Do Economic Reforms Accelerate Urban Growth? The Case of China

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Abstract

This paper examines the determinants of city growth in China. We provide evidence that economic reforms played an important role in accelerating urban growth. The relative magnitude of the state sector has a negative impact on city growth, and the city's openness to foreign direct investment has a positive impact on city growth. The results also lend support to the impact of other factors on urban growth, such as geography, industrial structure and human capital accumulation.

Keywords: Urban; Growth; Economic Reforms; Foreign Direct Investment

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1. Introduction

Interest in the study of urban growth has grown rapidly. City growth is an important issue in both the urban economics and economic growth literatures, as Davis and Henderson (2003) observe, "Urbanization and economic development go hand-in-hand as a country moves from a rural-agricultural base to an urban-industrial base"(p98). Identification of the sources of urban growth is important for developing policies to facilitate both urbanization and economic growth. Most empirical studies in urban growth focus on the experience of developed countries, especially the US. Glaeser et al. (1995) examined the growth in U.S. cities between 1960 and 1990 and found that both income and population growth are positively related to initial schooling and initial manufacturing share, and negatively related to initial unemployment. Crihfield and Panggabean (1995) studied the long-term trend of income growth in U.S. cities and found a significant convergence trend during the period 1960-77 but that income convergence slowed in more recent years. Glaeser and Shapiro (2003) identified three main determinants of growth of U.S. cities in the 1990s: human capital bases, dryness and temperature, and public transportation. In this paper we examine these factors to see if they are also important for urban growth in a large developing country, namely China. Moreover, we investigate how economic transition might affect urban growth since China is also the world's largest transition economy.

The economic reforms that started in the late 1970s have prompted several fundamental changes in China's economic and social structure. The closed central-planning system has been gradually changing into a modern market economy that is increasingly being integrated into the world economy. We focus on two indicators of these economic reforms: the importance of the state sector and the openness of cities to foreign direct investment (FDI). Initially, the pre-

reform central-planning system was dominated by the state sector, however the rapid decline of the state and growth of the private sectors has been the most striking feature of the reform period. Thus the importance of the state sector could be treated as one indicator of the pace of economic transition. With regard to FDI, the openness to foreign trade and foreign investment has long been recognized as an engine of economic growth in China (see, e.g., Chen and Warner, 1996; Fujita and Hu, 1999, Demurger, et. al., 2001; Zhang, 2001, Gao, 2003). However, there are few empirical studies linking city growth to the openness of cities to foreign trade. Lin and Song (2002) used a sample of 189 Chinese large and medium size cities from 1991-1999 to examine the determinants of city growth. They found that several factors including foreign direct investment, the extent of paved roads and levels of government expenditure in science are positively linked with per capita GDP growth; and the total government spending share in GDP has a negative impact on per capita GDP growth. In our study, we use the share of FDI in city total fixed investments to measure the openness of a city. By including these two indicators in city growth regressions, our study sheds light on the importance of the economic reforms on urban growth.

Our results indicate that the decline of state sector and openness to FDI accelerated urban growth in China. The magnitude of the state sector has a significantly negative effect on city income growth, and the magnitude of FDI has a significantly positive effect on city growth. Our results also lend support to the influence of other factors identified in the literature, such as geography, industrial structure and human capital accumulation.

The remainder of this paper is organized as follows: Section 2 describes the process of urbanization in China from 1949 to 1999. Section 3 discusses the urban characteristics that are closely linked with urban growth. In Section 4, we investigate the effect of economic reforms on urban growth in the 1990s. Section 5 concludes.

