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Economic Opening and Growth in China

INTERNATIONAL DEVELOPMENT



OECD 

By Sylvie Démurger

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ECONOMIC OPENING AND GROWTH IN CHINA

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Foreword

This publication was undertaken in the context of the OECD Development Centre's research programme on Globalisation and Regionalisation. The programme seeks to assess the risks and benefits for both developing and OECD Member countries from international economic opening.

Table of Contents

Acknowledgements	6
Preface	7
Map of China	8
Introduction.....	9
<i>Chapter 1</i> Regional Growth Patterns in China: Stylised Facts	13
<i>Chapter 2</i> The Growth-FDI Dynamic in China's Provinces	29
<i>Chapter 3</i> Policy Recommendations and Conclusion	49
<i>Annex 1</i> Historical and Geographical Background	55
<i>Annex 2</i> Modelling the Interactions between Foreign Direct Investment and Economic Growth	63
<i>Annex 3</i> Database: Sources and Methodology	79
Bibliography	83

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Preface

Recent changes in the People's Republic of China have led to intensified speculation. The rapid economic growth and the major structural changes that have accompanied China's policy of "openness and reform" — first launched in 1978 — make the Chinese transition experience at the same time unique and useful for comparison.

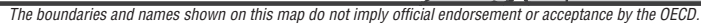
China's success in opening up its economy lies in its special ability to develop trade and financial relations with the rest of the world. For example, foreign direct investment to China has increased to such an extent that since 1993 China has been the leading recipient of FDI among developing countries.

The gains from openness and economic growth have been unequally distributed, however, as shown by the increased disparities between provinces. This raises the question of the sustainability of the development process, especially if unequal development in China were to create political and social tensions that might hold back economic growth in the long term. Thus an evaluation of the trends in China's regional economies is important not only for the country's current and future economic policy but also in an international economic context.

This volume, which forms part of the Development Centre's research programme on "Financial Systems, Resource Allocation and Growth", investigates the effects of opening up to foreign capital on China's economic growth and, particularly, on the evolution of inter-provincial disparities since the early 1980s. The author examines the dynamic relationships between foreign direct investment and growth and between the inter- and intra-provincial growth links. The results are useful in understanding the dynamics of China's growth; for the former, they provide a partial explanation for the geographical concentration of strong performances along the coast and the growing gap between the coast and the interior, while for the latter they underline the cumulative nature of the process.

The quantitative approach used in this study allows the author not only to make a substantial contribution to measuring the factors of China's growth, but also to present suggestions for policies which would most effectively support "openness", especially with a view to reducing regional imbalances.

Ulrich Hiemenz
Director
OECD Development Centre
September 1999



Introduction

In the late 1970s, the People's Republic of China initiated a process of "openness and reform" with the overall aim of encouraging the modernisation of the Chinese economy while maintaining a socialist structure. The major economic and social upheavals in the country since that time have led, in particular, to the emergence of new forms of economic activity, resembling those of a market economy, and to growing integration into the world economy. Over the same period, China also recorded remarkably high and sustained levels of economic growth, with average real GDP growth of the order of 10 per cent per annum between 1978 and 1997. As a result, the country today is at the centre of world economic interests.

The profound changes experienced by the Chinese economy were due to economic necessity and political determination to modernise and reform, the latter embodied in the person of Deng Xiaoping. The economic reforms were undertaken in the political context of the struggle for the succession to Mao Zedong in September 1976 and the arrest of the "Gang of Four" in October 1976. These two events marked the end of the tumultuous period of the Cultural Revolution (1966-76) and the beginning of Deng Xiaoping's official political rehabilitation. Deng had been known to have reformist tendencies and was dismissed from his post as secretary general of the Chinese Communist Party (CCP) in October 1966. His political victory over Hua Guofeng, Mao's chosen successor and an advocate of very cautious change, was confirmed in December 1978 with the official proclamation of the openness and reform policy at the Third Plenum of the XIth Central Committee of the CCP.

Under this policy of opening up to foreign trade and investment and of domestic structural economic reform, China gradually reduced the scope of mandatory planning, decentralised economic decision making and allowed market forces to operate. As a result, China today seems to have nearly completed its transition from a planned economic system to a system closer to a market economy. China stands apart from the world's other transitional economies in that it applied these economic reforms in an unchanged political context. The Chinese transition was thus first and foremost an economic transition, in which the presence of a centralised and authoritarian government ensured that the reforms were implemented gradually. Indeed, this gradual implementation of reform is the principal distinguishing feature of China's economic transition, setting the country apart particularly from the countries of Eastern Europe.

In general, reform measures were adopted in a selective, partial and pragmatic way: selective, because at first they affected only a few coastal provinces, which became the engines of the reform process; partial, because they were simply introduced into the existing economy, leading to the emergence of a mixed system retaining a number of “socialist” characteristics; pragmatic, because many of the reforms were often introduced when required by economic developments. This selective, partial and pragmatic approach makes the Chinese transition process a unique case.

This aim of this study is to review the mechanisms of the link between China’s economic reform and its phenomenal economic growth, especially by examining the implications of opening up to the outside world. A detailed review of the openness and reform policy suggests that although the “open door” was only one facet of the reforms, it nevertheless represents one of the most radical upheavals experienced by this economy since 1978. Apart from the notable exception of the agricultural sector, the internal reforms had not until quite recently brought about any genuine restructuring of the economy, which is still dominated by the inefficient public sector. To this day, state-owned enterprises still absorb more than half of all fixed-capital investment and employ 60 per cent of the urban working population, although their share in industrial output is shrinking. In contrast, the gradual liberalisation of foreign trade and opening up to foreign investment have had a structural impact on the economy that acted more quickly by introducing both competition and foreign technology, neither of which had been present before. Simple observation of the facts suggests that the opening process initiated in the late 1970s allowed China to exploit its comparative export advantages and also to acquire foreign technology through foreign direct investment (FDI).

It is widely recognised that technical progress accounts for a much lower proportion of growth in developing countries than in industrialised countries (Shaw, 1992). Developing countries thus stand to gain even more from the liberalisation of international trade in goods and technology because it gives them access to the global stock of knowledge and thus allows them to profit from the dissemination of technical progress. Like imports of high-technology goods, FDI is a major channel for acquiring advanced technology for developing countries. Apart from contributing to physical capital accumulation, FDI promotes improvements in the marginal productivity of capital and technical progress as it generally embodies more advanced levels of technology and managerial and organisational expertise. As Findlay (1978) emphasises, the establishment of more efficient foreign firms within a country can lead to indirect productivity gains through a “contagion” effect, since technical innovations are likely to be imitated more efficiently through personal contacts between those who already have some knowledge of the innovation and those who might copy it. Moreover, the non-competitive and partially non-exclusive nature of the technological and managerial expertise embodied in an investment by a foreign firm can generate externalities. It can, for example, be transmitted to the rest of the economy through the training of the workforce, the establishment of links between domestic and foreign firms, or by a process of “learning-by-watching” (Balasubramanyam *et al.*, 1996).

Foreign direct investment can thus serve as a fundamental engine of growth by promoting the diffusion of foreign technology and generating externalities. In view of the increasing inflows of foreign capital to China since the early 1980s, a detailed examination of the macroeconomic mechanisms linking openness to foreign capital and growth in China may prove instructive for understanding the processes of development and transition.

This study offers an explanation of China's economic growth based on this FDI-growth dynamic and on another dynamic involving the geographical propagation of growth. In this continental country, the growth paths of the individual provinces are particularly worth examining, since each province has a population comparable to that of an entire country and displays special features which distinguish it from the other provinces. A comparison of growth paths of the provinces since the early 1980s reveals some complex trends. For example, although there are fairly marked income disparities, particularly between the coastal and inland provinces, the comparison also reveals a trend towards a reduction of income dispersion within large regional groupings. Since all of China's provinces did not receive the benefits of the openness and reform policy at the same pace, nor to the same extent, this policy is a fundamental factor for understanding their different growth paths. On the basis of these observations, we assess the effect of this policy on the growth paths of China's provinces and provide some explanations for their evolution. The analysis begins with the dynamic relationship between FDI and China's growth, and subsequently evaluates the interdependence of growth paths at the provincial level and, within the provinces, at the city level. The latter stage, motivated by the idea that once growth begins it is likely to have its own particular dynamic, allows us to describe some growth propagation phenomena that are useful in understanding the Chinese experience.

Chapter 1

Regional Growth Patterns in China: Stylised Facts

The issue of regional development has always been important, or at least latent, in the economic policies of the People's Republic of China, the main driving factor being a concern for the maintenance of political stability. Over time, however, regional development strategies have undergone considerable change: the Maoist period's objective of reducing the inequalities stemming from the capitalist past were replaced in the late 1970s by a more inegalitarian strategy clearly aimed at developing a few provinces. Indeed, many observers suggest that the recent evolution of the Chinese economy has been marked by an increase in inter-provincial inequalities. Examination of a few economic indicators at the provincial level¹, however, reveals a complex pattern which cannot be described simply as "unequal growth", and in particular makes it possible to distinguish trends at the level of groups of provinces.

Economic Growth in China's Provinces

China's immense size in terms of both surface area and population means that the notion of development necessarily covers different situations depending on the geographical areas under consideration. Traditionally, China has been divided into three major regions (coast, centre and west; see Annex 1) which, from a simple geographical standpoint, can be distinguished by their different natural endowments. For the greater part of the Maoist period, China's regional economic policy was aimed at absorbing the natural and historical differences between the "advanced" coastal provinces and the backward inland provinces. The Chinese authorities, for reasons that were more ideological and strategic² than economic, deliberately adopted a strategy of balanced development by encouraging the transfer of physical and human resources and productive capacity from east to west. Although this strategy led to an increase in the inland provinces' share in investment and output, it did not have the expected effect of reducing income disparities between the coastal and inland provinces³.

The introduction of the openness and reform policy from 1978 — initially in only two provinces (Guangdong and Fujian), then gradually extended to all provinces — brought about a complete reversal of the Maoist period's regional development strategy. As Sung *et al.* (1995) point out, there were several significant reasons for the decision to adopt a “discriminatory” policy focused on a few “experimental” provinces. The first reason is related to the relatively small size of the economies of Guangdong and Fujian provinces in 1978. By limiting the trial efforts at liberalisation to these provinces instead of liberalising areas which were much more developed, such as Shanghai, the Chinese government avoided the possibility of disastrous consequences for the country if the experiment failed. Another reason for this choice was the geographical proximity of these two provinces to the buoyant economies of Hong Kong (China), Macao and Chinese Taipei, which not only generated positive externalities but also made it possible to prepare China for possible reunification with Hong Kong (China), Macao and Chinese Taipei (Sung *et al.*, 1995). The third and last reason lies in the choice of a “sequential” regional development strategy, since the aim of the Chinese authorities was to form growth centres in the eastern part of the country specialising in production of relatively technology-intensive goods for export and liable to transmit their growth dynamic to the inland provinces in the long term. Indeed, an explicit objective of the sixth five-year plan (1981-85) was to “exploit the economic power of the coastal regions by drawing on their strengths, in order to promote economic development in the interior” (quoted in Lemoine, 1994).

Differences in Regional Growth

The geographically selective implementation of the openness and reform policy from 1978 brought about an unequal distribution of growth across provinces. China's high overall GDP growth — 9.5 per cent a year on average over the 1978-96 period — obscures fairly large inter-provincial disparities: for the period as a whole, there was a gap of 7.1 percentage points between the growth rate of the most dynamic province (Guangdong) and that of the least dynamic (Qinghai).

Furthermore, a regional classification of provinces (Table 1.1, column 2) reveals that on average the coastal provinces grew faster than the inland provinces, despite the relatively poor performance of Liaoning province and the municipalities of Tianjin and Shanghai. The most dynamic provinces — Guangdong, Fujian, Zhejiang, Jiangsu, Shandong and Hainan⁴ — are located along China's north-south coastline and hence are all adjacent or close to one another. As one might expect, this concentration of growth on the coast has led to an increase in the relative disparity between regions, as will be seen below.

Table 1.1. Average Annual Growth Rates by Province (1978-96)
(percentages)

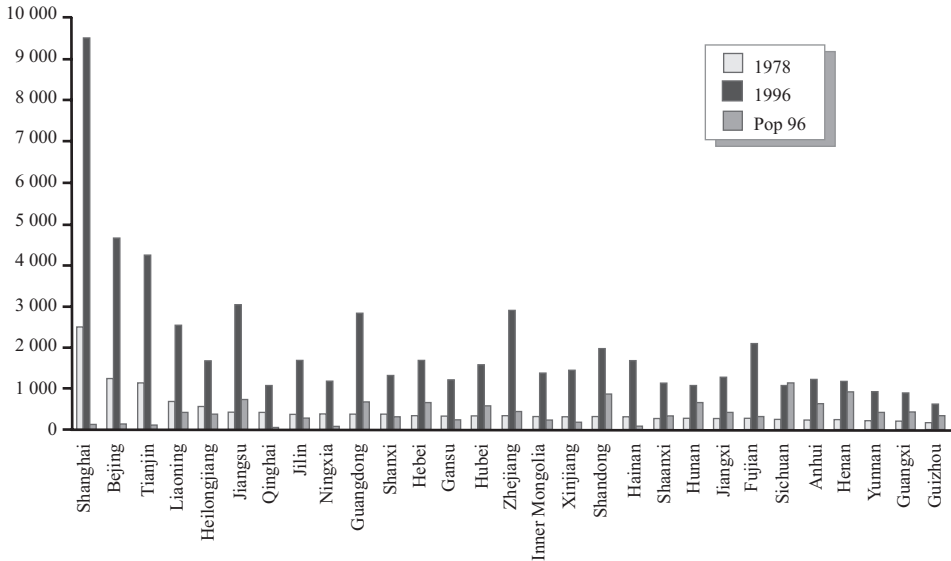
Province	Region	Real GDP				Population
		Total	Primary	Secondary	Tertiary	
Guangdong	I	14.0	6.4	17.4	14.4	1.8
Fujian	I	13.8	7.8	17.4	15.1	1.6
Zhejiang	I	13.8	4.3	18.1	14.4	0.8
Jiangsu	I	12.7	5.5	14.5	15.6	1.1
Shandong	I	11.9	6.9	13.9	14.1	1.1
Hainan	I	11.9	8.9	13	15	1.8
Henan	II	11.0	6.0	13.1	14.9	1.5
Anhui	II	10.9	5.2	15.2	13.6	1.4
Xinjiang	III	10.8	8.7	10.1	15.2	1.8
Hubei	II	10.6	5.3	13.1	13.5	1.4
Jiangxi	II	10.5	6.0	13.8	12.6	1.4
Hebei	I	10.4	5.2	11.4	13.6	1.4
Guangxi	I	9.9	6.8	13.9	9.6	1.7
Inner Mongolia	II	9.9	7.7	9.3	13.6	1.3
Yunnan	III	9.9	5.1	11.8	13.9	1.5
Beijing	I	9.8	7.5	8.6	14.0	2.1
Jilin	II	9.7	6.8	9.9	13.0	1.1
Shaanxi	III	9.4	5.9	10.2	12.8	1.4
Sichuan	III	9.3	4.0	12.6	12.1	0.9
Shanghai	I	9.3	2.1	8.9	11.4	1.4
Tianjin	I	9.2	6.9	8.7	10.8	1.5
Guizhou	III	9.0	5.4	10.7	11.8	1.6
Ningxia	III	9.0	6.2	8.7	11.6	2.1
Hunan	II	8.9	4.7	11.3	11.5	1.2
Shanxi	II	8.9	4.4	9.3	11.2	1.4
Gansu	III	8.8	6.9	7.5	13.2	1.6
Liaoning	I	8.7	5.5	7.8	13.7	1.1
Heilongjiang	II	7.3	5.2	6.9	11.1	1.0
Qinghai	III	6.9	3.8	6.9	9.4	1.6

Note: The "Region" column indicates to which geographical group the province belongs (I = coast, II = centre, III = west).
Sources: Hsueh *et al.* (1993); SSB, *China Statistical Yearbook* (various editions) and author's calculations.

These differing provincial growth paths were naturally accompanied by income disparities. In 1978, as Figure 1.1 suggests, income levels in the three municipalities of Shanghai, Beijing and Tianjin were substantially higher than in any of the provinces. Provincial levels of per capita GDP were all of comparable size, grouped around an average of 332 yuan (1978 prices), while the absolute income gap between the poorest province (Guizhou) and the wealthiest municipality (Shanghai) involved a ratio of 1 to 14⁵. The differing growth paths over the period had several effects on this distribution. The absolute gap between Shanghai and Guizhou (which in 1996 were still the two extremes of the income scale) increased slightly, as did the disparities

within the set of all the provinces (excluding municipalities)⁶. By 1996, per capita income levels in most of the coastal provinces had moved closer to those of the municipalities (excluding Shanghai), whereas those of certain inland provinces (especially Guizhou and Yunnan) remained very low.

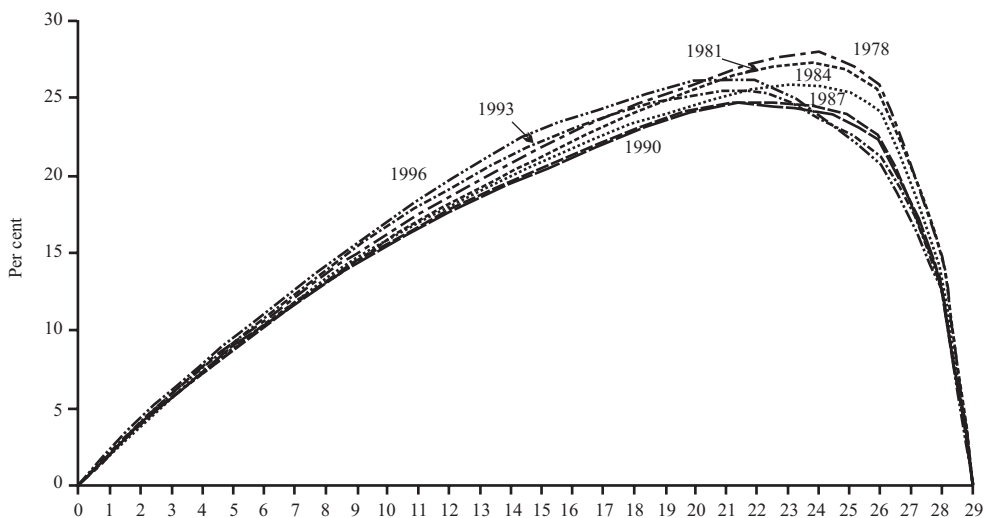
Figure 1.1. Evolution of Per Capita GDP by Province, 1978–96
(in 1978 yuan)



Note: The provincial population (Pop 96) is expressed in units of 100 000 inhabitants.
Sources: See Table 1.1.

Lorenz curves can be used to visualise these trends and obtain a clearer view of three interesting phenomena. Figure 1.2 confirms that, at the beginning of the period at least, there was a large disparity between a comparatively “very rich” leading group, composed of the municipalities of Beijing, Tianjin and Shanghai, and a poorer group consisting of all the provinces. This disparity outweighs any inequalities within the second group, which thus appears to be relatively homogeneous⁷. Although the gap persisted throughout the period, with the three municipalities still leading in 1996⁸ and income distribution among the provinces relatively constant, the evolution of the different curves reveals a trend towards a reduction of inequalities as the provinces catch up to the municipalities (Figure 1.2). Figure 1.3 suggests that when we exclude municipalities, which seem highly atypical, inter-provincial income inequalities were stable up to the early 1990s but have tended to increase since then⁹.

