examined the China effect on the nine economies on an individual basis, and found that there appears to be a significant FDI creation effect on India and the Philippines, but a significant FDI diversion effect on Indonesia, the Republic of Korea, Malaysia and Taiwan Province of China. Although China's main advantages still lie in labour-intensive and low-tech products, they have been rapidly expanding into medium- and high-tech industries. Thus, China may have become an alternative location for FDI not only to relatively under-developed Asian economies such as Indonesia, but also to Asian NIEs like the Republic of Korea and Taiwan Province of China.

Three important policy implications can be derived from the current study. Firstly, the development of China can create opportunities for its neighbouring economies as a whole. This is consistent with the

findings of other studies. Our findings are contrary to the claim by Kiminami and Kiminami (1999) that increased FDI inflows in China have led to fiercer competition among Asian economies for capital and financial resources and may contribute to "a recurrence of the Asian crisis in the 21st century". Secondly, whether the China effect is positive or negative depends on the relative positions of individual economies involved in particular segments of the IPN. These positions evolve as individual economies develop. In this dynamic process, a substituting (complementary) relationship between two economies today may turn to be a complementary (substituting) one tomorrow. If national governments in Asia are able to enhance complementarity of value creation activities in the region when they promote their national economic development, then Asian economies as a whole will gain more from each other's development. Thirdly, as locational factors are also important determinants of FDI inflows, Asian economies, including China, need to continue to pay special attention to the factors under their control to increase their attractiveness as FDI destinations.

It must be noted that the results from this study need to be interpreted with care due to a number of limitations. One is related to the reliability and comparability of data across economies, especially FDI data. Some estimates suggest China's FDI figures may be inflated by as much as 30–50% due to "round-tripping". On the other hand, India's FDI statistics are often believed to be underestimated. Until 2003, the Reserve Bank of India (RBI), the agency responsible for compiling FDI data, didn't follow the standard IMF definition and excluded reinvested earnings, royalty payments, inter-company debt transactions and commercial borrowing by foreign-invested firms. Secondly, though all the economies included in our sample have similar profiles at different periods in time and can reasonably be pooled, they are clearly at different development stages. Hong Kong (China), the Republic of Korea, Singapore and Taiwan Province of China are at relatively higher development stages than Indonesia and Malaysia. Despite these limitations, our study adds to the literature on the ongoing debate, especially in light of its five special features:

(1) We confine our analysis to ten Asian economies: Hong Kong (China), India, Indonesia, the Republic of Korea, Malaysia, the Philippines, Singapore, Taiwan Province of China, Thailand as well as mainland China. As demonstrated by Blonigen and Wang (2005), pooling developing and developed countries in this type of empirical study on FDI may be inappropriate since the underlying factors that determine FDI vary systematically between the two groups of countries.

(2) A system of simultaneous equations is introduced for estimation because FDI inflows in Asia are believed to be part of TNCs' systemic globalization strategies. We examine the "China effect" not only on its neighbours as a whole, but also on individual economies. We then try to provide an explanation as to why the effect is positive for some economies but negative for others.

(3) Important determinants of FDI in the host economy are controlled. In existing studies such as Eichengreen and Tong (2006) and Zhou and Lall (2005), some important determinants of FDI are not controlled for when the impact of China's inward FDI on other economies is investigated, which may have produced biased results.

(4) We perform panel data unit root and cointegration tests to avoid a possible spurious regression problem. It is well established in literature that, when time series data are used, the integration and cointegration issue should be addressed first to avoid spurious regression.

(5) We use different measures of the China effect and several different estimation techniques to see if the results are sensitive to these measures and econometric methods.

The central message from this study is that China does not appear to have competed with other Asian economies as a whole for inward FDI. At the level of the individual economy, it is likely that inward FDI to China has had an FDI creation effect in India and the Philippines, but a diversion effect in Indonesia, the Republic of Korea, Malaysia and Taiwan Province of China because of their comparative advantages in relation to China.

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Appendix

Variable	Measurement and data sources
FDI	The real annual aggregate inflow of FDI is derived from nominal aggregate FDI inflows deflated using the GDP deflator of the host economy. Source: UNCTAD website
FDS	The real aggregate FDI stock is derived from nominal aggregate FDI stock deflated using the GDP deflator of the host economy. Source: UNCTAD website and World Development Indicator (WDI) CD-ROM
GDPP	GDP per capita. It measures market potential. Source: WDI for all economies except Taiwan Province of China whose data are from International Financial Statistics Yearbook
RW	Real effective wage rate measured by the manufacturing wage rate adjusted for productivity. Productivity is measured as GDP per employee. Source: UN Common Database, Yearbook of Labor Statistics, LABORSTA website.
HC	Human capital measured by literacy rate. Illiteracy rate is the percentage of people aged 15 and above who can't, with understanding, read and write a short, simple statement on their everyday life. Literacy rate equals 100 – illiteracy rate. Source: WDI for all economies except Taiwan Province of China whose data are from Taiwan Province of China's official websites.
Openness	Openness is measured using trade to GDP ratio. Source: WDI for all economies except Taiwan Province of China whose data are from International Financial Statistics Yearbook
ER	Exchange rate of the host economy against Chinese Yuan. Source: International Financial Statistical Yearbook.
CR	Country risk. It is defined as 100 - annual country risk ratings. The ratings are scaled from 0 to 100. The higher the rating, the lower the chance of banking default. Source: Institutional Investor.
TELE	Infrastructure. Source: WDI for all economies except Taiwan Province of China whose data are from UN Common Database