2. Descriptive Empirics of Urban Growth in China

There are generally three definitions of an urban unit: an administratively defined "urban place", a "metropolitan area" and an "urban agglomeration." [1] Metropolitan areas or urban agglomerations are collections of contiguous urban places. "Urban agglomeration, defined as a central city and neighbouring communities linked to it by continuous built-up areas or many commuters" (Soo, 2002, p.7). The distinction between urban agglomeration and metropolitan areas is less clear. In China cities are defined as "urban places" that correspond to local administrative and jurisdictional entities. There are three different administrative levels of Chinese cities: municipalities (province-level cities), prefecture-level cities and county-level cities, each having the same status as the province, prefecture and county, respectively. Urban places with townships or a lower jurisdictional level are not treated as cities. This administratively defined "city" is less optimal than the "urban agglomeration" or "metropolitan area". Due to data limitations, information on "metropolitan areas" is not available for China and because the information on suburbs that are closely linked with central cities is not available, we are unable to aggregate the continuous urban places into "metropolitan areas". However, given the consistent city definition over time, it's still informative to investigate the growth pattern of these central cities.

The data used in our study are mainly compiled from various issues of *Urban Statistical Yearbooks of China* (State Statistical Bureau, 1985-2000). Information on city level Gross Domestic Product (GDP) is not available before 1990, and thus our study focuses on the period 1990-1999. Since there is no urban area consumer price index available, the relevant provincial annual

[1] See Henderson (1997) for the details.

consumer price index (CPI) is used to deflate nominal GDP into 1990 constant prices, for the years 1990 to 1999. The CPI data is compiled from various Provincial Statistics Yearbooks (1991-2000) and the information on various urban characteristics in 1990 is compiled from *Urban Statistical Yearbook of China* (State Statistical Bureau, 1991). The information on education levels in Chinese cities in 1990 is compiled from *Population Statistical Yearbook of China* (State Statistical Bureau, 2000).

[Table 1 about here]

Table 1 shows the growth in the number of cities and urban population from 1949 to 1999. Before The People's Republic of China was established in 1949, there were only 67 cities, 9 in Taiwan and 58 in China. For economic and political reasons, in 1949 four cities were dropped and 78 counties were redefined as cities, thus the total number of cities increased to 132 (excluding the Taiwanese cities after 1949) with a 39.49 million urban population.

Generally, there were four stages in the Chinese urbanization process[2]. The first was a stable growth period from 1949 to 1957. 1949 to 1952 was an adjustment period when the total number of cities increased from 132 to 153. In the first "Five-year Plan" (1953 - 1957), the total number of cities increased to 176. The urban population had grown to 70.77 million, and the level of urbanization had risen to 10.9%. The second stage included an expansion period from 1958 to 1961 and a contraction period from 1962 to 1965. In the "Great Leap Forward" (1958-1961), the total number of cities increased to 208, the urban population grew to 101.31 million, and the proportion of urban to national total population increased to 15.4%. In the national economic readjustment period (1962-1965), the total number of cities decreased to 168, the urban population decreased to 88.58 million, and the percentage of urban population fell to

[2] See *The Forty Years of Urban Development* (State Statistical Bureau, 1990) for detail information about Chinese urbanization process.

12.2%. The third stage was the period of economic stagnation (1966 - 1978). During this time the total number of cities increased by only 26. The urban population stabilized at between 90 and 110 million implying a level of urbanization of about 11% - 12%. The fourth stage was the economic reform period starting in 1978 when the urbanization process accelerated significantly. The total number of cities increased from 193 in 1978 to 667 in 1999, an increase of 245.6% in twenty years. The urban population jumped to more than 200 million, and the share of urban population increased to about 40%. Our study is motivated by this striking acceleration of the urbanization process during the economic reform period.

3. The Determining Factors of Urban Growth

Urban growth involves two processes: the expansion of existing cities and the formation of new cities. We focus on the income and population growth of existing cities. In the period from 1990 to 1999, Chinese cities experienced an unusually rapid expansion in both city size and income. The cross-city variation in urban growth is also substantial. Rows 2 and 3 in Table 3 show the annual growth rate of city income and size. The average city income increased annually by about 18.3%, with a standard deviation roughly equal to the mean. The annual growth rate of city size is about 3.4%, and the standard deviation is almost four times the mean, implying a substantial cross-city variation.

[Table 2 about here]

Which kind of city grows faster? Which economic factors facilitate urban growth? In this section we try to answer these questions by investigating the linkage between urban characteristics in 1990 and urban income and population growth between 1990 and 1999. We

identify several potentially important urban characteristics, the statistics of which are summarized in Table 2.