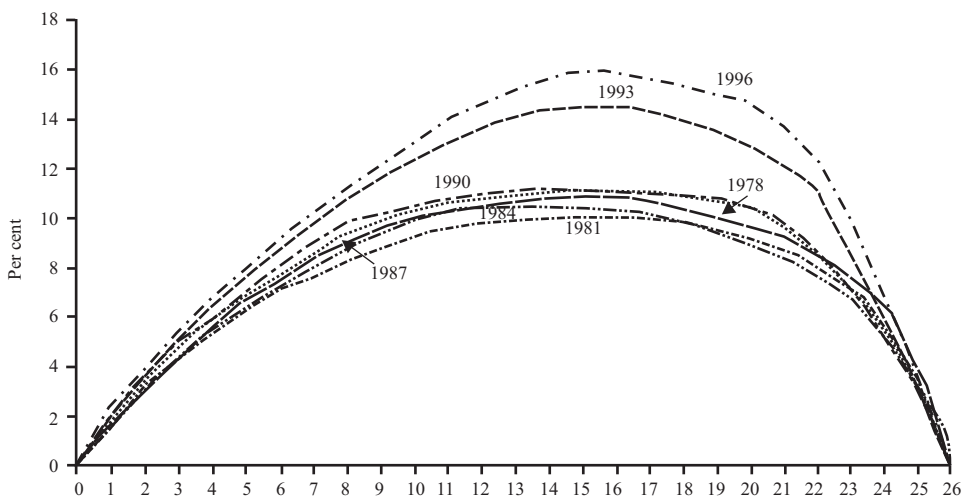
**Figure 1.2. Difference between the Lorenz Curves and the First Bisector for Per Capita GDP
29 provinces, municipalities and autonomous regions, 1978–96**



Note: Representation of the Lorenz curves as the difference from the first bisector provides a clearer view of their evolution without changing the way in which the figure is to be read (the “highest” curve represents the most unequal distribution).

Sources: See Table 1.1.

**Figure 1.3. Difference between the Lorenz Curves and the First Bisector for
Per Capita GDP, 26 provinces and autonomous regions, 1978-96**



Notes and Sources: See Figure 1.2.

Convergence or Divergence: Preliminary Remarks

These trends reveal that per capita incomes are subject to both convergence (the other provinces are catching up to the municipalities, as seen in Figure 1.2) and divergence (increased inequality within the restricted group of 26 provinces and autonomous regions, as seen in Figure 1.3). To identify any regional trends, the analysis below distinguishes between three regions: coast, centre and west (see Annex 1).

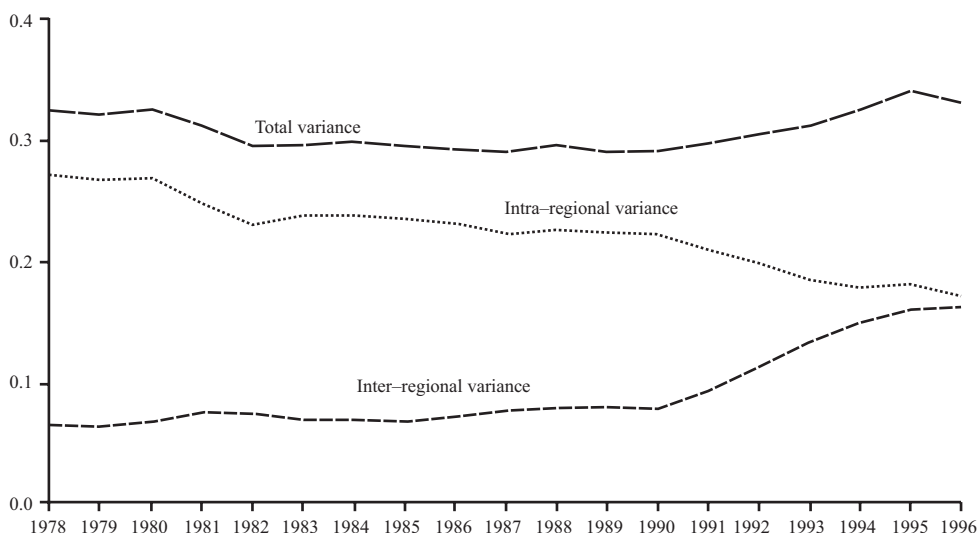
A clearer view of the trends characterising these three regions is obtained when the variance of the logarithm of per capita GDP is broken down into inter-regional and intra-regional variance, as follows:

$$V = \text{Var}(y_i) = \underbrace{\sum_{j=1}^3 n_j \cdot \text{Var}(y_j)}_{\text{Intra}} + \underbrace{\sum_{j=1}^3 n_j \cdot (\bar{y}_j - \bar{y})^2}_{\text{Inter}}$$

where y_i is the log of per capita GDP of province i , n_j the number of provinces in region j as a proportion of the total number of provinces, $\bar{y}_j$ the average of the y_i values for region j , $\bar{y}$ the average of the y_i values for all provinces and $\text{Var}(y_j)$ the variance of the y_i values for region j .

Figure 1.4 indicates a slight downward trend in the cross-section dispersion of per capita GDP for China as a whole — i.e. a “ σ -convergence” trend¹⁰ — until 1990, followed by an increase in dispersion in subsequent years.

Figure 1.4. Breakdown of the Variance of the Logarithm of Per Capita GDP by Region, 1978–96

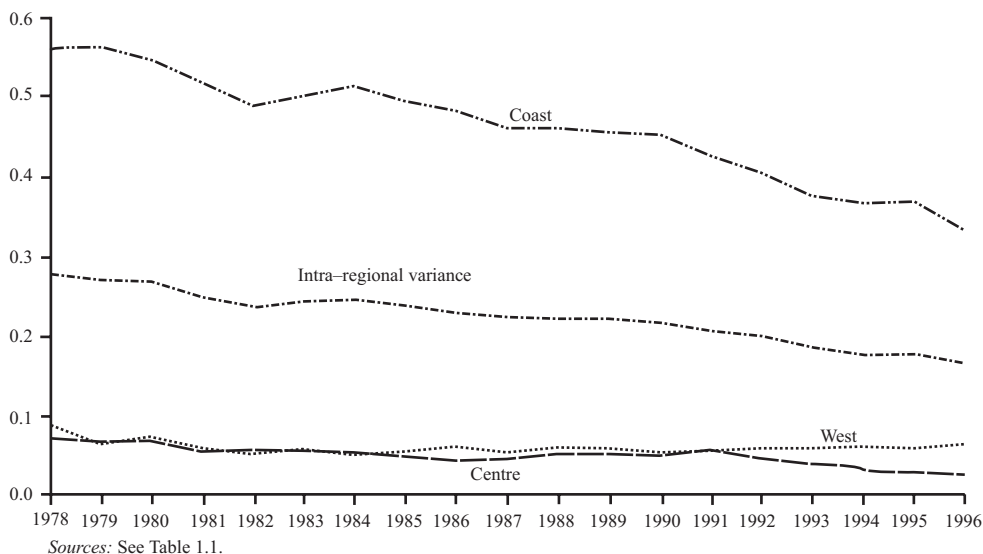


Sources: See Table 1.1.

The small variation in total income dispersion masks somewhat contrasting intra- and inter-regional trends. As shown in Figures 1.4 and 1.5, the slight reduction in the dispersion of per capita income for China as a whole through 1990 was due to a reduction of dispersion within the regions, especially among the provinces of the coastal region¹¹. The slight overall convergence observed thus seems to have been driven by convergence in the coastal region: the southern coastal provinces, starting from a below-average level of per capita income in 1978, grew very rapidly thereafter, whereas the municipalities, starting from a high level of per capita income, recorded comparatively low rates of growth.

The reversal of this trend from 1990 was due to a sudden increase in inter-regional dispersion. Two phenomena may explain this reversal: first, in the early 1990s the southern coastal provinces no longer had below-average levels of per capita GDP, but nevertheless continued their rapid growth, which undoubtedly increased divergence with respect to the inland provinces; second, from the early 1990s the opening of economic development zones, such as Pudong in Shanghai, encouraged faster growth in the provinces which were initially the wealthiest.

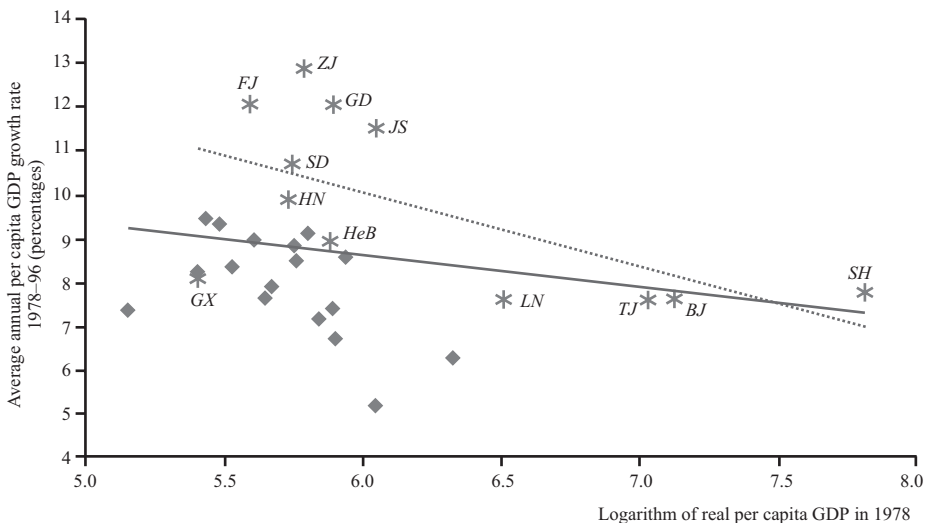
Figure 1.5. **Intra-regional Variance, 1978–96**



The opposing movements we have described — a catching-up process at the top of the income scale, particularly within the coastal region, and increased inequality between the regions from the late 1980s — sum up fairly well the complexity of China's regional development since the reforms were initiated. The overall effect, which will allow us to determine which of these trends is the dominant one, may be examined in Figure 1.6, which presents the relationship between the provinces' per capita GDP growth rates and their initial levels of per capita GDP. Following the

terminology of Barro and Sala-i-Martin (1995), there will be “absolute convergence” if the provinces which were initially the poorest tend to grow faster than those which were initially the wealthiest. However, analysis of these “absolute convergence” relationships (Figure 1.6) reveals only a very slight (and not significant) inverse relationship between the average real per capita GDP growth rate from 1978 to 1996 and the logarithm of per capita GDP in 1978. This result substantially qualifies the conclusions of Jian *et al.* (1996) and of Guillaumont and Boyreau Debray (1996), amongst others, concerning the existence of absolute convergence between the provinces since the reforms were implemented. Jian *et al.* (1996) find that there is absolute convergence of the real per capita GDP of 28 provinces over the 1978-93 period, at an annual rate of approximately 1.7 per cent; Guillaumont and Boyreau Debray (1996) confirm this relationship for the 1983-94 period, finding a slightly lower rate of convergence of 1.2 per cent a year. Apart from differences in the choice of variables used to evaluate these convergence relationships¹², the difference in our findings may be due in part to the length of the period considered. For the entire 1978-96 period, regional growth paths seem to have been inequalitarian only during the 1990s, as shown in Figures 1.2-1.4, whereas the period studied by Jian *et al.* (1996) stops at 1993, which may explain why their study detected only the convergence stage. Moreover, Guillaumont and Boyreau Debray (1996) did find a slowdown in convergence from the early 1990s, because the rate of convergence they calculate for the 1983-91 sub-period (2.7 per cent a year) is well above that for the period as a whole.

Figure 1.6. Absolute Convergence among China's Provinces, 1978–96



BJ: Beijing, FJ: Fujian, GD: Guangdong, GX: Guangxi, HeB: Hebei, HN: Hainan, JS: Jiangsu, LN: Liaoning, SD: Shandong, SH: Shanghai, TJ: Tianjin, ZJ: Zhejiang.

Equation for the solid line: $g_{PIB} = -0.007 (\text{Log}_{PIB78}) + 0.131$ (29 observations, adjusted $R^2 = 0.24$).

Equation for the dotted line: $g_{PIB} = -0.017 (\text{Log}_{PIB78}) + 0.202$ (12 observations, adjusted $R^2 = 0.62$).

The coefficient of Log_{PIB78} in the first equation is the only one which is not significant at the 5 per cent level.

Source: See Table 1.1.

Figure 1.6 does show, however, that a much clearer relationship of absolute convergence exists within the coastal region alone¹³, where one can see once again the performance differentials between the three municipalities, which were more “developed” initially, and the southern provinces. The significant absolute convergence relationship among the provinces of this region implies an annual rate of convergence of 2 per cent¹⁴, which means that it would take 35 years to reduce by half the gap between the poorest and richest coastal provinces¹⁵.

The Open Door Policy: Breakdown by Province

In addition to the inter-provincial disparities in growth, an analysis of the open door policy introduced from the late 1970s reveals other consequential differences between provinces. This policy was initially limited to two southern provinces (Guangdong and Fujian), then gradually extended to larger geographical units: first along the coast, then in the inland provinces¹⁶. The distributional consequence of this selective opening-up process was a heavy concentration of foreign investment flows and international trade activity in the coastal provinces, particularly Guangdong. The dominance of Guangdong is a natural consequence of the fact that this province is one of those having received the greatest benefit from the open door policy, notably through the establishment of the three Special Economic Zones of Shenzhen, Zhuhai and Shantou as early as the beginning of the 1980s.

Foreign Direct Investment

The gradual geographical extension of the reforms brought about a highly unequal regional distribution of foreign capital flows throughout the period. In 1983, nearly 93 per cent of foreign direct investment went to the coastal provinces, including 69 per cent for Guangdong alone. This imbalance decreased slightly over time, but 88 per cent of foreign direct investment (FDI) flows still went to the coastal region in 1996; however, the share of Guangdong had dropped sharply (to 28 per cent) in favour of other coastal provinces such as Fujian, Jiangsu and Shanghai, which attracted approximately 30 per cent of total FDI. If we reason in terms of disparities, as above, these developments indicate a trend towards equalisation within the coastal zone. In the inland provinces there are inverse trends, however, between an increase in the central region's share of FDI over time and a decrease in the western region's share.

The cumulative FDI flows for the 1983-96 period reported in Table 1.2 confirm the status of Guangdong as the main recipient province for foreign capital and highlight the contrast between the coastal and inland provinces, as the former attracted 88 per cent of cumulative FDI between 1983 and 1996.

Table 1.2. **Distribution of Foreign Direct Investment Flows (1983-96)**

Provinces	Geographical distribution of foreign direct investment (percentage of total)		Cumulative 1983-96
	1983	1996	
Coast	92.9	88	88.3
Guangdong	69.4	28.1	30.4
Beijing	13.1	3.7	4
Fujian	2.8	9.8	10.3
Shanghai	1.9	9.4	8.4
Jiangsu	1.5	12.4	11.2
Liaoning	1.2	4.1	4.3
Guangxi	1.1	1.6	2.1
Tianjin	0.8	5.1	3.5
Shandong	0.5	6.3	6.8
Zhejiang	0.4	3.6	3.2
Hainan	0.0	1.9	2.6
Centre	1.1	9.5	8.3
Inner Mongolia	0.6	0.2	0.2
Hunan	0.4	1.8	1.3
Heilongjiang	0.2	1.4	1.1
Hubei	0.0	1.6	1.7
Henan	0.0	1.3	1.1
West	6	2.5	3.4
Sichuan	3.3	1.1	1.7
Gansu	2.2	0.2	0.2
Shaanxi	0.4	0.8	0.9

Notes: This table shows only those provinces having a sufficiently high share of total FDI or which showed a noteworthy trend during the period under study.
FDI flows are expressed in current US dollars.

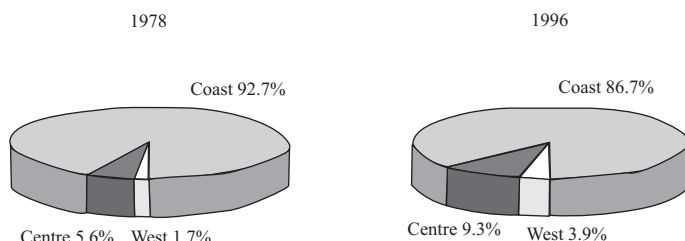
Sources: Hsueh *et al.* (1993); SSB, *China Statistical Yearbook* (various editions); Editorial Board of Almanac of China's Foreign Economic Relations and Trade (various years) and author's calculations.

International Trade

Examination of international trade reveals the same inequalities between coastal provinces and inland provinces. At the national level, exports grew at an average annual rate of 17 per cent over the 1978-96 period¹⁷, but once again it was Guangdong which derived the greatest benefit from this growth. In 1978, Guangdong was the third-ranking province in terms of exports, after Shanghai and Liaoning, but in 1996

it was far ahead of the other provinces and accounted for 34 per cent of China's exports. As in the case of FDI, the coastal provinces were much more export-oriented than the inland provinces, and although the coastal region's share of total exports fell over the period (87 per cent in 1996 versus 93 per cent in 1978), it remains very high. The share of exports in GDP is also four to five times higher in the coastal region (30 per cent in 1996) than in the two other regions (around 6 per cent each).

Figure 1.7. **Geographical Distribution of Exports, 1978–96**



Sources: See Table 1.2.

The geographical distribution of imports has changed very little since 1978, and the figures for 1996 are very similar to those for exports: 87 per cent, 8 per cent and 5 per cent respectively for the coast, the centre and the west. As was the case for exports, the structure of imports within the coastal region changed in favour of Guangdong province (whose share in total imports rose from 26 per cent in 1978 to 40 per cent in 1996) to the detriment of the municipality of Shanghai in particular.

The high level of foreign trade activity in the coastal provinces is generally linked to that of FDI, since foreign enterprises are supposed to be inherently more export-oriented than domestic firms. Indeed, the contribution of foreign firms to China's total foreign trade has grown since the mid-1980s. Exports by firms with foreign ownership amounted to 41 per cent of total exports in 1996, as against 1 per cent in 1985. Enterprises established in the coastal region accounted for nearly all of these (98 per cent on average in 1994)¹⁸. Moreover, the share of foreign firms in total imports rose from 5 per cent in 1985 to 54 per cent in 1996, since such firms on the whole imported more than they exported. As in the case of exports, the import share of foreign firms is highest in the southern coastal provinces.

Internal Reforms and Changes in Sectoral Structure at the Provincial Level

While the liberalisation policy led to heavy concentration of FDI and trade in the coastal provinces, the internal reforms linked to this liberalisation also had an impact on the sectoral structure at the provincial level. These reforms, which affected

both agricultural and industrial activity, had two main objectives: first, to restore a measure of autonomy to productive entities and to give them greater incentives by introducing a system of contracts between productive entities (family or firm) and the administrative hierarchy; and second, to introduce market mechanisms in domestic economic relationships. Among other things, the reforms helped to reorient economic activity towards the tertiary sector and industrial production towards the non-state sector. Examination of the province-level data reveals once again that the change in direction observed at the national level was essentially due to the coastal provinces.

Economic Sectors

Observation of China's productive structures uncovers several trends which are worth emphasising here. Overall, the secondary sector remained dominant throughout the period, accounting for 46 per cent of GDP on average between 1978 and 1997. During the same period, however, there was a reorientation of economic activity (both primary and secondary) towards the tertiary sector, raising the latter's share in GDP from 24 per cent in 1978 to 32 per cent in 1997. A breakdown by province not only corroborates these results but also allows more detailed analysis. Table 1.3 presents a summary of sectoral changes in large groups of provinces; these groups do not correspond exactly to the three regions used up to now, but they allow us to identify categories of provinces which are homogeneous both geographically *and* sectorally.

The first two categories consist of provinces which were industrialised at the beginning of the period and whose sectoral structures are dominated by heavy industry. This is particularly marked in the case of the north/northeast group of provinces. In the municipalities, where industry accounted for a very large share of economic activity in 1978 (72.7 per cent of GDP on average), there was a sharp reorientation from the secondary to the tertiary sector. A similar but smaller-scale transfer occurred in the north/northeast provinces, although the dominance of heavy industry has persisted. These two categories of industrialised provinces also include provinces which have posted some of the worst GDP growth performances over the period as a whole.

The third category, with very different characteristics, is composed of the southeast provinces, which are the most dynamic in China. The sectoral structure of these provinces, long dominated by light industry, underwent a shift from the primary to the tertiary sector, and the secondary sector also showed a tendency to increase its share at the expense of the primary sector.