3.1 Economic Transition and Openness of Cities

The economic reforms starting in the late 1970s have transformed a closed centrally - planned system into a modern market economy open to world markets. We are mostly interested in how these economic reforms affect urban growth. They have not been uniformly spread across regions. Certain regions have advanced more rapidly than others in the transformation. One of the most significant characteristics of the transition is the decline of the state-owned sector and the expansion of the private sector. Economic reforms have improved economic incentives, facilitated resource allocation, and removed impediments to the development of the private sector. The declining share of the state sector in China's economy implies that the private sector is becoming more important, and is more likely to increase city production capacity. We use the share of the state sector in total industrial output as an indicator of the extent of reform and expect a negative link between the share of the state sector and city growth. As Table 2 shows, state enterprises still retained a dominant role in city production for most cities in 1990. The average state share was about 97.2% while some cities had a very low share of the state sector of around 25%.

With respect to foreign trade China adopted "The Opening Door" policy in the early reform period and, as a consequence the volume of foreign trade and foreign direct investment in China grew rapidly, especially in the 1990s. The openness to foreign trade and foreign investment has long been recognized as one of the engines of economic growth in China (see, e.g., Chen and Warner, 1996; Demurger, et. al., 2001; Zhang, 2001, Gao, 2003). While the information on the level of foreign trade in cities is not available, the Urban Statistics Yearbooks report the flow of FDI into each city. We use the share of FDI in total fixed investment as a

proxy to measure the openness of cities and expect a positive impact of FDI on city growth. In 1990, the level of openness was low—less than 50% of cities had foreign direct investments (FDI). The average share of FDI in total fixed investments was only 1% while for certain cities, more than 50% of investments came from foreign investors.

3.2 The Industrial Structure

The initial industrial structure of cities may play an important role in urban growth. Changes in the sectoral composition of cities in the urbanization process are well documented in the literature. In the urbanization and industrialization process, employment in the agricultural sector shifts toward the manufacturing sector, and then toward the service sector. The importance of the manufacturing sector relative to the service sectors may affect the pace of city growth. A popular view is that manufacturing cities tend to expand in the early stages of industrialization but decline in the later compared to service-oriented cities. The service industries may be more skill intensive than the manufacturing industries and thus grow faster. Glaeser et al. (1995) found that both the income and the population growth in the U.S. are negatively related to the initial share of employment in manufacturing.

[Figure 1 and 2 about here]

Figure 1 shows the industrial shift measured by the average GDP share of the primary, secondary and tertiary sectors for 240 prefecture-level cities in China. First, it shows that the secondary sector remained the most important in city production, and that the primary sector had the smallest share in city GDP. Second, the figure indicates a time trend of industry structure shift. In the period 1990-1993 the GDP share of the primary sector steadily decreased from 15% to 10%, while both the secondary and tertiary sectors grew steadily. This implies a sectoral shift from the agricultural sector toward both the manufacturing and service industries. After 1993, the GDP share of the primary sector remained around 10%. The share of the

secondary sector significantly decreased, and the share of the tertiary sector grew steadily over time. This suggests that city production shifted from the secondary sector into the tertiary sector. Figure 2 shows the variation of the industrial share across cities. Substantial variation comes from the primary sector, with its standard deviation higher than its mean. The inter-city variations of the secondary and tertiary sectors are also significant, implying considerable variation in the industrial composition of cities.

The mix of manufacturing industries in the cities is also of interest. Unfortunately, we only have information on the city-level manufacturing industrial structure for 1990. Instead of examining the time variation of the manufacturing composition, we provide a cross section comparison of the diversity and specialization of cities. Following Duranton and Puga (2000), we use a relative diversity index to measure the diversity level of cities. The relative diversity index is defined as: $RDI_i = 1/\sum_j |s_{ij} - s_j|$, where s_{ij} is the share of industry j in city i and s_j is the share of industry j in national employment. Ranked by the relative diversity index, the most specialized and most diversified cities are listed in Table 3. The main industries of the most specialized cities are resource intensive, such as those involving coal mining, tobacco, petroleum and metal smelting. These industries rely heavily on local natural endowment.

[Table 3 about here]

The positive link between diversity and size of cities is well documented[3]. Table 3 also reports the income and size ranking for the most specialized and most diversified cities. Diversified cities are generally in the upper tail of the city size distribution, and the specialized cities tend to be in the lower tail. The overall correlation coefficient between the relative diversity index and city size is 0.564.

[3] See Duranton and Puga (2000) for details.

3.3 Other Characteristics

It is often argued in the economic growth literature that infrastructure investment is an important factor in engendering self-sustaining productivity gains and long-term growth (see, e.g., Barro, 1990; Jimenez, 1995). Demurger (2001) summarizes the national trends and spatial distribution of infrastructure investments in China. He found that differences in infrastructure did account for a significant part of the observed variations in the growth performance of Chinese provinces. Unfortunately, we do not have information on city-level government investments in the public infrastructure. We use government expenditures per capita in each city as a limited indicator.

Human capital accumulation plays a critical role in the endogenous growth model (see, e.g., Romer, 1990; Barro and Sala-i-Martin, 1995), and numerous empirical studies have revealed a positive link between human capital and regional growth. Glaeser et al. (1995) found that city growth in the U.S. is positively related to initial schooling. Simon and Nardinelli (2002) found that cities with higher average levels of human capital grew faster throughout the 20th century. They cite two reasons for this: "(a) knowledge spillovers are geographically limited to the city and (b) much knowledge is most productive in the city within which it is acquired" (Simon and Nardinelli, 2002, page 59). Glaeser and Shapiro (2003) provide international evidence supporting the view that cities with strong human capital bases grow faster. We use two measures of human capital accumulation: one is the fraction of employees in science and technology, which measures the skill composition of the labor force. Another one is the fraction of people with various education levels in the total population. As Table 3 shows, the skill composition of the urban labor force was low: less than 10% of employees were involved in science and technology in 1990. Because primary education was mandatory in China, primary enrollment was high, about 84%, and the variation across cities was very low. In contrast, the

average fraction of persons with at least a college education in the total urban population is only 3%, and the standard deviation is almost the same as the mean. This implies that the main cross-city variation in human capital accumulation is reflected in the enrollment in higher education..

Regional dummies are used to control for the effects of the geographic characteristics of cities (such as temperature and dryness), and of governmental regional development policies on city growth (there were changes in regional development policy priorities in China, in the reform period, the eastern coastal cities enjoyed favorable government policies and investments). Regional dummies also include the effects of foreign-market potential. With openness to world trade, coastal cities have much easier access to foreign markets than their inland competitors.

4. The Results

4.1 Baseline Results

To study the determinants of city growth, we estimate the following growth equations:

$$\begin{aligned} \log(y_{i,1999}/y_{i,1990}) &= \alpha_{0y} + \alpha_{1y}\log(y_{i,1990}) + \alpha_{2y}\log(N_{i,1990}) + \delta_y X_{i,1990} + \varepsilon_{iy} \\ \log(N_{i,1999}/N_{i,1990}) &= \alpha_{0N} + \alpha_{1N}\log(y_{i,1990}) + \alpha_{2N}\log(N_{i,1990}) + \delta_N X_{i,1990} + \varepsilon_{iN} \end{aligned} \quad (1)$$

where $y_{i,t}$ is real GDP per capita of city i in year t; $N_{i,t}$ is the total population of city i in year t. X is the different variables of urban characteristics. The variables $X_{i,1990}$ include: (1) an index of industrial structures: the ratio of manufacture output relative to service output; (2) an index of economic reform: GDP share of state economy; (3) an index of openness of city: the share foreign direct investment (FDI) in investments; (4) an index of geographic location: coastal eastern, central and western regional dummies; (5) an index of public investment: local government expenditure per capita; (6) the indexes of human capital accumulation: the fraction of personnel in science and technology of total employees; the fraction of people with at least

elementary school education (6 years); the fraction of people with at least middle school education (9 years); the fraction of people with at least high school education (12 years); the fraction of people with at least college education (16 years).