Table 1.3. **Sectoral and Industrial Structure (1978-96)**

Provinces	Dominant Sector		Transfer 1978-96			Light Industry (1980-93)	State Production	
	1978	1996					1978	1996
Municipalities								
Beijing	S (71.1)	T (52.6)	S	→	T	46.5	82.9	47.9
Tianjin	S (69.6)	S (53)	S	→	T	47.7	80.7	24.6
Shanghai	S (77.4)	S (54.5)	S	→	T	48.8	91.7	33.1
North/northeast								
Gansu	S (60.3)	S (44.1)	S	→	T	23.7	90.7	58.1
Ningxia	S (50.8)	S (41.2)	S	→	T	27.0	82.8	62.4
Liaoning	S (71.1)	S (48.7)	S	→	T	30.2	80.4	34.8
Heilongjiang	S (61.0)	S (53.3)	P and S	→	T	30.6	83.1	58.4
Qinghai	S (49.6)	S and T (39.0 and 39.5)	S	→	T	32.5	83.5	76.7
Jilin	S (54.2)	S (40.6)	S	→	T	37.1	78.9	56.6
Inner Mongolia	S (45.4)	S (39.3)	S	→	T	38.1	79.1	48.2
Xinjiang	S (47.0)	S and T (36.9 and 35.7)	P and S	→	T	42.7	89.1	76.2
Southeast								
Fujian	S (42.5)	S (41.8)	P	→	T	57.8	74.2	14.0
Zhejiang	S (43.3)	S (53.1)	P	→	S and T	59.4	61.3	10.7
Guangdong	S (46.4)	S (50.2)	P	→	S and T	62.1	67.8	14.7
Hainan	P (51.4)	T (42.3)	P	→	T	62.2	82.6	33.0
West/southwest	P (41.7)	S (39.6)	P	→	T	43.7	79.2	44.8
Centre/east	S (48.4)	S (47.1)	P	→	T	44.2	76.2	31.1

Notes: West/southwest designates the provinces of Hunan, Jiangxi, Sichuan, Guizhou and Yunnan and the autonomous region of Guangxi. Centre/east designates the provinces of Hebei, Jiangsu, Shandong, Shanxi, Henan, Anhui, Hubei and Shaanxi. The table presents only the average for each of these groups, which are relatively homogeneous and present no distinguishing features.

P = primary sector, S = secondary sector and T = tertiary sector (the share of the designated sector in the provincial GDP appears in parentheses). Light industry and state output are expressed as percentages of total industrial output.

Sources: Hsueh et al. (1993); SSB, *China Statistical Yearbook* (various editions) and author's calculations.

Ownership of the Means of Production

China's industrial sector can be divided into two broad categories: the state-owned sector, in which firms are under the direct control of the central and local governments, and the so-called non-state sector. In rural areas, the surplus labour supply and the rise in agricultural income resulting from the agricultural reforms encouraged the formation of small local industries, which are often collective¹⁹ and which form the backbone of the non-state sector²⁰. Other forms of organisation also emerged in urban areas, such as enterprises with foreign capital²¹. The non-state industrial sector's share of manufacturing output rose from 22.4 per cent in 1978 to 73.5 per cent in 1997, but this rapid growth was unequally distributed geographically and some provinces are still dominated by an inefficient state-owned industrial sector, which contributes to the increase in inter-provincial inequality.

The state sector/non-state sector breakdown is much the same as that for heavy and light industry. In a category of northern provinces (Gansu, Heilongjiang, Ningxia, Qinghai and Xinjiang in particular) the state-owned industrial sector is dominant, accounting on average for 81 per cent of industrial output and 92 per cent of fixed-capital investment over the 1978-96 period. By contrast, the "southern" coastal provinces (Guangdong, Fujian, Zhejiang, and also Jiangsu and Shandong) enjoyed substantial development of the non-state sector, which was responsible on average for 44 per cent of industrial output and 57 per cent of fixed-capital investment over the period.

In sum, the sectoral breakdown makes it possible to distinguish two diametrically opposed groups of provinces. The first is characterised by a combination of rapid GDP growth and a preponderance of light industry, little of which is state-owned (Guangdong, Fujian and Zhejiang in particular), and the second by a combination of sluggish GDP growth and a preponderance of heavy state-owned industry (Gansu, Heilongjiang, Ningxia, Qinghai).

Our comparison of the growth paths of China's provinces has thus uncovered two phenomena which will be dealt with in the quantitative analysis in Chapter 2. The first is the existence of pronounced regional disparities: on the one hand, provinces which are dynamic, open and market-oriented; and on the other, provinces which are less dynamic, draw few benefits from China's openness to the outside world and are dominated by heavy industry, largely owned by the state. The second phenomenon is a tendency for the income disparities between dynamic provinces to decrease. In the next chapter, an attempt will be made to explain the differences between regional growth paths in terms of unequal access to the benefits of openness and to provide some means of understanding the development of these differences.

Notes

1. For a description of the database used in this study, see Annex 3.
2. The ideological reasons included both egalitarian ideas and the fact that the authorities considered the inland provinces as more stable politically and more “trustworthy” than the coastal provinces, which had been subject to western influence for many years before the Communists came to power. From the strategic viewpoint, the risk of military conflict, first with the United States and subsequently with the former Soviet Union, was also an incentive to diversify economic activity outside the coastal region, which was particularly vulnerable to attack, in order to make the individual provinces self-sufficient in terms of plant and consumer goods (Hsueh and Woo, 1995, pp. 55-60). The development of a “Third Front” — covering the provinces of Sichuan, Guizhou, Shaanxi, Gansu, Qinghai, Ningxia, Henan, Hubei, Hunan and Shanxi (Hsueh, 1994, p. 41) — between 1964 and the early 1970s was part of this strategy (see Yeung, 1993; Hsueh, 1994; Hsueh and Woo, 1995; and Li and Fan, 1996).
3. In fact, Jian *et al.* (1996), Liu *et al.* (1996) and Zhao (1996) find that inter-provincial and inter-regional disparities increased from 1952 to 1978, particularly during the Cultural Revolution.
4. Until 1988, Hainan island was a district of Guangdong province. It has since become a province in its own right.
5. In 1952, Guizhou was already the poorest province and (when all provincial-level entities are counted) Shanghai the richest, per capita income in the latter being 11 times higher than in Guizhou (Jian *et al.*, 1996).
6. For example, in 1978 the per capita GDP of Guangdong was slightly below that of Qinghai, whereas in 1996 it was two-and-a-half times greater than in Qinghai.
7. This aspect is illustrated in Figure 1.2 by the broken-line curve showing both similarity within each segment and different levels of wealth between segments.
8. They still accounted for 31 per cent of “total income” in 1996, as against 36 per cent in 1978.
9. These results are analogous to those of Tsui (1996), who also examines changes in inter-provincial income inequality from 1978 to 1989 using indicators which are generally employed for analysing inequality between individuals. Using inequality

indicators calculated from real per capita GDP data, he finds a decrease in inequality during the first half of the 1980s, followed by an increase at the end of the period. See also Hu (1995) and Jian *et al.* (1996).

10. According to the definition of Barro and Sala-i-Martin (1995), there is “ σ -convergence” between individuals (or states, regions, provinces, etc.) when cross-section dispersion — for example, measured by the variance of the logarithm of income — decreases over time.
11. At the beginning of the period studied, national income dispersion was mainly due to the high level of dispersion within the coastal region; income levels in this region had become much more homogeneous by the end of the period.
12. The deflator used by Jian *et al.* (1996) is the retail price index for each province. For a comparison of this index with the implicit GDP deflator, see Annex 3.
13. In Figure 1.6, the coastal provinces are represented by star-shaped symbols. The slope of the dotted line measures the rate of absolute convergence within the coastal region.
14. For a definition of this concept, see Barro and Sala-i-Martin (1992).
15. This relatively low rate of convergence is nevertheless compatible with the usual results obtained on cross-section data for groups of countries or regions (see especially Mankiw, Romer and Weil, 1992; Barro and Sala-i-Martin, 1992, 1995).
16. For a description of this reform process, see especially Démurger (1997).
17. Exports are expressed here in constant yuan.
18. The share of exports by foreign-owned enterprises in total exports is highest in Guangdong and Fujian, at 37 per cent and 47 per cent respectively in 1994 (Shi, 1996).
19. The bulk of these, in terms of both number of enterprises and share of industrial output, are managed at the administrative level of the township or market town (*xiangzhen qiye*).
20. As Naughton (1996) points out, the changes in rural policy were an essential preliminary to creating the conditions for growth in the non-state sector.
21. Firms with foreign ownership, often called *sanzi qiye*, are of three types: joint ventures (*hezi jingying qiye*), firms that have entered into co-operation agreements (*hezuo jingying qiye*) and wholly foreign-owned firms (*waizi jingying qiye*). Joint ventures are limited liability companies in which the Chinese and foreign partners invest and operate on a joint basis, sharing profits, losses and risks. Firms with co-operation agreements may involve a foreign partner which provides technology and capital in exchange for a fixed return, which is negotiated in advance. In general, the Chinese partner provides land, building materials, the workforce and the main buildings.

Chapter 2

The Growth-FDI Dynamic in China's Provinces

This chapter examines regional growth paths in China since the openness and reform policy was introduced. It is concerned with the findings of the preceding chapter, which revealed fairly marked regional disparities, especially between the coastal and inland provinces, and a declining trend in income dispersion within large regional groupings. The openness and reform policy is fundamental to an understanding of these disparities, since it was not applied to all the provinces at the same pace and to the same extent. Thus the aim of this chapter is to assess the effect of this policy on the growth paths of the individual provinces and to provide some explanations for their evolution, particularly by evaluating the interdependence of growth paths at the provincial level and, within the provinces, at the city level.

Quantitative Analysis of the Cumulative Growth-FDI Process

Our econometric assessment of the effect of the open door policy on China's provinces begins with an examination of the dynamic relationship between foreign investment and growth, through estimation of the model presented in Annex 2. We will subsequently study the interdependence of growth paths at the provincial level and, within the provinces, at the city level.

Specification of the Model

The impact of foreign direct investment (FDI) on the economic growth of developing countries is generally apparent in the technology transfer arising from such investment. Annex 2 of this study therefore presents a model designed to account for the mechanisms of technology transfer by using endogenous growth models such as that of Romer (1990)¹. The resulting growth equation expresses the economic growth rate as a function of the relative level of FDI.

To estimate this equation, one must formulate an approximation of it which can be evaluated using the available data and econometric techniques. To this end, we use a log-linear approximation based on the usual characteristics of the production function². Since the aim is not only to measure the impact of foreign investment on growth, but also to compare this impact with that of openness to foreign trade, we add a measure of openness to the variables representing the traditional factors of production. Following Feder (1983) and similar works that estimate the role of openness in growth³, we examine the impact of exports on factor productivity; this seems appropriate in the case of China, since trade liberalisation was the other facet of the open door policy followed by the Chinese government since the late 1970s. If exports are considered as an additional “factor of production”, the crucial variable in a growth equation will be the export growth rate⁴.

To approximate the theoretical equation (A30) derived in Annex 2, we must also introduce a means of measuring the variable H , which represents the level of human capital. Defining a human capital variable can be difficult because indicators of the stock or quality of human capital are not easily obtained and because the estimations are often marred by measurement errors, due among other things to the way in which duplication and migration are handled⁵. The human capital indicators generally used in the empirical literature are the school enrolment rate and the average number of years of schooling of the population⁶. In the case of China, the use of primary and secondary school enrolment rates for the individual provinces, calculated as the ratio of the number of students per educational level to total population, yields unsatisfactory results⁷. Moreover, this approach is not appropriate from a methodological standpoint, since the theoretical equation (A30) suggests that the effect is due to the level rather than to flows of human capital. A variable for human capital stock can be constructed, however, on the basis of the population censuses of 1982 and 1990, which provide information on the population by educational level and by province. Using the annual number of graduates at various educational levels, and taking the mortality rate as a proxy for a “depreciation rate”, we construct an annual variable for human capital stock which measures the total number of people having completed primary or secondary school in each province. This variable is expressed as a level and, as suggested by equation (A30), is used in interaction with the foreign investment variable.

Taking these modifications into account, we estimate the following approximation of the theoretical growth equation:

$$(2.1) \quad g = \alpha_0 + \alpha_1 g_L + \alpha_2 s_{ICF} + \alpha_3 s_{IE} + \alpha_4 g_{Exp} + \alpha_5 h + \alpha_6 h^* s_{IE}$$

where g is the annual real GDP growth rate, g_L the rate of growth of the labour force, s_{ICF} the ratio of fixed-capital investment to GDP, s_{IE} the ratio of foreign investment to GDP, g_{Exp} the export growth rate and h the number of people having completed primary or secondary education as a proportion of total population.

The theoretical model presented in Annex 2 yields a second result that is worth testing in this chapter: equation (A32) establishes an inverse relationship between foreign investment and economic growth. If the inflow of foreign capital can be a determining factor of China's growth dynamic, it may be assumed that this growth dynamic could in turn have become a deciding factor in attracting foreign investors to China. Mere observation of incoming foreign capital flows reveals that foreign investment trends since the introduction of the openness and reform policy have closely followed the country's overall economic and political evolution. Wang and Swain (1995) and Zhang (1995)⁸ have also shown with aggregate data that the actual and potential size of the Chinese domestic market was a major determining factor for foreign investment flows into China during the 1980s. More recently, Yang (1998) showed that the distribution of FDI at the provincial level is positively influenced by the market size of the individual provinces and their level of industrialisation.

As provincial-level data are available, we focus on the determinants of the geographic structure of foreign investments in China. The geographic selectiveness of the openness and reform policy is obviously the fundamental factor in the distribution of foreign investment. Although successive packages of measures extended the range of the reforms both sectorally and geographically, major disparities persisted. For example, preferential policies in favour of foreign investors, especially tax policies, were not applied uniformly, which necessarily introduced a bias in investors' choice of location. To represent these differences in the reform process, at least in part, we introduce the following independent variables for foreign investment: an indicator of the degree of openness to trade (the ratio of the sum of exports and imports to GDP), an indicator of the extent of internal reforms (share of the collective sector in industrial output) and a lagged foreign investment variable. We thus assume that, other things being equal, foreign investment will turn towards the provinces which have relatively well developed foreign trade, which have a large, dynamic collective sector and which, being liable to offer a better investment environment, are already relatively well endowed with foreign capital.

Another major asset in attracting investors is obviously the actual and potential size of the host province's market, just as it is for China as a whole. Foreign investment flows are heavily concentrated in the coastal provinces, which on average have the highest per capita GDP levels and economic growth rates in China. Lastly, the quality of physical infrastructure can be a factor in investment decisions, especially in the non-coastal provinces. High-quality infrastructure can reduce the costs and time involved in transporting goods, thus facilitating both domestic and foreign trade. Foreign investors will therefore probably prefer the provinces in which transport-related infrastructure is well developed, other things being equal.

To assess the impact of these variables, we specify a foreign investment equation in the following log-linear form:

$$(2.2) \quad s_{IE} = \beta_0 + \beta_1 PIBH + \beta_2 g + \beta_3 Fer + \beta_4 Ouv + \beta_5 Coll + \beta_6 s_{IE-1}$$

where *PIBH* is real per capita GDP, *Fer* the ratio of the number of kilometres of railway to the surface area of the province, *Ouv* the ratio of total foreign trade (exports plus imports) to GDP and *Coll* the share of collective enterprises in industrial output.

Estimation Method

The database used for our statistical analysis covers 24 Chinese provinces, municipalities and autonomous regions over the 1985-96 period⁹, allowing us to use panel econometric tools to analyse the growth question. Given the small size of the sample, it is preferable to use this database in the form of an “annual” panel (with annual data), so that the statistical analysis will take account of as much of the available information as possible¹⁰. However, the problems that may accompany use of an annual panel should be pointed out. First, annual data contain short-term fluctuations which do not necessarily reflect long-term trends. Second, using an annual panel amounts to assuming that opening up to the outside world will have a nearly immediate impact on productivity. This assumption nonetheless seems acceptable in the Chinese context since the changes undergone by this economy did in fact occur very quickly.

As both cross-section and time series data are available, all estimations in this chapter are based on the following specification:

$$(2.3) \quad Y_{it} = \mu_i + \beta X_{it} + \varepsilon_{it}$$

where the pair (i, t) represents the cross-section and temporal dimensions of the panel of provinces, Y and X are respectively the dependent variable and the matrix of independent variables, and μ_i is a province-specific parameter. The use of a fixed-effect model is justified by, among other things, the fact that all the provinces were not affected by the same economic reforms at the same time. Such a model can also help to account for differences in investors’ choice of location; for example, the migratory history of the coastal provinces has forged close links between these provinces and the overseas Chinese, who constitute the largest source of foreign investment. The choice of specification is confirmed, moreover, by the F -statistic of the equality test using fixed effects over some preliminary regressions, and the Hausman specification test indicates that estimation of the constant term using fixed effects is statistically preferable to an estimation using random individual effects. The use of the parameter μ_i is equivalent to calculating, for each observation on each variable, the deviation from the provincial average; for the rest of this chapter we therefore use the variables as transformed by the “intra” operator.

The issue of whether the independent variables are exogenous, a statistically fundamental assumption in a quantitative analysis, has been addressed only recently in the empirical literature, and in general only in the form of a Hausman test justifying the use of (or the decision not to use) instrumental variables in a model having a single equation, or else in the form of a causality test to demonstrate whether there is an inter-relationship between the variables concerned.

In the case of China, few analyses admit the possibility of an inter-relationship between FDI and growth. Some emphasise the importance of FDI flows to China's growth (Wei, 1994; Husain and Wang, 1996; Mody and Wang, 1997), while others point to market size as a major determining factor of foreign investment flows to China (Wang and Swain, 1995; Zhang, 1995; Yang, 1998), but none formally demonstrates the existence of any inter-relationship¹¹. Our aim here is to extend this approach a step further by examining the relationship between growth and FDI via a system of simultaneous equations which, in view of the analyses above, may be written as follows:

$$\begin{aligned}
 (2.4) \quad g_{it} &= \mu_i + \alpha_1 g_{Lit} + \alpha_2 s_{ICF_{it}} + \alpha_3 s_{IE_{it}} + \alpha_4 g_{Exp_{it}} \\
 &\quad + \alpha_5 h_{it} + \alpha_6 h_{it} * s_{IE_{it}} + \alpha_7 Temps_t + \varepsilon_{it} \\
 (2.5) \quad s_{IE_{it}} &= \mu'_i + \beta_1 PIBH_{it-1} + \beta_2 g_{it-1} + \beta_3 Fer_{it-1} + \beta_4 Ouv_{it-1} \\
 &\quad + \beta_5 Coll_{it-1} + \beta_6 s_{IE_{it-1}} + \varepsilon'_{it}
 \end{aligned}$$

The overall specification of these equations was described above. In addition, the growth equation (2.4) includes a dummy variable (*Temps*) which takes the value 1 for 1989 and 1990, to represent the foreseeable impact on growth of the Tiananmen Square repression of June 1989. This variable is not included in the foreign investment equation (2.5), however, because it does not appear to be correlated with the foreign investment/GDP ratio¹². Lastly, to take into account the fact that foreign investors do not react immediately to the economic situation on the Chinese market, the independent variables of the investment equation are introduced with a one-year lag. We thus assume that when a foreign firm plans to invest in China at date t , it does so on the basis of what it observes at $t-1$. This specification has the further statistical effect of helping to reduce possible endogeneity problems in connection with the independent variables.

The Determinants and Role of FDI

Among the available methods for full-information estimations, the generalised method of moments (GMM) stands out for its usefulness in reducing problems connected with heteroskedasticity¹³. Although this method is generally used for non-linear models, recent contributions to the literature have shown that it can also be used effectively to estimate dynamic panel models or models with non-exogenous independent variables¹⁴.

The estimation of dynamic fixed-effect models raises the problem of convergence of the estimators, owing to the correlation between the lagged endogenous variable and the residuals (Sevestre and Trognon, 1996). To resolve this problem, we use the Balestra-Nerlove method, as developed by Sevestre and Trognon (1996), which regresses the lagged endogenous variables on all the other explanatory variables for each year and uses the latter variables in the final GMM estimation¹⁵.