[Table 4 about here]

Ordinary Least Squares estimates for city income growth equation and city population growth equation are reported in Table 4. White's correction for heterodcedasticity (White, 1980) is applied to standard error calculations. Column 2 and 7 of Table 4 present the regression of city growth only on the initial income and size. Other columns include various urban characteristics in the regression. The regression equations explain about a quarter of the variation in city growth. The results show a significant pattern of both income convergence and size convergence. Small cities grew faster than large cities, and poor cities tended to catch up with the rich cities. On the one hand, the initial city size has a significant and positive effect on the income growth of cities, which implies a local scale effect on city productivity. On the other hand, initially rich cities are more attractive to migration and experience more rapid expansion in the city population.

The determinants of city population growth and income growth in China are different. The overall correlation coefficient between the growth rate of city population and income is –0.359. The income growth captures the growth of city productivity, and population growth captures the attractiveness to migrants. If labor is fully mobile across cities, and migration responds to growth opportunities, then the determinants of city population growth and income growth are expected to be similar. One possible reason for the difference between the city population growth and income growth processes in China is that the inter-regional migration limits prevent population migration from fully responding to the city growth opportunities (see, e.g., Chan, 1994, Au and Henderson, 2002). We perform a Breusch-Pagan test (Breusch and

Pagan, 1980) for the independence of these two equations. The correlation coefficient between the residuals of two equations is -0.305. The null hypothesis that the disturbance covariance matrix is diagonal (independent equations) is rejected at a significance level of 5%.

As Table 4 shows, the estimated coefficient of the share of the state sector is significant and negative. The per capita income of cities with a lower share of the state sector grew faster. The estimated coefficient of the share of FDI is significant and positive, which implies that city growth is positively correlated with access to FDI. These results underline the importance of economic reform and openness to FDI in stimulating city income growth.

Our results also highlight the roles of other characteristics that are identified in the urban growth literature. The estimated coefficient on the ratio of manufacturing to service output is negative and significant in the population growth regression implying that an expansion of the service sector (financial and commercial industries for example) brings higher growth opportunities and attracts more migrants. Cities with a larger service sector proportion tend to grow faster. Human capital plays an important role in city population growth. While the coefficient of the share of skilled workers in the labor force is not statistically significant the fraction of people with at least a college education is highly significant reflecting a growing demand for highly educated labor.

There are substantial variations in income growth across geographic regions – a circumstance that has long been recognized. The regional dummies indicate significant effects: the coastal eastern cities have experienced a much higher growth rate than inland cities. This geographic heterogeneity comes from several sources: government policies favoring coastal cities, easy access to foreign markets in coastal cities, and other geographic natural features, such as dryness and temperature. Per capita government expenditures have had an insignificant effect on income growth.

4.2 Robustness Test

To test the robustness of the previous results, the study period is extended into the 1980s. The difficulty with this extension is that the measure of income, GDP of each city, was not reported in the 1980s. Using the Gross Output Value (GOV) of industry as the measure of city income for a comparison between different periods, we repeat the same exercise for city growth in the 1990's. Information on city government expenditure and city education level is not available for 1985. The results of city income growth and city population growth are reported in Table 5 and Table 6, respectively.

[Table 5 and Table 6 are about here]

Tables 5 and 6 show a consistent pattern of city growth in different periods. First, both city income and city population show a significant convergence trends. Second, the share of FDI in total investment has a significant and positive impact on city income growth, and the share of the state sector has a significant and negative impact on city growth. This confirms the previous findings that economic reform and openness of cities play important roles in accelerating city growth. Compared to the period 1990-1999, the effects of economic reform are weaker in the period 1985-1990.

5. Conclusion

The strikingly rapid urbanization process in China during the economic reform period has attracted increasing attention. This paper provides empirical evidence on the significant influence of economic reforms on urban growth in China, with a special focus on the period 1990-1999. The extent of the state economy, as an indicator of economic transition, has a negative effect on urban growth; and the openness of cities to foreign direct investment has a

significantly positive effect on urban growth. Our study also stresses the importance of other factors identified in the literature, such as geographic factors, industrial structure and human capital accumulation.

Our study has focused on the expansion of existing cities, we have not discussed another important aspect of Chinese urban growth namely the formation of new cities. The Chinese urbanization process in the reform period is characterized by rapid formation of new cities. The number of cities tripled from 1978, the starting point of economic reform, to 1999. The mechanism behind the formation of new cities in this era could prove to be a fruitful topic for further investigation.

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Table 1

The Number of Cities and Urban Population in China, 1949-99

Year	Total cities	Urban Population (10,000 persons)	Share in National Population (%)
1949	132	3949.05	7.3
1952	153	4788.00	8.3
1957	176	7077.27	10.9
1961	208	10131.47	15.4
1965	168	8857.62	12.2
1970	177	9324.11	11.2
1978	193	11657.06	12.1
1980	223	13418.42	13.6
1985	324	21231.49	20.1
1990	467	33542.83	29.3
1994	622	47782.76	39.9
1999	667	53171.72	42.6

Source: *Cities China, 1949-1998*, China Statistic Press, Beijing, 1999.

Table 2

Summary of Statistics of Urban Characteristics

				Quartile Values				
	Mean	S.D.	Min	25%	Median	75%	Max	Observation
Annual growth rate of city income	0.183	0.179	-0.030	0.091	0.142	0.223	1.880	455
Annual growth rate of city size	0.034	0.118	-0.086	0.007	0.014	0.025	1.682	455
Log (GDP per capita in 1990)	7.605	0.584	6.274	7.178	7.508	8.028	10.208	455
Log (Population in 1990)	3.979	0.800	0.148	3.543	4.030	4.484	6.664	455
Log (Employment in 1990)	3.334	0.846	-1.079	2.869	3.375	3.872	6.175	455
Log (Wage in 1990)	7.623	0.379	5.585	7.479	7.604	7.732	12.471	455
The ratio of manufacture to service in 1990	2.012	1.440	0.203	1.139	1.652	2.435	13.956	455
The relative diversity index	1.077	0.349	0.529	0.552	1.027	1.230	3.674	455
The share of FDI in total fixed capital investment	0.010	0.040	0	0	0	0.004	0.510	455
The share of state economy	0.972	0.082	0.256	0.982	0.998	1	1	455
Government expenditure per capita	5.181	0.709	3.708	4.615	5.130	5.720	8.426	455
The fraction of employees in science and technology	0.076	0.036	0.007	0.050	0.072	0.096	0.354	455
The fraction of people with at least a elementary school education	0.843	0.062	0.517	0.810	0.851	0.888	0.963	455
The fraction of people with at least a middle school education	0.476	0.128	0.062	0.375	0.464	0.589	0.794	455
The fraction of people with at least a high school education	0.171	0.087	0.039	0.097	0.148	0.241	0.445	455
The fraction of people with at least a college education	0.030	0.027	0.003	0.009	0.021	0.044	0.145	455

Note: the measure of size is the log of city population (10,000); the measure of income is the log of real GDP per capita (in 1990 constant price)

Table 3

Diversity and Specialization of Cities, 1990

Relative Diversity Index	Most Diversified Cities	Income Rank	Size Rank	
3.674	Tianjing	42	3	
2.877	Jinan	58	14	
2.618	Shanhai	12	1	
2.316	Hangzhou	17	41	
2.234	Wulumuqi	27	62	
2.232	Nanchang	137	37	
2.110	Beijin	15	2	
2.108	Wuhan	109	5	
2.065	Hefei	78	98	
2.007	Qingdao	47	16	
Relative Diversity Index	Most Specialized Cities	Income Rank	Size Rank	Major Industrial Specialization
0.529	Jingchang	8	434	Smelting & Pressing of Nonferrous Metals
0.543	Dongying	5	206	Petroleum and Gas Production
0.543	Kelamayi	3	417	Petroleum Processing & Coking Product
0.551	Qitaihe	261	297	Coal Mining
0.556	Heshan	336	438	Coal Mining
0.559	Daqing	2	107	Petroleum Processing & Coking Product
0.571	Yuxi	7	353	Tobacco
0.576	Huolingele	197	458	Coal Mining
0.583	Shiyan	20	317	Transportation Equipment
0.585	Shuzou	178	275	Coal Mining