Table 2.1. GDP Growth and Foreign Investment:
Simultaneous Estimations (1985-96)

Dependent Variable		Independent Variables						Number of Observations
g	g _L	s _{ICF}	s _{IE}	g _{Exp}	h	h*s _{IE}	Temps	288
	0.287 (1.563)	-0.004 (-0.205)	0.037 (2.561)	0.010 (0.401)	0.105 (0.913)	0.042 (2.432)	-0.051 (-7.210)	
s _{IE}	PIBH ₋₁	g ₋₁	Fer ₋₁	Ouv ₋₁	Coll ₋₁	s _{IE-1}		288
	1.598 (5.371)	1.722 (1.868)	1.941 (2.036)	0.612 (3.052)	0.392 (1.391)	0.098 (1.813)		

Overidentification test: $\chi^2(13) = 12.8366$

(The null hypothesis that all moments are null cannot be rejected.)

Notes: All variables are expressed as differences from the provincial average (intra operator). Values in parentheses are the t-statistics. The method used for simultaneous estimation of the two equations is the generalised method of moments (GMM). Instruments: for the first equation, s_{ICF(-1)}, s_{IE(-1)}, g_{Exp(-1)}, g_L, h₋₁, (h*s_{IE})₋₁, their squares and Temps; for the second, PIBH₋₁, g₋₁, Fer₋₁, Ouv₋₁, Coll₋₁, s_{IE(-1)} and their squares. Estimated standard deviations are corrected using White's test. They are also corrected for autocorrelation.

The GDP growth equation yields several interesting results. First, the contribution of domestic factors of production is not significant. For labour, the estimated elasticity of 0.287, although somewhat low and not significant at the conventional 5 per cent level, is nevertheless consistent with the usual results for labour's contribution to the economic growth of China, since the elasticities reported in the literature on national growth accounting are often around 0.3-0.4. In contrast, the negative and non-significant coefficient for fixed-capital investment does not confirm the results generally found at the national level for the contribution of domestic physical capital to growth. This is nevertheless a result that has already been obtained on panel data by Prime and Park (1995)¹⁶, who justify it by arguing that domestic capital is subject to measurement errors. It can also be explained by the inefficiency of domestic capital, which is at a low technological level and is mostly state-owned. As Lemoine (1994) points out, the technical structure of investment is dominated by spending which involves a limited level of technology — such as construction, civil engineering and additions to stocks — while investment aimed at modernising and upgrading machinery and infrastructure accounted for only 20 per cent of total investment over the 1985-91 period. In addition, the bulk of domestic investment was made by the state throughout the period, which means that it went to the least dynamic sector of the economy. Over the 1985-96 period, state-owned enterprises were responsible for an average of 62.4 per cent of total fixed-capital investment. The state's share of investment was remarkably stable through 1992 but then began to drop substantially, falling to 53 per cent in 1997.

The second noteworthy result is that export growth had no significant impact on economic growth between 1985 and 1996. The weak relationship between exports and growth, which does not allow us to confirm the export-led growth hypothesis advanced by other analysts¹⁷, suggests that in China exports do not play the role that they are generally supposed to in a country's growth process. This unusual result

seems justified on at least two counts. First, although China has indeed liberalised foreign trade, it has done this only slowly and partially¹⁸: at the end of the 1980s planned exports still accounted for 45 per cent of total exports, and many goods were subject to export licensing or still handled exclusively by the local Foreign Trade Companies. It may therefore be inappropriate to invoke free-trade theories. Second, one may reasonably assume that, given the country's size, China's opening up was motivated more by the need for access to foreign technology than by any need to expand the market in which domestic enterprises operate. This argument can be pushed a step further: producers are probably stimulated more by the development potential of the domestic market than by the prospect of capturing a greater share of the international market, since world demand is relatively rigid whereas domestic demand is growing rapidly. That is, even if Chinese producers exploit their comparative advantages to the full, particularly the abundant supply of cheap labour, the relative rigidity of global demand will prevent any rapid or easy increase in China's share of the international market. In contrast, one consequence of China's openness and reform policy was a rapid rise in the living standards of the population, which led in turn to a rise in domestic demand for consumer goods that shows no signs of flagging¹⁹.

A third interesting result is that Table 2.1 confirms the conclusions of previous econometric studies on the importance of the open door policy in attracting foreign capital and technology, and the role played by foreign investment as the engine of China's growth process. Wei (1994), using cross-section data for a sample of Chinese cities, established that from 1988 to 1990 foreign investment (expressed as a level) contributed more than exports to the differences in growth of nominal industrial output. In particular, he found that the foreign investment effect works through the spillover of technological or managerial know-how between enterprises located in the same city. Mody and Wang (1997), using sectoral data, have also shown that foreign investment flows per capita have had a considerable impact on growth of industrial output in the short term²⁰, but that this effect tends to decrease in the long term. They interpret this result as showing that in the short term, foreign investment is the most mobile factor of production and hence the principal engine of growth. Over the longer term, however, variables such as education and infrastructure can take over from foreign investment and thus reduce its contribution to growth. Finally, Husain and Wang (1996) have shown, for a complementary period (1990-94) and using cross-section provincial data, that FDI per capita is a driving force in capital accumulation and per capita GDP growth, and that the output share of foreign-owned enterprises is positively correlated with per capita GDP and productivity growth.

The finding that foreign investment was the predominant factor in China's growth can be justified by reference to recent theories of growth. In the Chinese context, FDI is the main source of more efficient production and management techniques from abroad, as well as a more extensive knowledge base. It allows direct contact to be established between Chinese and foreign entrepreneurs through joint ventures or co-operation agreements. This seems particularly important, since the presence of foreign enterprises in China has clearly contributed to the development of local

entrepreneurship, by signalling that conditions had changed and by giving the Chinese an incentive to start up businesses²¹. Moreover, foreign investment flows introduced competition into the Chinese economy and encouraged local enterprises to allocate available resources more efficiently, which in turn favours productivity growth. Lastly, foreign investment serves as a vehicle for advanced foreign technology and managerial know-how.

The estimation presented in Table 2.1 also sheds light on another aspect of the role of foreign investment in China's growth process since the mid-1980s, namely the role played by education. The model presented in Annex 2 makes it possible to test whether provinces with a greater human capital endowment have a better chance of assimilating the new technologies acquired through direct investment, the underlying assumption being that an educated workforce is more efficient and better qualified to understand and use the new technologies. This hypothesis of complementarity between FDI and human capital was tested by Borensztein *et al.* (1998) for 69 developing countries. These authors showed that the contribution of FDI from industrialised countries to the economic growth of developing countries is strengthened by the interaction between FDI and the level of human capital in the host country.

When human capital is introduced in the growth equation (2.1), the coefficient of the term representing the interaction between FDI and human capital is positive and significant. Consequently, the marginal effect of foreign investment on the growth of China's provinces rises in proportion to the share of educated people in the overall population. It therefore seems that provinces having a relatively high level of human capital did indeed derive more advantages from foreign investment than the other provinces.

Finally, it should be pointed out that the effects captured by analysis of our annual panel data are basically short-term effects, and hence that our results confirm those of Mody and Wang (1997) on the short-term dominance of foreign investment. FDI is an external factor of production which depends very little on domestic productive capacity or the previous sectoral structure, and which therefore has a greater impact than exports in the short term. The effects of export growth on industrial growth may be less direct, since they mostly arise from the fact that export promotion, by pushing domestic firms into a competitive environment, enables these enterprises to obtain knowledge of foreign technology and consequently makes them more efficient.

Apart from the fundamental role of foreign investment in China's growth, the estimation presented in Table 2.1 indicates which factors determine the geographical distribution of this investment. The foreign investment equation shows that the distribution of foreign capital flows is mainly influenced by the provinces' level of development, in terms of GDP and infrastructure, and by their degree of openness. Other things being equal, investors are more likely to invest in the provinces which are open to foreign trade and capital, have large economies and possess more developed infrastructure. This unsurprising result points up the inegalitarian side of the growth process, since foreign investment is directed to provinces where the investment and growth rates are already high. Moreover, the positive and significant (at the 10 per

cent level) impact of provincial growth rates on the distribution of FDI flows corroborates this inequalitarian dynamic and confirms the geographical differences that increased during the reform years between the open, market-oriented eastern provinces and the central and western provinces, which remained under the sway of inefficient state-owned industry.

The positive and significant impact of the provinces' degree of openness on the distribution of foreign investment flows also permits a reinterpretation of the role played by foreign trade in the growth process. This relationship between the degree of openness of provinces and the distribution of foreign investment establishes an indirect link between growth and openness to foreign trade, and thus qualifies our conclusions regarding the weakness of the link between growth and exports.

Regional Growth Paths: Convergence and Propagation

Regional Growth Disparities: Convergence or Divergence?

Our analysis of inter-provincial income disparities is based on the idea that although the economic reforms implemented since the late 1970s brought about general efficiency gains, their effects differed from one province to another. This is explained, as we have seen, by the sharp contrasts observed in China's current economic geography, particularly between the provinces dominated by market activities and those dominated by heavy state-owned industry.

Apart from the disparities between the coastal and inland regions, however, we have not uncovered any trend towards absolute divergence between provinces; to the contrary, it is conceivable that the introduction of control variables to take account of the heterogeneity of the provinces might reveal some form of catching-up process. For this reason, we added to equation (2.4) another variable $PIBH_{-1}$, which measures real per capita GDP for the preceding year. The purpose of this is to show, as suggested by the abundant literature on "conditional convergence"²², that the further a province is from its own steady-state value (as measured by the accumulation of factors of production), the faster it grows, although it should be noted that the adjustment measured here undoubtedly reflects short-term effects more than any genuine convergence as usually defined²³.

Estimation of this equation (Table 2.2) permits a "conditional convergence" effect to be identified in our sample at a rate of around 9 per cent, which is consistent with the rates usually obtained on panel data but relatively fast compared to the results presented in several recent works on convergence among China's provinces²⁴. Chen and Fleisher (1996), using an augmented Solow model estimated on both cross-section data and panel data for China's provinces, found that per capita GDP converged at a rate of 1.6 per cent to 5.6 per cent (depending on the estimation method used) over the 1978-93 period, and they concluded that convergence exists within the coastal and inland regions but not between these regions. Guillaumont and Boyreau Debray (1996),

using cross-section data for 29 Chinese provinces over a slightly shorter period, found a conditional convergence relationship in national per capita income at a rate of approximately 1.6 per cent. They also showed that the convergence relationship is progressive, i.e. that it appears only above a certain level of per capita income²⁵; below this threshold, there is a divergent trend. In the same vein, Raiser (1998), who also finds conditional convergence of per capita GDP between 1978 and 1992, shows that the rate of convergence fell after 1985.

Table 2.2. Convergence of China's Provinces:
Simultaneous Estimations (1985-96)

Dependent Variable		Independent Variables							Number of Observations
g	g _L	s _{ICF}	s _{IE}	g _{Exp}	h	h*s _{IE}	Temps	PIBH ₋₁	288
	0.343 (1.845)	-0.0004 (-0.016)	0.067 (3.339)	0.005 (0.171)	0.443 (2.668)	0.080 (2.928)	-0.041 (-4.828)	-0.090 (-3.126)	
s _{IE}	PIBH ₋₁	g ₋₁	Fer ₋₁	Ouv ₋₁	Coll ₋₁	s _{IE-1}			
	1.725 (5.785)	1.959 (2.134)	2.173 (2.287)	0.621 (3.177)	0.340 (1.229)	0.064 (1.315)			288
Overidentification test: $\chi^2(14) = 10.0854$ (The null hypothesis that all moments are null cannot be rejected.)									

Notes: All variables are expressed as differences from the provincial average (intra operator). Values in parentheses are the t-statistics. The method used for simultaneous estimation of the two equations is the generalised method of moments (GMM). Instruments: for the first equation, s_{ICF(-1)}, s_{IE(-1)}, g_{Exp(-1)}, g_L, h₍₋₁₎, (h*s_{IE})₍₋₁₎, PIBH₍₋₁₎, their squares and Temps; for the second, PIBH₍₋₁₎, g₍₋₁₎, Fer₍₋₁₎, Ouv₍₋₁₎, Coll₍₋₁₎, s_{IE(-1)} and their squares. Estimated standard deviations are corrected using White's test. They are also corrected for autocorrelation.

The usual neo-classical explanation of catching up is that economies with a low capital/labour ratio tend to have higher rates of return and thus attract new capital. In China, especially the coastal region, this argument provides an important preliminary justification for the catch-up phenomenon since it was indeed the under-industrialised areas²⁶ which benefited the most from inflows of capital, particularly foreign capital. In contrast, the most industrialised provinces, i.e. those targeted by state investment plans in the pre-reform period, had much lower growth rates. This phenomenon has been accentuated by the quality of investment in physical capital, since the weight of this highly unproductive state investment undoubtedly handicapped the industrialised provinces during the decade of reform.

This simple explanation in terms of decreasing returns to capital can be supplemented by an argument in terms of the inter-provincial diffusion of the gains from growth. This diffusion was mentioned in the explanations of convergence by Jian *et al.* (1996) and by Guillaumont and Boyreau Debray (1996) but has never been formally tested. It actually provides at least a partial explanation for the apparent contradiction between the fact that during the period considered, development was deliberately directed towards the coastal provinces — and hence *a priori* inegalitarian — and the fact that even a weak convergence relationship was observed. Generally speaking, it also provides a complementary explanation of the growth process, with the originality of bringing to the fore a dynamic principle that may partly explain a phenomenon of self-sustained growth.

Analysis of an Inter-provincial Growth Propagation Effect

To refine our analysis of regional growth paths, we will now analyse China's growth in terms of diffusion. In several recent studies²⁷, "regional diffusion" variables have been introduced in growth models with the aim of detecting any growth-enhancing effects arising from contact with dynamic neighbouring provinces. Easterly and Levine (1997), in their analysis of African cases of failed growth, placed special emphasis on the fact that, on a global scale, success stories and failures are both highly concentrated geographically; they explain this degree of concentration through the existence of contagion effects. Likewise, we have noted a tendency for strong Chinese performances to be concentrated on the coast, and we have seen that the concept of diffusion is used in some explanations of the convergence observed during the reform period. We therefore propose to use the concept of diffusion to explain this geographical concentration by the very strong interaction between dynamic provinces and to show that there is a more general contagion effect directed towards the inland provinces. Just as the existence of geographical spillovers between Hong Kong (China) and Guangdong province is often used to explain the phenomenal growth of the latter over the last 20 years²⁸, it seems worthwhile to test whether, more generally, the individual dynamism of the various Chinese provinces had an effect of collective emulation. We believe that this type of analysis is also useful for formulating a regional development strategy, since it can help in determining whether the "discriminatory" development strategy adopted in the late 1970s to stimulate national economic growth did indeed have the desired effect of transmitting growth towards the inland provinces²⁹.

It is widely accepted that ideas and technologies can spread between neighbouring countries, notably because proximity is conducive to trade in goods, services and factors of production, which in turn facilitates the transmission of knowledge. The transmission mechanisms are easily grasped in an endogenous growth framework and strongly resemble those described in the case of technology diffusion through FDI. The technical and managerial knowledge embodied in a country's investments, where the use of this knowledge cannot be confined to domestic enterprises alone, can generate externalities at the microeconomic level to the extent that the country is not able to capture the entire social return on its investments. To the contrary, this knowledge is likely to be transmitted to other countries, which thus benefit from the dynamic of the country which is investing heavily in capital accumulation. Diffusion is most likely to take place between neighbouring countries, because geographical proximity facilitates both the transfer of labour³⁰ and learning by observation and by interaction.

The introduction of variables representing inter-provincial diffusion, is also based on the assumption that cultural and geographical proximity allows neighbouring provinces to enjoy efficiency gains arising from a given province's extensive contact with foreign markets. To measure the diffusion process, we use a methodology based on Chua (1993) and incorporating the changes suggested by Easterly and Levine (1997). First a regional classification system is constructed, linking each province to the set of all its neighbours, as described in Annex 1. As Hainan province is an island,

we assume that it has a common “border” with the two provinces (Guangdong and Guangxi) lying on the coast of the South China Sea³¹. Using this classification, we then calculate an indicator of diffusion for each province, specified as the average of its neighbouring provinces’ values for the variable under consideration. Since it seems likely that the larger a province is, the greater the impact it will have on its neighbours, we weight the diffusion indicator by the real per capita GDP of the neighbouring province for the year $t-1$. Thus the “direct growth contagion” variable (SPI) used for the following analysis is measured for each province p by the weighted average of the GDP growth rates of the n neighbouring provinces:

$$SPI_{pt} = \frac{1}{\sum_{i=1}^n Log(PIBH_{i,t-1})} \cdot \sum_{i=1}^n Log(PIBH_{i,t-1}) \times g_{it}$$

This variable raises a problem of simultaneity which we handle (following Easterly and Levine, 1997) by using as instruments the weighted averages (following the same technique) of the variables which explain GDP growth.

Table 2.3. Inter-provincial Propagation of Growth:
Simultaneous Estimations (1985-96)

Dependent Variable	Independent Variables							Number of Observations
g	g _L	s _{ICF}	s _{IE}	g _{Exp}	h	h*s _{IE}	Temps	
	0.274 (2.234)	0.006 (0.459)	0.022 (2.653)	0.004 (0.351)	0.221 (2.079)	0.026 (2.038)	-0.004 (-0.501)	288
	PIBH ₋₁	SPI						
	-0.043 (-2.908)	0.751 (6.976)						
s _{IE}	PIBH ₋₁	g ₋₁	Fer ₋₁	Ouv ₋₁	Coll ₋₁	s _{IE-1}		
	1.975 (6.880)	1.759 (1.859)	1.923 (1.974)	0.554 (3.048)	0.388 (1.420)	0.004 (0.075)		288

Overidentification test: $\chi^2(25) = 24.2009$

(The null hypothesis that all moments are null cannot be rejected.)

Notes: All variables are expressed as differences from the provincial average (intra operator). Values in parentheses are the t-statistics. The method used for simultaneous estimation of the two equations is the generalised method of moments (GMM). Instruments: for the first equation, $s_{ICF(-1)}$, $s_{IE(-1)}$, $g_{Exp(-1)}$, g_L , $h_{(-1)}$, $(h*s_{IE})_{(-1)}$, $PIBH_{(-1)}$ and the weighted average of the lagged independent variables for the neighbouring provinces, their squares and Temps; for the second, $PIBH_{(-1)}$, $g_{(-1)}$, $Fer_{(-1)}$, $Ouv_{(-1)}$, $Coll_{(-1)}$, $s_{IE(-1)}$ and their squares. Estimated standard deviations are corrected using White’s test. They are also corrected for autocorrelation.

The results presented in Table 2.3 show that the coefficient of the diffusion variable is positive and significant. Its magnitude signifies that a one-point rise in the average growth rate of a given province’s neighbours raises the growth rate of that province by 0.75 points. This estimation of a growth contagion effect among Chinese

provinces is much higher than that found by Easterly and Levine (1997) for African countries (of the order of 0.5)³², but it corroborates Mody and Wang's (1997) estimation for the industrial sectors of seven Chinese coastal provinces. Mody and Wang measured the effect on the industrial sector's growth rate in one province of industrial sector growth in the others, obtaining a coefficient close to 0.8.

The existence of a direct contagion effect on growth may be explained in several ways. Easterly and Levine (1997) attributed contagion effects in Africa to imitation of neighbouring countries' economic policies. In the case of China it is inappropriate to speak of imitation, because the main lines of economic policy are set by the central government; nevertheless, a similar argument can be made since, as we have pointed out, the reforms (particularly those concerned with opening up to the outside world) were tried out in the coastal provinces first and then gradually — and partially — extended to the inland provinces. As a result, the mere extension of the reforms may have generated a contagion effect, as Jian *et al.* (1996) point out. In addition, population movements, most of which cover only short distances³³, may have helped to spread ideas and technologies developed in the “experimental” provinces; and the natural economic links between neighbouring provinces may have been strengthened by the traditionally very strong social links between such provinces.

This analysis of a process of “direct growth contagion” complements our explanation of the phenomena uncovered in our analysis of inter-provincial and inter-regional disparities. Direct contagion may be compared to the physical phenomenon of wave propagation: the buoyancy of the coastal provinces tends to engender a pace-setting effect, a geographical dynamic that promotes faster growth in the coastal provinces and is disseminated to other provinces. However, this propagation phenomenon, in which the coastal region fuels the overall dynamism of the Chinese economy, is attenuated by the gradually decreasing dynamism of the provinces as the “wave” moves from east to west. This effect thus affords at least a partial explanation for the complexity of China's regional development: both the convergence observed within the coastal region and the persistent disparities between coastal and inland provinces can be attributed to the fact that, owing to these diffusion effects, the economic buoyancy of the coast is self-sustained³⁴.

This analysis in terms of propagation thus provides a complementary explanation of China's growth paths and, as such, deserves to be emphasised. This evidence of a propagation effect between China's provinces seems all the more important because it suggests that although the geographically selective approach to reform may have had inequalitarian effects, it generated a countrywide dynamic which allowed the inland provinces to benefit from the dynamism of the coast.

Growth Propagation: Complementary Analysis at the City Level

To examine the growth propagation process at a still lower geographical level, we now present an analysis based on a sample of Chinese cities. The database used here is derived from the urban statistical yearbooks published by the State Statistical

Bureau (1989 to 1993-94)³⁵. It covers 107 cities (and surrounding districts under their jurisdiction)³⁶, 75 per cent of which are located in the coastal provinces. Although the unit under study is more disaggregated than that used in the preceding analysis, the use of data for individual cities raises a number of problems. First of all, these data are available only for the extremely short period of six years (1988-93). This period includes successive stages of slowdown (1988-91) and acceleration (1992-93) in the pace of reform and of economic growth. Moreover, the data available for the disaggregated city level cover only a limited number of variables. In particular, we have no city-level data for GDP, which leads us to use the annual average growth rate of each city's total industrial output as our dependent variable³⁷. Data are also lacking for most of the independent variables in the foreign investment equation used in the analysis by province, which precludes estimation of a foreign investment function at the city level.

The analysis here thus deals with the determining factors of individual cities' industrial growth, mainly for the purpose of evaluating the diffusion of growth between cities. As in the preceding analysis, we estimate a linear approximation of the theoretical growth equation, expressed in a form similar to that of equation (2.1):

$$(2.6) \quad g = \alpha_0 + \alpha_1 g_L + \alpha_2 s_{ICF} + \alpha_3 s_{IE} + \alpha_4 g_{Exp}$$

where g is now the annual average growth rate of real industrial output, g_L the annual average growth rate of the non-agricultural population, s_{ICF} and s_{IE} respectively the ratio of fixed-capital investment to industrial output and the ratio of FDI to average industrial output over the 1988-93 period, and g_{Exp} the annual average growth rate of exports by the Foreign Trade Companies³⁸.

To identify a growth contagion effect, which here takes the form of inter-urban diffusion of growth, we add the variable $DIFF_{i_p}$ which, for each city i_p located in province p , measures the industrial growth of the set of all other cities in the province under consideration³⁹:

$$DIFF_{i_p} = \frac{1}{5} \cdot \left[\log(PI_{p,93} - PI_{i_p,93}) - \log(PI_{p,88} - PI_{i_p,88}) \right]$$

This variable, which differs from that used for the analysis at the provincial level, attempts to represent the assumption that being located in a dynamic province can be a growth-enhancing factor for cities. The concept of "neighbours" is difficult to define in this case, given the lack of borders between cities and because we have, for practical reasons, treated cities located in the same province as neighbours. Insofar as provincial boundaries reflect not only administrative considerations but also different demographic, cultural and geographical characteristics, it seems that this criterion can be used to calculate a growth diffusion variable. However, it leads to the exclusion of the municipalities of Beijing, Tianjin and Shanghai for which, by definition, there is no distinction between the concepts of "city" and "province".

Estimation of equation (2.6) using cross-section data for the 1988-93 period confirms most of the results of the analysis by province. Once again, the contribution of fixed-capital investment to growth is not significant, which corroborates our inference concerning the inefficiency of domestic capital. The contribution of foreign investment to growth is significant, with a magnitude comparable to that obtained at the provincial level. Lastly, the export growth variable is now significant, but not robust to the introduction of additional variables (see equation 2 in Table 2.4). These results at the disaggregated city level confirm the finding of our provincial-level analysis concerning the preponderant role of foreign investment.

Table 2.4. Growth Propagation at the City Level (1988-93)

Equation	Independent Variables					Number of Observations	Adjusted R ²
(1)	g_L	s_{ICF}	s_{IE}	g_{Exp}	Constant		
	0.503 (8.615)	-0.006 (-0.441)	0.023 (3.921)	0.047 (2.161)	0.179 (5.601)	107	0.465
(2)	g_L	s_{ICF}	s_{IE}	g_{Exp}	Constant	<i>DIFF</i>	
	0.465 (5.883)	-0.007 (-0.568)	0.018 (2.389)	0.035 (1.688)	0.107 (2.193)	0.438 (1.967)	103 0.501

Notes: Values in parentheses are the t-statistics. The two equations are estimated using the double least squares (DLS) method with the following instruments: g_L , the initial (1988) value of the independent variables ($s_{ICF(88)}$, $s_{IE(88)}$), g_{Exp} multiplied by the share of exports in industrial output in 1988, a dummy variable for the cities of Guangdong province, the diffusion variable for exports and foreign investment (for the second equation only), and the constant. The estimated standard deviations are corrected using White's test.

Equation (2) of Table 2.4 presents the results of the estimation using the inter-urban diffusion variable *DIFF*. The coefficient of this variable is positive and significant, suggesting that inter-urban diffusion of growth does occur. This diffusion of growth within provinces may be justified by the same sort of arguments as were used for inter-provincial diffusion. In particular, social and cultural links, which can promote the diffusion of knowledge and ideas, and thus help to strengthen natural economic links, are likely to be even stronger within each province.

The analysis in this chapter has demonstrated the existence of a dynamic between foreign investment and growth which we consider essential to an understanding of recent economic developments in China and which, more generally, testifies to the importance of access to foreign technology in a developing country's growth process. It has also highlighted a dynamic peculiar to growth at both the provincial and the more disaggregated urban levels. This result provides a complementary explanation of China's growth process in terms of inter- and intra-provincial propagation phenomena.

Notes

1. See Démurger (1997) for a presentation of this theoretical framework. See also Berthélemy and Démurger (forthcoming).
2. See, for example, Borensztein *et al.* (1998).
3. For a more recent contribution, see also Balasubramanyam *et al.* (1996).
4. Following Feder (1983), one can also consider using a second variable representing the product of the exports/GDP ratio and the export growth rate. According to Feder, when this variable alone is added to the equation, it represents the overall effect of exports on growth. When it is introduced together with the export growth variable, it represents differential effects between inter-sectoral externalities on the one hand, and productivity differences between the export and non-export sectors on the other. Use of this variable did not change the econometric results presented in the following sections and did not allow a distinction to be made between the two effects found by Feder.
5. In addition to the difficulty of defining a human capital variable, there is some controversy concerning estimation of the impact of such a variable on growth (see especially Knight *et al.*, 1993; Benhabib and Spiegel, 1994; Islam, 1995; and Berthélemy *et al.*, 1997).
6. Barro and Lee (1993, 1996) calculated these indicators for 126 countries, including China, over the 1960-90 period. The available variables are the percentage of educated people by level of educational attainment and by sex, and the average number of years of education by level and by sex.
7. This confirms the results of Mody and Wang (1997), who showed that the secondary school enrolment rate had a significant negative impact on industrial output growth in the coastal provinces from 1985 to 1989. This relationship may be explained by a cyclical shift in favour of labour: in the provinces where the reforms caused a rapid rise in demand for unskilled labour, the trade-off between labour and education operated in favour of the former. This is corroborated by the fall in the secondary school enrolment rate over the period.
8. These two analyses of the determinants of FDI in China use national time-series data and do not examine the geographical distribution of investment.
9. See Annex 3.

10. Most growth studies on longitudinal data use variables in the form of multi-year averages (over five years or so) for purposes of estimation, which reduces the impact of short-term effects in their explanations of growth (see especially De Gregorio, 1992; Knight *et al.*, 1993; Zhang and Zou, 1995).
11. The lack of such a demonstration led the present author to carry out formal tests concerning the exogeneity of foreign investment, which allow us to reject this hypothesis (Démurger, 1997, 1998).
12. This lack of correlation can be interpreted as resulting from the similar temporal patterns of GDP and foreign investment (expressed as a level), which makes the “foreign investment rate” independent of the dummy variable. Moreover, no temporal interruption was found in the evolution of this rate at the national level.
13. When the error terms are homoskedastic, the GMM estimator is asymptotically equivalent to the triple least squares (TLS) estimator. When these terms are heteroskedastic, however, the TLS estimator is not effective and it is preferable to use the GMM estimator (Ogaki, 1993; Greene, 1997).
14. See especially Ahn and Schmidt (1995) and Sevestre and Trognon (1996).
15. Dessus (1998) describes and compares the various methods of handling the problem of non-convergence of estimators in a dynamic fixed-effect model.
16. See also Chen and Fleisher (1996). These authors estimate a growth model for 25 provinces over the 1978-93 period, finding a coefficient for the investment rate which is significant and negative for cross-section data and not significant for panel data.
17. Kwan and Kwok (1995), using aggregate data for 1956 to 1985, conclude that there is export-led growth. Prime and Park (1995), who estimate a Feder (1983) production function for a panel of 26 provinces over the 1985-90 period, find that export growth had a significant impact on GDP growth in the coastal provinces alone. These two studies used no FDI variable, however, which leads us to consider that the estimated equation was not correctly specified.
18. See especially Lardy (1992), Fukasaku and Wall (1994), and Tseng *et al.* (1994).
19. Examples include the rapid rise in demand for household consumer and electronic goods, such as television sets, refrigerators and hi-fi systems. In rural areas, the number of television sets per 1 000 households rose from 4 in 1980 to 924 in 1997.
20. Their sample consists of 23 industrial sectors in seven coastal provinces, observed over the 1985-89 period.
21. This effect is particularly apparent in the southern coastal provinces, where small shops and small enterprises proliferated rapidly.
22. See especially Barro (1991, 1996), Barro and Sala-i-Martin (1992, 1995), and Mankiw *et al.* (1992). A current issue in this literature has to do with the rate of convergence. Whereas the usual rates found using cross-country cross-section data are around 2 to 3 per cent, Caselli *et al.* (1996) have recently found a rate of the order of 10 per cent using panel data. For a recent review of this issue, see Dessus (1998).

23. Nagaraj *et al.* (1998) also estimate a convergence relationship using annual data for a panel of Indian states.
24. See Chen and Fleisher (1996), Jian *et al.* (1996), Guillaumont and Boyreau Debray (1996) and Raiser (1998).
25. The threshold seems to be located on the median, which corresponds to the income level of the autonomous region of Inner Mongolia.
26. The Special Economic Zones are the best example of this. From a very small initial industrial base, they managed to attract considerable amounts of foreign investment which in turn allowed them to develop substantial infrastructure and productive capacity. For example, in 1979 Shenzhen was a rural town with a population of 23 000; today it is a major city with more than 3 million inhabitants.
27. See especially Chua (1993), Chua and Ades (1993), Mody and Wang (1997), and Easterly and Levine (1997).
28. Chua (1993), in his analysis of the diffusion of growth at the world level, provides the following example of geographical spillover: “Guangdong grew at an average annual rate of 12 per cent over the last decade, this growth being fuelled by the capital and technical knowledge flowing in from neighbouring Hong Kong and Taiwan” (p. 2).
29. See Hsueh and Woo (1995).
30. As Chua (1993) points out, labour transfer can be a major vehicle for diffusion since it may be assumed, following Lucas (1988), that individuals become more productive when they are in contact with productive individuals from whom they can learn.
31. Hainan island does not appear directly in the regressions because it is one of the excluded provinces (see Annex 3), but it does appear in the calculation of the diffusion indicator for its neighbours (Guangdong and Guangxi).
32. Apart from the different growth experiences of China’s provinces and African countries, this difference may be partly due to the fact that our sample covers a set of provinces within a single country, whereas Easterly and Levine’s estimations refer to countries which may have close cultural links but for which the mere existence of borders may limit the diffusion effect.
33. As a result of political decisions during the Maoist period which placed strict controls on population movements, migration is a very recent phenomenon in China. It is mainly due to surplus labour supply in rural areas. Informal migration in particular began to increase in the mid-1980s, creating a “mobile” or “floating” urban population category which Blayo (1998) estimates at approximately 100 million people. According to Peng (1994), two-thirds of all current migration is intra-provincial, over short distances and directed towards urban areas. Moreover, most inter-provincial migrants move to neighbouring provinces, usually in the more developed eastern region. Their contacts with their home villages and families can facilitate the diffusion of new technologies.
34. This result corroborates the finding of Guillaumont and Boyreau Debray (1996) that growth spread to provinces touching the coastal provinces and not to the most landlocked provinces.

35. This source is also used by Wei (1993, 1994), Démurger (1995, 1996*a*, 1996*c*), and Husain and Wang (1996).
36. The cities are defined in Annex 1. The number of cities recorded in the statistical yearbooks is much higher (434 for the 1989 edition), but data are not available for all of them for the variables considered here.
37. Industrial output, like all the variables expressed in constant yuan, is deflated by the provincial retail price index.
38. We use the value of Foreign Trade Companies' exports as an approximation of total exports. According to H. Wang (1993), FTC exports accounted for 84 per cent of total national exports in 1988.
39. Mody and Wang (1997) use a similar variable to show that the growth of the industrial sector in one region is influenced by the growth of the same sector in the other regions.

Policy Recommendations and Conclusion

The recent economic history of the People's Republic of China has been exemplary in the sense that the country's transition to a market economy carried out since the late 1970s has been accompanied by outstanding economic growth. Since the initiation of the openness and reform policy, China has also shown an extraordinary capacity for developing economic relations with the rest of the world, both in the volume of trade in goods and the amount of foreign capital inflows. When this recent economic development is viewed in historical perspective, it becomes apparent that there have been changes in the nature of China's growth process since the late 1970s, suggesting a relationship between the reforms and growth. In view of the importance of the "open door" in the reform process, we have endeavoured to evaluate the extent to which this policy explains China's remarkable growth over the past 20 years.

The quantitative analysis on province-level data supplemented by city-level data led to several results that provide insight into the Chinese growth process. Although the implications of these econometric exercises should not be overestimated in economic policy recommendations, our results do suggest several lines of thought concerning the ranking of priorities in implementing reforms.

A first result distinguished between the respective contributions of foreign trade and foreign direct investment to growth and led to substantial qualification of the importance of the former. To be sure, trade liberalisation has brought about a substantial increase in China's exports since the early 1980s, but it does not appear to be a major *direct* determinant of China's growth performance. The econometric estimations presented in this study established that trade liberalisation contributed to growth indirectly through its positive effect on foreign investment, thus suggesting that there is some complementarity between the two main components of the open door policy: promoting exports and attracting foreign direct investment (FDI).

It is theoretically possible that there is an inter-relationship between FDI inflows and economic growth, as suggested in the model described in Annex 2. FDI and the policies concerning it have a preponderant role as the engine of growth because of the diffusion of technology. FDI can contribute to technological upgrading in two ways: if it embodies a higher level of technology than domestic investment, it makes a direct

contribution by raising the overall technological level of the host country; and it can also make an indirect contribution through positive externalities which benefit local enterprises. Quantitatively, our analysis of growth paths at the provincial level — like that conducted at the city level — identifies foreign capital inflows as an essential ingredient in China's growth process. Although the technology incorporated in FDI was relatively small, it had a substantial effect on growth which may be at least partially explained by its contribution of comparatively advanced technology and know-how. Moreover, this reasoning can be linked to one of the results of the theoretical model, which suggests that the foreign investments most conducive to stimulating growth in the host country are those whose technological content is the closest to that of the local productive sector. FDI has also been one of the main channels for introducing market economy practices and competition into the Chinese economy, which seems to have generated a positive externality by providing incentives for local firms to allocate their available resources more efficiently. As the average share of FDI in total investment remained under 10 per cent throughout the period, China's mode of development remained relatively independent of the outside world. Nevertheless, it testifies to the importance of access to foreign technology for growth in developing countries and suggests that openness to foreign capital can, owing to its impact on growth, be an important component of outward-looking policies.

The second result reveals that domestic factors of production play an ambiguous role in the growth process. This finding may be justified by the fact that state-owned enterprises unquestionably make inefficient use of their share of these factors. The public sector is lagging behind today, both because reform in this sector is just beginning and because it is the only sector that does not benefit from the overall buoyancy of the Chinese economy. Reform of public enterprises will clearly be one of the most difficult stages of China's transition process, as shown by the government's current difficulties in implementing the public sector restructuring programme it announced in September 1997. Moreover, recent lower rates of economic growth, which are partly attributable to the impact of the Asian crisis on trade and new FDI inflows, are highly constraining because they reduce the prospects of re-employment for dismissed employees. From a purely economic viewpoint, however, reform of public enterprises remains necessary because the persistence of distortions in the domestic economy can sharply reduce the productivity and resource allocation gains generated by the open door policy. In the long term, this means that steady growth will be possible only if the government actively pursues a policy of public sector reform and reallocation of domestic factors of production to the non-state sector.

In keeping with this observation, a further theoretical and empirical result suggests that the effectiveness of policy aimed at attracting FDI depends on the educational level of the local supply of human capital, as measured in years of primary and secondary schooling. This implies that to take full advantage of the gains from openness, it is essential not only to ensure that domestic factors of production are allocated efficiently but also to promote accumulation of skills through an appropriate educational policy. Educational development in China is all the more important since, according to official sources, over 16 per cent of the population over age 15 was still illiterate or semi-

literate in 1997 (SSB, *China Statistical Yearbook*, 1998). To be sure, this relatively high illiteracy rate is mostly inherited from the very low educational level of those born before the founding of the People's Republic of China; according to the 1990 census, two-thirds of all illiterates were 45 or older, whereas only 10 per cent of the 15-44 age group were illiterate (as against an overall average of 22.3 per cent in 1990). Even in the youngest age groups, however, illiteracy has not been eradicated. A survey conducted by the State Statistical Bureau revealed that nearly 20 per cent of children aged 6 to 14 were not enrolled in school during the 1989-90 school year (West, 1997). The high dropout rate is primarily due to the rising cost of enrolment fees and school supplies for education, but the economic reforms may also have had a negative impact on educational choices, particularly in the coastal provinces. By contributing to a rapid rise in demand for unskilled labour, the reforms promoted a trade-off between labour and education in favour of labour and thus led to a drop in school enrolment rates, particularly at the secondary level (Mody and Wang, 1997).

Despite China's determination to achieve compulsory universal education and to stamp out illiteracy, as expressed in the 1986 law extending the mandatory term of schooling to nine years, investment outlays for education have remained inadequate and even seem to have fallen. Although public spending on education as a percentage of GDP was already very low in 1985 compared to other countries at an intermediate level of human development, it then decreased from 1985 to 1995 and stood at only 2.3 per cent in the latter year (UNDP, 1998). Given the importance of human capital in the assimilation of foreign technology and know-how, it seems essential that educational outlays be increased and that priority be given to primary and secondary schooling.

The quantitative analysis presented in this study uncovered two phenomena which strengthen the impact of FDI on growth. The first is the existence of an interdependence between FDI and growth, which highlights the importance of the relationship between these two variables. Examination of the determinants of FDI showed that the magnitude of provincial growth rates had in turn a significant impact on the geographical distribution of foreign investment in China. This result points up one of the main characteristics of foreign investments: they are attracted by China's domestic market, which affords opportunities in terms of both production costs and consumption. It also provides a partial explanation for the geographical concentration of strong performances along the coast and the growing gap between the coast and the inland provinces. Our analysis also revealed that, other things being equal, investors are more likely to invest in provinces which are open to foreign trade and capital and which have the most developed transportation infrastructures. This furnishes another explanation for the geographical concentration of FDI in provinces with high growth potential, which strengthens the contrast between coastal and inland provinces that emerged during the reform period.

Finally, the FDI-growth dynamic seems to have been strengthened by inter- and intra-provincial diffusion of growth. Starting from the observation that growth, though rapid, was unevenly distributed across provinces, we completed our analysis of the

determinants of growth by demonstrating the existence of a phenomenon of attenuated inter-provincial growth propagation. This propagation provides an additional explanation of the Chinese growth process which seems all the more important for suggesting that although the geographically selective approach to reform may have had inegalitarian effects, it generated a country-wide dynamic that allowed the inland provinces to benefit from the buoyancy of the coast. Moreover, an assessment of the diffusion of industrial sector growth among cities located in a single province confirmed the relevance of the analysis by showing that being located in dynamic provinces is a growth-enhancing factor for cities. This implies that a “discriminatory” regional development strategy like that adopted by the Chinese government in the late 1970s can increase the overall rate of growth if it is accompanied by geographical diffusion of growth.

The results presented above suggest that some conclusions can be drawn from them for economic policy with a view to reducing inter-provincial disparities in development. We consider this question to be of fundamental importance for China’s growth in the long term, since more or less inegalitarian development could give rise to political and social tensions that might hamper economic growth.

Comparison of provincial growth paths since the early 1980s revealed a complex situation: there are fairly marked income disparities, particularly between the coastal and the inland provinces, but income dispersion within large regional groupings tended to fall. The analysis showed that, since all Chinese provinces did not receive the benefits of the openness and reform policy at the same pace and to the same extent, the positive impact of this policy — and particularly of openness to foreign investors — had an inegalitarian effect across provinces. Consequently, a natural recommendation for achieving balanced growth would be to extend the open door policy to the inland provinces, especially by introducing preferential measures to attract FDI, as was done in the limited space of the open economic zones. Our results suggest, however, that the mere inauguration of such a policy will not suffice to bring growth to the inland provinces, and that it will also be necessary to provide infrastructure capable of inducing foreign investors to abandon their preference for the coast. The fact is that relatively developed means of transportation and the presence of other foreign investors proved to be major determinants of the geographical distribution of FDI, and the inland provinces are lacking on both counts. China’s enormous infrastructure requirements are a matter of concern to the government, which announced in February 1998 an ambitious policy of major civil engineering projects in which road and railway construction figure prominently. The weaknesses of the transportation networks of the most remote provinces could thus be offset by appropriate investments. Some recently announced infrastructure projects for urban areas — the development of road networks, environmental protection and improved water distribution — could contribute to ending the isolation of certain provinces, because a preferential policy for cities of the centre and west is planned, notably through the central government’s granting of higher subsidies for these areas than for the coastal region.

In the area of public expenditure, government efforts to reduce regional disparities can also take the form of educational development. We have already noted the importance of education to the growth of China as a whole, but a province-by-province examination also reveals marked inequalities in access to education. The illiteracy rates of Beijing and Tibet, for example, stand in a ratio of 1 to 7. The industrialised north and northeast, favoured by central planning in the Maoist period, are relatively well educated, with illiteracy rates under 10 per cent. In contrast, the west (excluding Xinjiang) and southwest have high illiteracy rates, approaching and even surpassing 50 per cent in some provinces. These provinces have large minority populations which have their own languages and cultures, but do not have equal access to the educational system; major efforts are needed to improve their access to education.

Consequently, despite the inter-provincial diffusion of growth that was observed, it seems essential to implement supporting policies which will allow the inland provinces to take full advantage of both their own opening up and the pace-setting effects of the most dynamic provinces.

Productivity gains from the transfer of foreign technology will certainly decrease in China's economic development over the longer term. The country therefore needs to build up its own capacity for technological innovation through research and development. In this context, the programme for reform of public sector ownership, initiated in September 1997 but progressing unsteadily, is important for the financial rehabilitation of the large firms which might set up their own research activities. Furthermore, educational policy in this context is also fundamental for increasing the innovative potential of the economy. This objective can be attained by raising the quality of higher education to complement the development of universal basic education and by effective policies to encourage the return of Chinese students educated abroad, as was done elsewhere in Asia, such as in Korea and Chinese Taipei.

Historical and Geographical Background

Timeline of China's Economic Reforms (1978-99)

China's rapid economic growth was supported by a complex set of reform measures intended both to improve the functioning of the domestic economy and to develop economic relations with the rest of the world. As most observers have pointed out (e.g. Bell *et al.*, 1993; Sung *et al.*, 1995), reforms followed one another in a cyclical pattern in which phases of liberalisation alternated with phases of recentralisation necessitated by the appearance of economic disturbances revealed by soaring inflation and balance-of-trade difficulties. In the first phase (1978-84), the measures adopted were aimed at rationalising the managed economic system without calling its fundamentals into question. Changes were therefore made at the microeconomic level to restore the classic motives of profit seeking to productive entities, by introducing contract systems offering material incentives and encouraging productivity increases. These were the objectives of the first reforms of China's internal economy, in both the agricultural and the industrial sectors.

From 1984, reforms were applied on a larger scale — although with some interruptions, notably after the events in Tiananmen Square in June 1989 — and brought about a more thoroughgoing transformation of the Chinese economic system, which became further and further removed from a planned system. The timeline presented below falls into three periods, corresponding to major stages in the economic liberalisation process. The year 1984 was a watershed because it saw both a substantial geographical extension of the open door policy and the implementation of the first industrial reforms. The pace of reform picked up in 1992, with the declared objective of building a “socialist market economy”.

China's market transition can be described in terms of its two main components: opening up to the outside world, which marked the end of the isolationist policy of the Maoist period; and reform of the domestic economy. It is not easy to establish a chronological order between these two components insofar as they were conducted simultaneously, at a gradual pace and with a number of interruptions. During each sequence of reforms, both the open door measures and the reforms to the domestic economy were extended to a greater number of geographical areas, productive sectors and goods, allowing local administrative and economic entities to acquire a degree of autonomy through decentralisation.

1978-83

- 1978 • Third Plenum of the XIth Central Committee of the PCC issues directives for concerted reform: letting the market play a larger role (December).
- 1980 • Stabilisation programme (recentralisation) (December).
- 1981 • Restoration of central government control over the economy (February).
- 1982 • The decision to open up China to the outside world is formally added to the Constitution (December).

Open door policy

- 1978 • Regional experiments with the decentralisation of foreign trade in Beijing, Shanghai and Tianjin (December).
- 1979 • Decentralisation of control over foreign trade.
 - Introduction of the foreign currency retention system.
 - Shekou is designated an “industrial export zone” (January).
 - The county of Baoan obtains “special municipality” status (February).
 - Zhuhai obtains “special municipality” status (March).
 - Foreign Affairs Minister Li Qiang announces that China will accept foreign loans (March).
 - Law concerning Chinese-foreign joint ventures (1 July).
 - Special measures for Guangdong and Fujian (15 July).
 - Shantou obtains “special municipality” status (December).
 - Shenzhen, Zhuhai and Shantou are designated Special Economic Zones (SEZs) (December).
- 1980 • Xiamen becomes an SEZ.
 - Eight ports on the Changjiang river are opened to foreign trade (April).
 - China joins the International Monetary Fund and the World Bank (April/May).
 - Law on business income tax for joint ventures (September).
- 1981 • Institution of the “domestic payments rate” (January).
 - Law on business income tax for wholly foreign-owned firms (December).
- 1982 • Tariff reduction on imports of goods such as raw materials and capital goods for light industry and textile manufacturing (January).
 - Establishment of the Ministry of Foreign Economic Relations and Trade (MOFERT) (March).
- 1983 • Hainan is designated a “special zone open to foreign investment”.
 - Joint ventures in Shenzhen are authorised to sell their products on the domestic market (April).

Domestic reforms

- 1979 • Decollectivisation of agriculture and introduction of the Household Responsibility System (HRS).
 - Introduction of the single child policy (January).
 - Prices of agricultural products rise by 25 per cent on average (April).
 - Industrial reform (“Mandatory Rule for Introducing the Retained-Profit Scheme”) (13 July).
- 1980 • Budgetary autonomy granted to provinces.
 - Legalisation of family farms (September).

- 1981 • Industrial reform (“Information on Implementation of the Economic Responsibility System in Industrial Production”) (29 October).
- 1982 • Law authorising limited-term employment contracts.

1984-91

- 1984 • Extensive programme of reforms mainly targeting the urban industrial sector (Third Plenum of the XIIth Central Committee) (October).
- 1985 • Restoration of control by the central government (July).
- 1987 • Economic reform resumes (XIIIth National Congress) (November).
- 1988 • Official proclamation of the “coastal development strategy” by Zhao Ziyang (January).
- Strict controls on investment and credit are reimposed (September).

Open door policy

- 1984 • Creation of 14 open cities (April).
- Proclamation of the decentralisation of foreign trade (August).
- Creation of the Economic and Technological Development Zone (ETDZ) of Huangpu in Guangzhou (December).
- 1985 • First official swap centre created by the Shenzhen branch of the People’s Bank of China.
- The double exchange rate system is replaced by a single exchange rate set at 2.8 yuan per US dollar (January).
- Opening of the Zhujiang delta, the Changjiang delta and the south Fujian triangle (Zhangzhou, Quanzhou and Xiamen) (February).
- Law on economic contracts with foreigners (April).
- 1986 • Devaluation of the RMB (January).
- Law on wholly foreign-owned enterprises (12 April).
- Devaluation of the RMB by 13.6 per cent (July).
- The “Law of 22 Articles” (measures to encourage foreign investment) (October).
- 1987 • Extension of the Zhujiang delta Economic Development Zone (December).
- 1988 • The Contractual Responsibility System (CRS) is applied to the national Foreign Trade Companies.
- Law on co-operation between enterprises (13 April).
- Hainan island becomes a separate province and an SEZ (April).
- Opening up of many areas in Liaoning, Shandong, Guangxi and Hebei provinces (April).
- 1989 • Devaluation of the RMB by 21.2 per cent against the US dollar (4.7 yuan/dollar) (December).
- 1990 • Creation of the Pudong zone (Shanghai) (April).
- Devaluation of the RMB by 9.57 per cent against the dollar (5.187 yuan/dollar) (16 November).
- 1991 • Extension of the Contractual Responsibility System to provincial governments.
- Harmonisation of fiscal measures concerning foreign investors (April).

Domestic reforms

- 1984
 - The People's Bank of China becomes the Central Bank and four specialised state banks are created.
 - Creation of township and village enterprises (TVEs).
 - Industrial reforms (creation of the director's responsibility system) (20 October).
 - The *People's Daily* announces the elimination of the public monopoly on the purchase and sale of the main agricultural products (31 December).
- 1985
 - Implementation of the fiscal reform adopted in September 1984 (1 January).
- 1986
 - Legalisation of the inter-bank lending market.
 - Adoption of the Compulsory Education Act, which stipulates that obligatory schooling in most regions should be increased to nine years before the turn of the century (April).
 - Law authorising redundancies. Introduction of an employment contract system and an unemployment insurance system (July).
 - Law on bankruptcies of state-owned enterprises. First introduced on an "experimental basis", it went into effect in 1988 (August).
 - Industrial reform ("Decision on Intensifying the Enterprise Reform and Revitalising Enterprise") (5 December).
- 1987
 - First sale of user's rights to Chinese land at Shenzhen (September).
- 1988
 - Price reform.
 - Legalisation of the rental of land use rights.
 - Price liberalisation is suspended (August).
- 1991
 - Elimination of guaranteed lifetime employment.
 - Law on land administration (February).

1992-99

- 1992
 - Deng Xiaoping's tour of the south (January).
 - The Politburo decides to quicken the pace of reform and opening up (9-10 March).
 - The Party calls for the establishment of a "socialist market economy" (October).
- 1993
 - "Sixteen Point Programme" to bring economic overheating under control, fight corruption and put an end to rural unrest (July).
 - The Third Plenum of the XIVth Central Committee adopts a resolution on the "establishment of a socialist market economy system" (November).
- 1997
 - XVth Congress of the PCC and resumption of reforms (September).
- 1998
 - Zhu Rongji becomes Prime Minister (17 March).
- 1999
 - Constitutional amendment designating the non-state sector as a "major component" of the socialist market economy (March).

Open door policy

- 1992
 - Preferential policies for ten major cities.
 - Establishment of six development zones along the Changjiang valley.
 - All provincial capitals and 13 border cities are authorised to adopt an open door policy.
 - Foreign investment is authorised in sectors where it had been forbidden, such as finance and insurance (July).
- 1993
 - Abolition of import licensing for 9 categories of goods (31 December).
 - Tariff reduction for approximately 3 000 products (31 December).
- 1994
 - End of mandatory planning of foreign trade.
 - Temporary (one-year) tariff reduction for 235 products (1 January).
 - Unification of the exchange rate (1 January).
 - Elimination of quotas and import licences for 195 products (May).
 - Foreign trade law clarifying all existing regulations (1 July).
- 1995
 - Regulations concerning the opening of the services sector (“Provisional Regulations Guiding Foreign Direct Investment”, June).
- 1996
 - Elimination of tariff exemptions for imports by foreign-owned enterprises (1 April).
 - The RMB is made convertible for current transactions (1 December).
- 1997
 - The average tariff rate is reduced from 23 per cent to 17 per cent (1 October).
- 1998
 - Re-establishment of some tax privileges for foreign-owned enterprises (1 January).
- 1999
 - The end of development zones (elimination of privileges with respect to business income tax), except for SEZs (1 January).

Domestic reforms

- 1993
 - Introduction of a health insurance system for retired people.
 - Law on competition.
 - Abolition of swap centres (April).
 - Implementation of a new accounting system for enterprises (1 July).
- 1994
 - Liberalisation of coal prices.
 - Adoption of a new system of taxation standardising the tax rate on domestic firms at 33 per cent, unifying the income tax rate for individuals and applying VAT to a broader range of products (1 January).
 - Adoption of the first state budget bill by the National Congress (March).
 - Adjustment of the price of oil (May).
 - Adjustment of the price of cereal grains and other food products (June).
 - Application of the “law on companies” authorising the transformation of public enterprises into limited liability companies (July).
- 1995
 - Labour law making employment contracts mandatory for all industrial companies, including township and village enterprises.
 - Introduction of the five-day work week.
 - Law on the status of the Central Bank, making it more independent of the central government (March).
 - Legislation on commercial banks (adopted in May, took effect on 1 July).
- 1997
 - Proclamation of the reform of public sector ownership during the XVth Congress (September).
- 1998
 - Housing reform aimed at creating a property market (1 July).

Administrative Structure of the People's Republic of China¹

The administrative structure of the People's Republic of China comprises four levels: the province (*sheng*), the municipality (*shi*) or prefecture (*diqu*), the district (*xian*) and the township (*xiang*).

At the provincial level, the administrative map of China is divided into 31 entities [excluding Hong Kong (China), which became a Special Administrative Region on 1 July 1997, Chinese Taipei and Macao]: 22 provinces (*sheng*), 5 autonomous regions (*zizhiqu*) and 4 municipalities under the direct control of the central government (*zhixiashi*). The provincial-level entities are themselves divided into municipalities (*shi*) and autonomous prefectures (*zizhizhou*), which in turn are composed of districts (*xian*) and autonomous districts (*zizhixian*), which in turn are composed of townships (*xiang*), ethnic or "minority" townships (*minzu xiang*) and market towns (*zhen*). Lastly, municipalities of a certain size may have a number of urban precincts (*shixiaqu*) and rural districts.

The term "city" (*shi*) refers to a jurisdictional and administrative unit composed of the city proper (*shiqu* or *shixiaqu*), officially designated as an urban area, and certain primarily agricultural rural districts administered by the city (*jiaoxian* or *shixiashian*). Sung (1994) points out that since cities are administrative units, they can be merged or divided for administrative reasons. The areas of jurisdiction of many Chinese cities were substantially enlarged in 1983; as a result, the proportion of the population living in "cities" (*shizhen zongrenkou*) rose from 20 per cent in 1981 to 32 per cent in 1984 and has been over 50 per cent since the late 1980s.

There were 668 cities in 1997, classified according to a similar hierarchy which defines their degree of political and economic autonomy. Beijing, Tianjin, Shanghai and Chongqing² are directly subordinate to the central government (*zhixiashi*) and hence are administratively equivalent to provinces. Below this "provincial" level, there are "prefecture" cities (*dijishi*, 222 in 1997), under the direct authority of provincial governments; these are provincial capitals and other large cities. Lastly, there are "district" cities (*xianjishi*, 442 in 1997) which are subordinate to the prefectures. Wholly rural districts can become "district" cities if their non-agricultural population amounts to 80 per cent of their total population. Moreover, special arrangements may be applied for border districts and districts near the SEZs.

Classification of China's Provinces by Geographical Region

Following the three-fold division adopted in the seventh five-year plan (1986-90), the provinces of China are classified according to their geographical locations into three regions: coast, centre and west (see map page 8).

- The coastal region is composed of three municipalities (Beijing, Tianjin and Shanghai), eight provinces (Hebei, Liaoning, Jiangsu, Zhejiang, Fujian, Shandong, Guangdong and Hainan) and one autonomous region (Guangxi).
- The centre is composed of eight provinces (Shanxi, Jilin, Heilongjiang, Henan, Anhui, Hubei, Hunan and Jiangxi) and one autonomous region (Inner Mongolia).
- The west is composed of six provinces (Gansu, Shaanxi, Sichuan, Guizhou, Yunnan and Qinghai) and three autonomous regions (Ningxia, Xinjiang and Tibet). Since 1997, the city of Chongqing (Sichuan) has held the status of a municipality under the direct authority of the central government.

The geographical regions used for the statistical analysis in Chapter 2 refer to this classification, with the only modifications being that the city of Chongqing and Sichuan province are not treated separately and that the autonomous region of Tibet in the western region is excluded because very many data are missing. We also use the terms “inland region” and “inland provinces”, which refer to all non-coastal provinces, i.e. the provinces of the centre and west.

Notes

1. This section draws on Cabestan (1994) and Sung (1994).
2. The city of Chongqing, in Sichuan province, obtained this status in March 1997. Statistically speaking, this recent change in status implies that, for the period before 1997, Chongqing is included in the statistics for Sichuan province.

List of 29 Chinese Municipalities, Provinces and Autonomous Regions (excluding Tibet and Chongqing) and Their “Neighbours”

	Province	Region	Neighbours
BJ	Beijing	I	Tianjin, Hebei
TJ	Tianjin	I	Beijing, Hebei
HeB	Hebei	I	Liaoning, Inner Mongolia, Shanxi, Henan, Shandong, Beijing, Tianjin
<i>SX</i>	<i>Shanxi</i>	<i>II</i>	<i>Hebei, Inner Mongolia, Shaanxi, Henan</i>
<i>NM</i>	<i>Inner Mongolia</i>	<i>II</i>	<i>Heilongjiang, Jilin, Liaoning, Hebei, Shanxi, Shaanxi, Ningxia, Gansu</i>
LN	Liaoning	I	Jilin, Inner Mongolia, Hebei
JL	Jilin	II	Heilongjiang, Inner Mongolia, Liaoning
HJ	Heilongjiang	II	Inner Mongolia, Jilin
SH	Shanghai	I	Jiangsu, Zhejiang
JS	Jiangsu	I	Shanghai, Zhejiang, Anhui, Shandong
ZJ	Zhejiang	I	Shanghai, Jiangsu, Anhui, Jiangxi, Fujian
AH	Anhui	II	Jiangsu, Zhejiang, Jiangxi, Hubei, Henan, Shandong
FJ	Fujian	I	Zhejiang, Jiangxi, Guangdong
JX	Jiangxi	II	Fujian, Guangdong, Hunan, Hubei, Anhui, Zhejiang
SD	Shandong	I	Hebei, Henan, Anhui, Jiangsu
HeN	Henan	II	Hebei, Shandong, Anhui, Hubei, Shaanxi, Shanxi
HuB	Hubei	II	Henan, Anhui, Jiangxi, Hunan, Sichuan, Shaanxi
Hun	Hunan	II	Hubei, Jiangxi, Guangdong, Guangxi, Guizhou, Sichuan
GD	Guangdong	I	Fujian, Jiangxi, Hunan, Guangxi, Hainan
GX	Guangxi	I	Yunnan, Guizhou, Hunan, Guangdong, Hainan
<i>HN</i>	<i>Hainan</i>	<i>I</i>	<i>Guangdong, Guangxi</i>
SC	Sichuan	III	Yunnan, Guizhou, Hunan, Hubei, Shaanxi, Gansu, Qinghai
<i>GZ</i>	<i>Guizhou</i>	<i>III</i>	<i>Yunnan, Guangxi, Hunan, Sichuan</i>
YN	Yunnan	III	Sichuan, Guizhou, Guangxi
SHX	Shaanxi	III	Inner Mongolia, Shanxi, Henan, Hubei, Sichuan, Gansu, Ningxia
GS	Gansu	III	Inner Mongolia, Ningxia, Shaanxi, Sichuan, Qinghai, Xinjiang
<i>QH</i>	<i>Qinghai</i>	<i>III</i>	<i>Sichuan, Gansu, Xinjiang</i>
NX	Ningxia	III	Inner Mongolia, Shaanxi, Gansu
XJ	Xinjiang	III	Gansu, Qinghai

Notes: The third column (“Region”) indicates the regional classification of the province concerned: I = coast, II = centre, III = west.

Provinces in italics are those excluded from the econometric analysis in Chapter 2.

Modelling the Interactions between Foreign Direct Investment and Economic Growth

We present here the formal model of the mechanisms of the FDI-growth dynamic, which forms the theoretical basis for the quantitative analysis in Chapter 2. The starting point is Romer's (1990) model in which technical progress consists of the invention of new processes and products, which makes it possible to avoid decreasing returns in the long term. To highlight the role of FDI in economic growth, we distinguish between two technological levels in the innovation process, which can correspond to a distinction between local and foreign companies. The following model therefore employs two categories of enterprises in the intermediate sector, with the first producing goods arising from innovation on a higher technological level than that observed in the second. This feature of the model makes it possible to show that the economic growth rate depends in part on the relative weight of these two categories of enterprises.

One of the ways in which FDI can affect long-term growth has to do with the fact that FDI promotes the diffusion of technology (Findlay, 1978; Wang, 1990; Balasubramanyam *et al.*, 1996). Although foreign companies bring advanced technology into the host country, the distinction between enterprises with low technological content and those with high technological content can be interpreted in terms of domestic enterprises *versus* foreign enterprises. To investigate the effect of FDI on growth, therefore, we assume that goods deriving from an innovation process at a higher technological level are produced by foreign firms established in China, while domestic firms produce so-called low-technology goods.

FDI affects the local economy in two ways. The first, which we will call an "extension effect", is due to the increased diversity of goods produced by the local intermediate goods sector, which leads to increased specialisation by producers of inputs. The second is an externality affecting research, since the research of local enterprises can use some of the knowledge embodied in foreign enterprises. The two specifications chosen to represent the impact of FDI on economic growth differ from the specification proposed by Borensztein *et al.* (1998), in which FDI has only an indirect effect on growth by reducing the cost of innovation. The extension effect modelled here is much more direct in that growth is influenced by the number of

varieties of intermediate goods rather than by the rate of increase of this number. Another advantage of our specification over that of Borensztein *et al.* is that it leads to a decentralised equilibrium solution of the model in which growth is both endogenous and partly determined by FDI¹.

Description of the Model

We use a simplified economy with two types of agents: producers and consumers. The former can be subdivided into two groups, according to whether the good produced is intended for household consumption or production of a final good. Producers have the following factors of production: unskilled labour (L), skilled labour (H) and intermediate inputs. As the objective of the model described here is to highlight any growth linked to technical progress, we ignore population growth effects by assuming the supply of the aggregate factors L and H to be exogenous and constant. The manufacturing sector is made up of two subsectors: the final goods sector, which produces a homogeneous good for end consumers and savings; and the intermediate goods sector, which produces differentiated goods for intermediate consumption in the final goods sector. As in Romer's model, the final good serves as a *numeraire*, which means that prices are measured in units of the final good.

The Final Goods Sector

The final goods sector produces a homogeneous good which may be consumed by households or saved as new capital. Production technology in this sector is a function of unskilled labour L , the human capital devoted to the final good H_y and the set N of intermediate goods x available on local markets.

The specification borrowed from Romer is an extension of the Cobb-Douglas production function (A1). Intermediate goods are used symmetrically in the production function for the final goods sector², and all producers of such goods use the same production technology, employ the same inputs and use the same price system. At equilibrium, all intermediate goods are utilised in the same quantity. If we represent this quantity as $\bar{x}$ and postulate that $K = N\bar{x}$, we can rewrite the production function (A1') so that, if K is interpreted as a "physical stock of technology"³, this production function is homogeneous in the first degree with respect to the three production factors (L , H_y and K). If, in addition, we consider technical knowledge N as an accumulative production factor, then the production function of the final goods sector shows increasing returns⁴. Another interesting property of the model lies in the preference for diversity, following Dixit and Stiglitz (1977) and Ethier (1982). For a given quantity of technology K , the productivity of the other factors, L and H , rises with the number N of differentiated intermediate goods. This phenomenon can be interpreted as reflecting the fact that diversity allows more worker specialisation and thus increases productivity.

The final goods sector is competitive, since the final good Y is a homogeneous good. Each producer of the final good thus takes prices as given and determines the quantities of unskilled labour (remunerated at the rate w_L), human capital (remunerated at the rate w_{HY}) and intermediate goods $x(j)$ (at price $m(j)$) that it will use as inputs, maximising its profits subject to technological constraints. The first-order conditions that result from solving for the programme of the final good producer (A2) give the usual equalities between factor prices and marginal productivity (equations A3, A4 and A5).

Intermediate Goods Sector

In the intermediate goods sector, each enterprise j produces a differentiated good j . This sector is made up of N enterprises (producing N varieties of goods), which fall into two categories depending on the level of technology used in research: n enterprises with low technological content and n^* enterprises with high technological content ($N = n + n^*$). Each enterprise in the intermediate sector can be considered as an integrated enterprise conducting two distinct activities: research, which creates new varieties of inputs; and production, which uses this new technology⁵. The decision to enter the market is made by the production side.

Research has the objective of producing new knowledge, and to this end it makes use of human capital and the existing stock of knowledge. Intermediate goods production implements the projects developed through research and uses saved output to produce intermediate goods which can be used as inputs for production of final goods.

Research is a key activity because it allows the accumulation of new varieties of intermediate goods. The only input for research is human capital. Following Romer, we assume that R&D gives rise to intertemporal externalities, namely that researchers benefit from the discoveries of past researchers⁶. We also assume that the presence of enterprises with high technological content contributes through externalities to the body of knowledge available to researchers in low-technology enterprises. In order to calculate balanced growth with continuous accumulation of knowledge, the production of knowledge is assumed to have constant returns with respect to the two variables: “low-technology” knowledge (n) and “high-technology” knowledge (n^*). By representing the human capital employed in low-technology research as H_R , we thus assume that the accumulation of knowledge in this sector (A6) is linear with respect to the only private input (human capital) and that the productivity of skilled labour in this research is described by the parameter δ .

This specification differs from Romer’s in that we introduce an externality in the form of a geometric mean of “low-technology” knowledge (n) and “high-technology” knowledge (n^*). In Romer’s model the weighting factor μ is equal to 1, but we allow μ to be less than 1. This inequality may be interpreted as the inability of a “low-technology” firm to use all past discoveries in its current research, because they are

not all appropriate for the type of research the firm is conducting, because researchers are not kept informed of all discoveries, or because some discoveries are “obsolete” or “minor”. Research thus involves learning-by-doing, but the impact of this factor is slight. Equation (A6') establishes that, given the level n^* of “high-technology” knowledge, and if the externality is positive ($1-\mu > 0$), then for a constant level of human capital devoted to “low-technology” research, the lower the level of this technology n , the higher the rate of accumulation of knowledge will be.

Symmetrically, we assume that the research activities of high-technology enterprises use human capital H_R^* with a productivity level δ^* (A7) greater than δ (since we have assumed that the two categories of enterprises differ in the technological level of their research activities). The overall distinction between enterprises with high or low technological content, introduced into the model through this parameter, can be applied in the case of foreign-owned firms since, in developing countries, such firms are generally more technology-intensive than local firms. Thus, even though FDI in China is oriented towards labour-intensive industries⁷, foreign-owned firms use more advanced technology than most Chinese enterprises. This distinction of “nationality” is all the more important if we define the concept of technology broadly, to include not only productive technologies but also know-how and experience in management and industrial organisation.

Furthermore, if foreign enterprises are more technology-intensive, it may also be assumed that they create more externalities than domestic enterprises and hence that the weighting coefficient for foreign research μ^* is greater than μ . In particular, it may be assumed that μ^* is greater than $1/2$, which means that the most technology-intensive enterprises benefit more easily from research conducted by enterprises at the same technological level than do enterprises at a lower level⁸. However, μ can be less than $1/2$ if technologically advanced firms generate substantial external effects.

This specification distinguishing low-technology from high-technology activities amounts to a distinction between two effects in the accumulation of knowledge, which may be termed the “internal effect” and the “external effect”. The former designates the externality highlighted by Romer, namely that each researcher helps to increase the productivity of other researchers *within* the same sector (high-tech or low-tech). The external effect designates the externality *between* low-tech and high-tech enterprises, as each researcher helps to increase the productivity of researchers in the other sector.

When R&D leads to a discovery and hence to the registration of a patent, we assume that this patent is “sold” to the production unit at price P_n for a low-technology enterprise and P_n^* for a high-technology enterprise⁹.

Since research is a competitive sector, the only private production input, human capital, will be remunerated at its rate of marginal productivity, i.e. at the rate w_H (measured in units of the final good) for low-technology enterprises (A9) and at w_H^* for the others (A10).

Each enterprise j of the intermediate goods sector, using a technology which is assumed to be identical to that for the final good, produces new intermediate goods from designs “bought” from the research sector. The hypothesis that the production functions for the final goods and intermediate goods sectors are identical allows production in the intermediates sector to be treated as the conversion of a number of final good units η into an intermediate good unit. The resources that would have been used to produce the final good are in fact used to produce intermediate goods. The output of each enterprise j in the intermediate goods sector is then sold as inputs to the final goods sector at price $m(j)$.

The differentiation of goods in the intermediates sector means that each enterprise has a monopoly in the market for intermediate goods. It thus has the exclusive right to use the patent relating to technology j , which allows it to repay the fixed cost arising from purchase of this patent by charging a monopoly price which is higher than the marginal cost of production. As these differentiated goods are substitutable, however, the enterprise faces Chamberlin-type competition. On condition that entry into the market is free, each monopolistic enterprise is therefore subject to competitive pressure which at equilibrium leads to equality of rent and fixed costs.

As the intermediate goods sector is characterised by monopolistic competition, equilibrium in this sector may be defined as follows: each enterprise maximises its profits subject to its demand curve, and the phenomenon of free entry to the sector pushes each enterprise’s profits towards zero. The behaviour of intermediate input producers is thus determined at two levels: the enterprise decides whether it will enter the market and also, once a decision to invest is made, it decides on its production level. The first decision arises from the zero discounted profits condition¹⁰ (A12), the second from maximisation of discounted profits (A13).

If the analysis is restricted initially to enterprises with low technological content (local enterprises), the decision to produce a new specialised input depends on the comparison between discounted flows of net income and the price P_n of buying the patent. As the market for innovations is competitive, P_n is the discounted value of the net income of the monopoly which will manufacture this new capital good.

The level of production of input j is determined by profit maximisation subject to the demand constraint. Intermediate good producers consider as a given the inverse demand function of enterprises producing the final good, which stems from setting the price $m(j)$ equal to the marginal productivity of input j in production of the final good (equation A3). Maximisation of discounted net income subject to the demand constraint gives the equilibrium production level for intermediate goods (A14), the equilibrium price for good j (A15) and the market value of the invention at equilibrium (A16). Each enterprise in the intermediates sector uses its monopoly power to charge a monopoly price which is higher than the marginal cost of production: the stronger the monopoly, the greater the difference between the monopoly price and marginal cost.

Our analysis of high-technology enterprises (foreign enterprises) is not fundamentally different from what we have just seen. In particular, we assume that the production technology used by such enterprises is not different from the technology η used by low-technology enterprises. To assume that productivity in the intermediate goods sector varies with the technological level of research would amount to distinguishing η from some η^* . However, it can be shown that introducing this distinction into the model would have no influence on the way the long-term growth rate is expressed.

Consumers

The solution of the model requires the specification of savings, which finances investment. Following models of the Ramsey type, the saving rate is here determined endogenously from the consumers' utility function. The economy is made up of a finite number of households which supply labour in exchange for wages, receive income from financial assets, buy consumer goods and accumulate savings. Following the usual specifications for Ramsey models, we assume that consumers, who have an infinite life-span, maximise their utility function subject to the intertemporal budget constraint. The intertemporal utility function (A17), which is assumed to be a constant intertemporal elasticity of substitution (CIES) utility function, expresses consumers' preferences as a function of total consumption by the representative household (C); the degree of preference for the present (ρ), which measures the impatience of the consumer; and the inverse of the intertemporal elasticity of substitution of consumption (θ), which measures risk aversion. The solution to this consumers' intertemporal optimisation process (A18) allows us to obtain the so-called Keynes-Ramsey optimality condition (A19), which provides an expression for the growth rate of consumption ($\dot{C}/C$) as a function of the degree of preference for the present, risk aversion and the interest rate r . In a steady state, the consumption growth rate coincides with the output growth rate (g)¹¹, which means that there is a relationship between the interest rate r and the overall economic growth rate g .

The Path of Balanced Growth

The long-term equilibrium of this model is represented, as in Romer (1990), by price and quantity paths such that: *i*) consumers choose their saving and consumption levels by considering interest rates as given; *ii*) those who embody human capital choose between working in the research sector and working in the manufacturing sector by considering the stock of knowledge, the price of innovations and the wage level in the final good sector as given; *iii*) producers of final goods choose their inputs of labour, human capital and differentiated capital goods by taking prices as given; *iv*) each enterprise holding the manufacturing patent for a capital good and producing that good maximises its profit by considering the interest rate and the falling demand curve for this good as given and sets the price of that good; *v*) enterprises contemplating

production of a new capital good consider the price of innovations as given; vi) the supply of each good is equal to demand (Romer, 1990). The balanced growth solution corresponds to an equilibrium where, if L , H_Y and $\bar{x}$ are fixed, output grows at the same rate as N , which leads to the expression for the long-term growth rate given in equation (A30).

The growth rate g thus depends, as in Romer's (1990) model, on the total level of human capital in the economy, and it is possible to arrive at "poverty trap" conclusions if this level is too low. An economy rich in human capital can thus enjoy a higher growth rate, since it devotes more resources, in both absolute and proportional terms, to the accumulation of knowledge (N). In contrast, if the total level of human capital H is too low, the share allocated to the research sector may be null ($H_R = 0$), in which case there will be no development. The usual results are obtained in which the economic growth rate will be higher when the intertemporal elasticity of substitution for consumption ($1/\theta$) is higher or when consumers are patient (ρ is low), i.e. when a low degree of preference for the present induces them to save more.

The introduction of different technological levels in research leads to the introduction of a multiplier expressed as a function of the productivity ratio (δ/δ^*), which makes it possible to examine the impact of these technological differences on long-term growth.

The FDI-Growth Dynamic

The Role of Foreign Direct Investment

To assess the implications of this model in terms of foreign direct investment, we assume henceforth that high-technology enterprises are foreign enterprises established in China, while low-technology enterprises are domestic enterprises. This hypothesis implies that the technology index N , which appears in the production function for the final good, depends in part on the presence of foreign firms (n^*) in the country. By contributing to the rise in the total number N of intermediate goods produced, and hence to the domestic technological level, foreign capital thus helps to increase productivity in the final goods sector.

Furthermore, the growth equation (A30) suggests that the growth rate depends on the productivity ratio between foreign enterprises and domestic enterprises (δ/δ^*), and hence indirectly on the relative level of FDI n^*/n (A21). This impact of FDI on economic growth may be examined through the comparative statics of the growth equation (A30). The partial derivative of g with respect to δ/δ^* is given in equation (A31).

The sign of this derivative indicates that the contribution of foreign capital and the presence of foreign enterprises in the domestic economy increase the growth rate of that economy up to a threshold $\left(\frac{1-\mu}{\mu}\right)^{(\mu+\mu^*-1)}$ which depends on the “externality” coefficients μ and μ^* . Since $\delta/\delta^* < 1$ and n^*/n is likely also to be less than 1 at equilibrium¹², we have $\mu + \mu^* > 1$ (equation A21). When μ is less than 1/2, the threshold effect disappears because $\frac{1-\mu}{\mu} > 1$, which means that FDI always results in an acceleration of growth. When μ is greater than 1/2, the threshold effect exists, but it is a decreasing function of μ , which signifies that the higher the value of μ , the “shorter” will be the accelerating effect of FDI. A value of μ close to 1 means that the local sector mainly benefits from its own research (where $\mu = 1$, we are back in a Romer framework), but that there are very few externalities between the two sectors. Thus, the smaller the “external effect” of foreign enterprises on domestic enterprises, the lower the threshold. In other words, this result implies that the stronger the links between the domestic and foreign sectors of the local economy, the higher the growth rate of that economy will be.

As a result, the more a country offers investors the possibility of integration into the local market, the greater are the growth gains it can derive from opening up to foreign investors. In this context, investments which are “too technology-intensive” for the local productive sector can provide only slight growth benefits. The model therefore justifies the presence of low-technology FDI in China. Interestingly, this result is in line with an idea put forward by Findlay (1978) that for catching up between a technologically backward country and an industrialised country to occur, the technological distance between the countries must not be “too” large. “Stone-age communities suddenly confronted with modern industrial civilisation can only disintegrate or produce culturally irrational responses” (*ibid.*). The implication of this result for economic policy is that, in order to promote the emergence of externalities, it may be in a government’s interest to encourage investments with a technological content relatively close to that of the local productive sector, or joint projects, such as joint ventures rather than exclusively foreign-owned firms.

Determination of Foreign Direct Investment

Analyses of the determinants of FDI generally reveal the endogenous character of such investment, since a country’s economic growth is one of the factors that can attract foreign investors¹³. A more formal justification for this inter-relationship can be provided here by deriving from equations (A10), (A16) and (A25) an expression for n^* which has the advantage of bringing some determinants of FDI to the fore (A32).

If n^* is considered as a measure of the level of FDI, equation (A32) reveals that an inverse relationship exists between this level and the local technological level n , which signifies that the larger the technological gap between the country under study and the rest of the world, the higher the FDI level will be. Comparison with our previous results reveals an ambiguity which is worth examining: the level of FDI rises with the size of the technological gap between the two countries; but its effect on growth is stronger when the technological gap between domestic and foreign investment is small. The apparent contradiction between these two results has to do with the fact that the first case involves a technological gap between countries while the second involves a gap between the enterprises in a single country, regardless of their “nationality”.

Moreover, if N is interpreted as measuring total factor productivity, equation (A32) suggests that the higher the level of total factor productivity in an economy, the larger FDI flows will be. Also, logically, FDI will be lower when the quantity of human capital allocated to production of the final good is large. This result describes a crowding-out effect between the final goods sector and the research sector, stemming from the allocation of human capital to one or the other of these two sectors.

Finally, equation (A32) establishes a positive relationship between n^* and r , which implies that over the long term, FDI is influenced by the growth rate of the local economy. This result should be emphasised insofar as a dynamic linking FDI to the growth rate of the local economy can be formally demonstrated. The latter result, which shows the two-way nature of the FDI-growth relationship, has important empirical implications since it points up the need to take account of the endogeneity of FDI when examining its contribution to growth.

Formal Presentation of the Theoretical Model

Final Goods Sector

The production function for the final goods sector is as follows:

$$(A1) \quad Y(H_Y, L, x) = H_Y^\alpha L^\beta \int_0^N x(j)^{1-\alpha-\beta} dj$$

with $0 < \alpha < 1, \quad 0 < \beta < 1 \quad \text{et} \quad 1 - \alpha - \beta < 1$

or:

$$(A1') \quad Y = N H_Y^\alpha L^\beta \bar{x}^{1-\alpha-\beta} = N^{\alpha+\beta} H_Y^\alpha L^\beta K^{1-\alpha-\beta}$$

The profit maximisation programme is:

$$(A2) \quad \begin{aligned} \text{Max}_{H_Y, L, x(j)} \quad & Y - w_{H_Y} H_Y - w_L L - \int_0^N m(j) x(j) dj \\ \text{s.c.} \quad & Y = H_Y^\alpha L^\beta \int_0^N x(j)^{1-\alpha-\beta} dj \end{aligned}$$

It implies:

- for intermediate good j ,

$$(A3) \quad m(j) = \frac{\partial Y}{\partial x(j)} = (1 - \alpha - \beta) H_Y^\alpha L^\beta (x(j))^{-\alpha-\beta}$$

- for human capital H_Y ,

$$(A4) \quad w_{H_Y} = \frac{\partial Y}{\partial H_Y} = \alpha \frac{Y}{H_Y}$$

- for unskilled labour L ,

$$(A5) \quad w_L = \frac{\partial Y}{\partial L} = \beta \frac{Y}{L}$$

Research

The accumulation of knowledge function for low-technology enterprises is written in the following form:

$$(A6) \quad \dot{n} = \delta H_R n^\mu n^{*(1-\mu)} \quad 0 < \mu \leq 1$$

$$\Leftrightarrow (A6') \quad \frac{\dot{n}}{n} = \delta H_R \left(\frac{n^*}{n} \right)^{(1-\mu)}$$

and, symmetrically, that for high-technology enterprises is:

$$(A7) \quad \dot{n}^* = \delta^* H_R^* n^{*\mu} n^{*(1-\mu^*)} \quad \frac{1}{2} < \mu^* \leq 1$$

The assumption of full employment of human capital yields the following condition:

$$(A8) \quad H_R + H_R^* + H_Y = H$$

Profit maximisation in research implies:

$$(A9) \quad w_H = P_n \frac{\partial \dot{n}}{\partial H_R} = P_n \delta n^\mu n^{*(1-\mu)}$$

$$(A10) \quad w_H^* = P_n^* \frac{\partial \dot{n}^*}{\partial H_R^*} = P_n^* \delta^* n^{*\mu} n^{*(1-\mu^*)}$$

Intermediate Goods Sector

Discounted net profits of enterprise j take the following form¹⁴:

$$(A11) \quad \Pi_{tot} = -P_n + \int_t^\infty [m(j)x(j) - \eta x(j)] \cdot e^{-(\tau-t)r} d\tau$$

The no-entry condition is:

$$(A12) \quad P_n = \int_t^\infty [m(j)x(j) - \eta x(j)] \cdot e^{-(\tau-t)r} d\tau \quad (\Leftrightarrow \Pi_{tot}(t) = 0)$$

and profit maximisation subject to the demand constraint is:

$$(A13) \quad \begin{aligned} \text{Max}_{x(j)} \quad & \Pi_{tot} = -P_n + \int_t^\infty [m(j)x(j) - \eta x(j)] \cdot e^{-(\tau-t)r} d\tau \\ \text{s.c.} \quad & m(j) = (1 - \alpha - \beta) H_Y^\alpha L^\beta x(j)^{-\alpha-\beta} \end{aligned}$$

$$\text{i. e.} \quad \text{Max}_{x(j)} \quad \Pi_{tot} = -P_n + \int_t^\infty [(1 - \alpha - \beta) H_Y^\alpha L^\beta x(j)^{1-\alpha-\beta} - \eta x(j)] \cdot e^{-(\tau-t)r} d\tau$$

The equilibrium level of intermediate goods output obtained is the following:

$$(A14) \quad x(j) = \bar{x} = \frac{(1 - \alpha - \beta)^{2/\alpha+\beta} H_Y^{\alpha/\alpha+\beta} L^{\beta/\alpha+\beta}}{\eta^{1/\alpha+\beta}}$$

whence the equilibrium price for good j :

$$(A15) \quad m(j) = \bar{m} = \frac{\eta}{1 - \alpha - \beta}$$

From equations (A14) and (A15), we deduce the market value of the invention at equilibrium:

$$(A16) \quad P_n = \frac{\bar{m}\bar{x}}{r}(\alpha + \beta) = \frac{(\alpha + \beta)(1 - \alpha - \beta)}{r} \cdot \frac{Y}{N}$$

Consumption

The intertemporal utility function for consumers is as follows:

$$(A17) \quad U = \int_0^\infty \frac{C^{1-\theta} - 1}{1-\theta} e^{-\rho t} dt$$

$$\text{with} \quad \rho \in [0, \infty], \quad \theta \in [0, \infty]$$

The consumers' programme is:

$$(A18) \quad \begin{aligned} \text{Max}_{C,A} \quad U &= \int_0^\infty \frac{C^{1-\theta} - 1}{1-\theta} e^{-\rho t} dt \\ \text{s.t.} \quad \dot{A} &= W + rA - C \end{aligned}$$

where A represents the stock of financial assets of households, W households' wage income and r the market interest rate on financial assets.

Its solution implies:

$$(A19) \quad \frac{\dot{C}}{C} = \frac{(r - \rho)}{\theta}$$

Market for Skilled Labour

Equalisation of wage levels in the research sector ($w_H = w_H^*$) yields:

$$(A20) \quad P_n \delta n^\mu n^{*(1-\mu)} = P_n^* \delta^* n^{*\mu} n^{*(1-\mu^*)}$$

and equalisation of the prices of intermediate goods design ($P_n = P_n^*$)¹⁵ gives:

$$(A21) \quad \frac{\delta}{\delta^*} = \left(\frac{n^*}{n} \right)^{\mu + \mu^* - 1}$$

which implies:

$$(A22) \quad \frac{\dot{n}}{n} = \frac{\dot{n}^*}{n^*}$$

From this, it can be deduced that:

$$(A23) \quad \delta H_R \left(\frac{n^*}{n} \right)^{(1-\mu)} = \delta^* H_R^* \left(\frac{n}{n^*} \right)^{(1-\mu^*)}$$

or, combining equation (A24) with equation (A8):

$$(A24) \quad \begin{cases} H_R = \frac{1}{1 + \left(\frac{\delta}{\delta^*} \right)^{1/(\mu + \mu^* - 1)}} (H - H_Y) \\ H_R^* = \frac{\left(\frac{\delta}{\delta^*} \right)^{1/(\mu + \mu^* - 1)}}{1 + \left(\frac{\delta}{\delta^*} \right)^{1/(\mu + \mu^* - 1)}} (H - H_Y) \end{cases}$$

Lastly, equalising the remuneration levels of skilled labour implies:

$$(A25) \quad P_n \delta n^\mu n^{*(1-\mu)} = P_n^* \delta^* n^{*\mu} n^{*(1-\mu^*)} = \alpha N H_Y^{\alpha-1} L \bar{x}^{1-\alpha-\beta}$$

or, if we substitute for P_n the value obtained in (A16):

$$(A26) \quad H_Y = \frac{1}{\delta} \cdot \frac{\alpha}{(\alpha+\beta)(1-\alpha-\beta)} \cdot \left(\frac{n}{n^*}\right)^{-\mu} \cdot \left(1 + \frac{n}{n^*}\right) \cdot r$$

Long-term Growth Rate

Given that $x(j) = \bar{x}$, the production function for the final good is given by (A1'). If L , H_Y and $\bar{x}$ are fixed, output rises at the same rate as N , i.e.:

$$\frac{\dot{N}}{N} = \frac{\dot{n} + \dot{n}^*}{n + n^*} = \frac{n}{N} \cdot \frac{\dot{n}}{n} + \frac{n^*}{N} \cdot \frac{\dot{n}^*}{n^*}$$

and since the accumulation rates are equalised (A22), we have:

$$(A27) \quad \frac{\dot{N}}{N} = \frac{\dot{n}}{n} = \frac{\dot{n}^*}{n^*}$$

whence:

$$(A28) \quad g = \frac{\dot{C}}{C} = \frac{\dot{Y}}{Y} = \frac{\dot{N}}{N} = \delta H_R \left(\frac{n^*}{n}\right)^{(1-\mu)} = \delta^* H_R^* \left(\frac{n}{n^*}\right)^{(1-\mu^*)}$$

or:

$$(A29) \quad g = \delta \frac{\left(\frac{\delta}{\delta^*}\right)^{(1-\mu)/(\mu+\mu^*-1)}}{1 + \left(\frac{\delta}{\delta^*}\right)^{1/(\mu+\mu^*-1)}} H - \frac{\alpha}{(\alpha+\beta)(1-\alpha-\beta)} r$$

From the relationship between g and r obtained in equation (A19), we deduce the following expression for the economic growth rate:

$$(A30) \quad g = \frac{1}{1 + \Lambda \theta} \left[\delta \frac{\left(\frac{\delta}{\delta^*}\right)^{(1-\mu)/(\mu+\mu^*-1)}}{1 + \left(\frac{\delta}{\delta^*}\right)^{1/(\mu+\mu^*-1)}} H - \Lambda \rho \right]$$

with $\Lambda = \frac{\alpha}{(\alpha+\beta)(1-\alpha-\beta)}$

Comparative Statics

The partial derivative of g with respect to δ/δ^* gives the following expression

$$(A31): \quad \frac{\partial g}{\partial \left(\frac{\delta}{\delta^*} \right)} = \frac{\delta H}{1 + \lambda \theta} \left[\frac{\frac{1}{\mu + \mu^* - 1} \left(\frac{\delta}{\delta^*} \right)^{(2-2\mu-\mu^*)/(\mu+\mu^*-1)} \left[1 - \mu - \mu \left(\frac{\delta}{\delta^*} \right)^{1/(\mu+\mu^*-1)} \right]}{\left[1 + \left(\frac{\delta}{\delta^*} \right)^{1/(\mu+\mu^*-1)} \right]^2} \right]$$

whence

$$\frac{\partial g}{\partial \left(\frac{\delta}{\delta^*} \right)} \geq 0 \quad \Leftrightarrow \quad \left(\frac{\delta}{\delta^*} \right) \leq \left(\frac{1-\mu}{\mu} \right)^{(\mu+\mu^*-1)}$$

Determinants of Foreign Direct Investment

The system made up of equations (A10), (A16) and (A25) gives the following expression for n^* :

$$(A32) \quad n^* = \left[\frac{\alpha}{(\alpha + \beta)(1 - \alpha - \beta)} \cdot \frac{N}{\delta^* H_Y} \right]^{1/\mu^*} \cdot n^{(\mu^*-1)/\mu^*} \cdot r^{1/\mu^*}$$

or, alternatively:

$$\frac{n^*}{N} = \left[\frac{\alpha}{(\alpha + \beta)(1 - \alpha - \beta)} \cdot \frac{1}{\delta^* H_Y} \right]^{1/\mu^*} \cdot \left(\frac{n}{N} \right)^{(\mu^*-1)/\mu^*} \cdot r^{1/\mu^*}$$

Notes

1. In the model developed by Borensztein *et al.* (1998), FDI appears only through the fixed cost of the capital goods sector. Hence a complete solution of their model (which the authors do not present) would lead to a rate of balanced growth strictly identical to that of Romer (1990) and thus independent of the level of FDI.
2. Owing to the additively separable form of the production function with respect to intermediate goods, the invention of a new variety of goods does not make existing varieties obsolete.
3. K is a composite good, made up of a continuum of differentiated inputs which embody technology.
4. It will be remarked, however, that the producer of the final good pays no remuneration for the use of technical knowledge. This means that, since the production function does not show increasing returns with respect to the three remunerated factors of production, the production function in the final goods sector can be described as the result of the actions of a single representative enterprise which is aggregate and competitive.
5. For the sake of simplicity, it is indeed preferable to assume that enterprises with low-technology R&D sell their patents to low-technology enterprises and that those with high-technology R&D sell their patents to high-technology enterprises, which allows us to consider each enterprise in integrated form.
6. We thus make the same assumption as Romer concerning the non-competitive and non-exclusive character of knowledge in the research sector. We will also assume, however, that each researcher can use only a part of the sum of available knowledge to produce additional knowledge, which is not the case in Romer's model.
7. In 1991, according to Fukasaku and Wall (1994), 80 per cent of FDI projects involved manufacturing or processing industries (textiles, electronics, mechanical equipment and chemical products). Since the early 1990s, however, FDI flows seem to be increasingly oriented towards technically advanced enterprises (Broadman and Sun, 1997).
8. The existence of externalities generated by low-technology research can be justified if knowledge is broadly defined. In the case of China, foreign enterprises (more technology-intensive) face problems of familiarisation with the local economic, social and cultural system and hence can benefit from the presence of local (and less technology-intensive) enterprises.

9. If no distinction is made between research and production, this price (P_n or P_n^*) can be interpreted as a fixed cost of producing the intermediate good, which corresponds to an initial investment cost expressed as the cost of designing the product. It is this fixed cost which Borensztein *et al.* (1998) express as a function of FDI.
10. Owing to the existence of a fixed cost arising from research, the number of enterprises will grow only as long as the revenue obtained by each is at least equal to the fixed cost.
11. The size of the population being constant, the regular growth equilibrium sought is an equilibrium where output and consumption grow at the same rate.
12. Since n^*/n measures the ratio of foreign enterprises to domestic enterprises, it is reasonable to assume that this ratio is less than 1 at equilibrium.
13. Agarwal (1980) provides an excellent review of the theoretical and empirical literature on the determinants of foreign investment. For an empirical review, see also Pearce *et al.* (1992).
14. The simple form of the discount factor is due to the assumption that the interest rate r on loans denominated in goods is constant under conditions of balanced growth. A general formulation would involve introducing an average interest rate between dates t and τ , $\bar{r}(\tau, t) \equiv \frac{\int_t^\tau r(s)ds}{(\tau - t)}$, such that the discount factor is $e^{-(\tau - t) \cdot \bar{r}(\tau, t)}$.
15. At equilibrium the market value of an invention does not depend on the level of technology it embodies (see equation A16).

Database: Sources and Methodology

The statistical information used throughout this volume derives from China's official national accounts, published by the State Statistical Bureau. The database by province covers 29 provinces, autonomous regions and municipalities over the 1978-96 period¹. It was constructed from a variety of official Chinese sources published by the State Statistical Bureau², the *Almanac of China's Foreign Economic Relations and Trade* (various years) and Hsueh *et al.* (1993). Certain data being unavailable, the econometric analysis presented in Chapter 2 is restricted to a smaller number of provinces and years. Before 1983, no data are available for the geographical distribution of foreign investment, and until 1985, there are no data for a certain number of provinces. Also excluded from the econometric analysis, owing to the insufficiency or sporadic nature of the data concerning them, are Shanxi, Hainan, Guizhou and Qinghai provinces and the autonomous region of Inner Mongolia.

Various measures of income exist for each province, which distinguish in particular between national income (until 1992) and GDP and which reflect different methods of national income accounting. Since 1978, China has made great efforts to bring its statistical accounting system for national output and income into line with international standards. The State Statistical Bureau adopted the United Nations' system of national accounts (SNA) in 1985 and constructed new time series for GDP. Until 1993, it also preserved the previous system, the material product system (MPS)³, in which value added in the Chinese economy is measured by national income or net material product, defined as "the value created by labour in material production activities over a certain period" (SSB, *China Statistical Yearbook*, 1994, p. 52). In collaboration with Hitotsubashi University in Japan, the State Statistical Bureau recently converted the MPS national income data since 1952 into GDP time series for the country as a whole and for each province (State Statistical Bureau, 1997; State Statistical Bureau and Hitotsubashi University, 1997).

We decided to use the GDP series, which includes the tertiary sector and probably provides a more comprehensive view of economic activity in each province than does the national income variable alone⁴. The GDP is structured as follows: the primary

sector comprises agriculture, livestock raising, forestry and fishing; the secondary sector, industry (mining, manufacturing, electricity, water and gas utilities) and construction; and the tertiary sector, distribution and services.

Apart from any problems involving the reliability of official Chinese data⁵, data gathering brings to light a number of shortcomings that are worth pointing out. The most noteworthy have to do with the publication of separate price indices (consumption, output, investment, etc.) for each province. Only GDP is expressed in “comparable prices”, making it possible to derive an implicit deflator measured by the ratio of current GDP to the GDP expressed in “comparable prices”. As Chow (1994) points out, the advantage of this implicit deflator is that it is probably more complete than the retail price index, which does not take into account the cost of services or the prices of agricultural products and does not include energy-related products (petrol, coal, fuel oil)⁶. Moreover, as Guillaumont and Boyreau Debray (1996) have indicated, this deflator tends to rise more rapidly than the retail price index⁷. On the other hand, the retail price index — the only price index by province that is available for the entire period — is certainly more flexible than the implicit deflator and is a better reflection of market prices since it is based on prices set by the government, on negotiated prices and on free-market prices (weighting coefficients, which are not divulged, are applied to each of these three categories of prices). Apart from GDP, all variables expressed in real terms in Chapters 1 and 2 are therefore deflated by the retail price index for each province (base 100 = 1978).

As for the variables expressed in US dollars (exports, imports and FDI), the lack of detailed statistical information led us to select a conversion method using the official exchange rate⁸ and an assumption of identical deflators for production. It should be emphasised that these assumptions are not very satisfactory, given the obvious heterogeneity resulting from the dual exchange rate system, the foreign exchange retention system and the modification of the exchange rate system over the period studied.

Finally, it is worth mentioning that the foreign investment variable used in the econometric analysis in Chapter 2 includes data for both foreign direct investment and loans from abroad. This overall variable was used rather than the variable for FDI alone because it enabled us to use a broader sample. Nevertheless, it should be pointed out that at the provincial level, foreign loans also constitute a form of investment used to carry out major regional industrial projects. Furthermore, the results obtained in Chapter 2 remain valid on a restricted sample for which the FDI data alone were used.

Notes

1. Statistics concerning the municipality of Chongqing are not treated separately from those for Sichuan province for the period before 1997. The autonomous region of Tibet was excluded from the database because data were lacking for most of the variables considered. As for Hainan province, which was a district of Guangdong province until 1988, most of the statistics used are from Hsueh *et al.* (1993) and State Statistical Bureau (1996), and have already been corrected.
2. The State Statistical Bureau publishes various statistical yearbooks on an annual basis. The list of those used appears in the Bibliography.
3. Ruoen (1997) points out that even today, “China’s national accounting system remains a hybrid between the material product system (MPS) and the United Nations’ system of national accounts (SNA)”. Official statistics concerning production of a certain number of services remain particularly questionable.
4. As Tsui (1996) points out, given that the share of the tertiary sector in GDP varies from one province to another, omitting this sector will have some effect on the analysis of growth by province.
5. Two recent OECD Development Centre studies (Ruoan, 1997; Maddison, 1998) suggest adjustments which attempt to take into account problems linked to over- or underestimation of China’s official statistics.
6. The general retail price index is composed of an urban index and a rural index. The former reflects price levels for consumer goods sold in the market. The latter reflects both the prices of rural consumer goods and the means of agricultural production.
7. Guillaumont and Boyreau Debray (1996) add that the use of the retail price index as the GDP deflator results in over estimation of growth in coastal provinces. They suggest two reasons for this: services are underrepresented in this index, and prices of export products are not counted at all. These two factors would tend to lower the rate of increase of the retail price index for the coastal provinces (where services and exports are important sectors) with respect to the implicit GDP deflator.
8. The exchange rate used for currency conversions comes from *International Financial Statistics Yearbook* (1997).

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