Table 4
Determinants of City Growth, 1990-99

	City Income Growth						City Population Growth					
Intercept	1.10**	2.29**	2.34**	2.17**	2.37**	2.39**	-0.50**	-0.99**	-0.98**	-0.67*	-0.47	0.11
	(4.22)	(4.94)	(5.24)	(3.86)	(3.79)	(4.03)	(-2.19)	(-2.77)	(-2.80)	(-1.66)	(-1.00)	(0.24)
Log (GDP per capita in 1990)	-0.11**	-0.20**	-0.19**	-0.18**	-0.20**	-0.20**	0.17**	0.18**	0.18**	0.14**	0.13**	0.09**
	(-3.35)	(-2.55)	(-2.29)	(-2.12)	(-2.35)	(-2.45)	(7.22)	(3.74)	(3.47)	(2.64)	(2.45)	(1.96)
Log (Population in 1990)	0.10**	0.06**	0.06**	0.06**	0.06*	0.06	-0.16**	-0.13**	-0.13**	-0.13**	-0.14**	-0.17**
	(3.25)	(2.07)	(1.99)	(2.00)	(1.93)	(1.82)	(-4.73)	(-3.97)	(-4.01)	(-4.06)	(-4.14)	(-4.63)
Coastal dummy		0.32**	0.33**	0.32**	0.33**	0.33**		-0.06	-0.06	-0.05	-0.04	-0.02
		(6.20)	(6.40)	(6.24)	(5.91)	(6.11)		(-1.36)	(-1.27)	(-1.21)	(-0.88)	(-0.41)
Central dummy		0.17**	0.17**	0.18**	0.17**	0.17**		0.03	0.03	0.01	0.02	0.03
		(3.49)	(3.64)	(3.77)	(3.62)	(3.54)		(0.64)	(0.68)	(0.28)	(0.41)	(0.74)
The ratio of manufacture to service in 1990		0.01	0.01	0.01	0.02	0.02		-0.04**	-0.04**	-0.04**	-0.03**	-0.02**
		(1.09)	(1.02)	(1.02)	(1.12)	(1.15)		(-3.91)	(-3.92)	(-3.78)	(-3.25)	(-2.56)
The share of FDI in total fixed capital investment		1.63**	1.64**	1.62**	1.63**	1.63**		0.15	0.15	0.16	0.15	0.18
		(2.51)	(2.47)	(2.51)	(2.42)	(2.43)		(0.49)	(0.47)	(0.54)	(0.50)	(0.61)
The share of state economy		-0.58**	-0.61**	-0.59**	-0.63**	-0.63**		0.12	0.07	-0.002	-0.02	-0.06
		(-2.02)	(-2.08)	(-2.01)	(-2.14)	(-2.17)		(0.51)	(0.30)	(-0.01)	(0.48)	(-0.27)
Government expenditure per capita		-0.01	-0.002	0.006	-0.01	-0.01		0.06*	0.06*	0.04	0.02	-0.01
		(-0.11)	(-0.04)	(0.11)	(-0.17)	(-0.16)		(1.80)	(1.85)	(1.08)	(0.48)	(-0.18)
The fraction of employees in science and technology			0.67	0.67	0.65	0.64			0.68	0.64	0.62	0.44
			(1.42)	(1.43)	(1.37)	(1.34)			(1.62)	(1.56)	(1.48)	(1.07)
The fraction of people with at least element school education			-0.14						-0.01			
			(-0.44)						(-0.03)			
The fraction of people with at least middle school education				-0.14						0.32*		
				(-0.59)						(1.73)		
The fraction of people with at least high school education					0.09						0.63*	
					(0.22)						(1.81)	
The fraction of people with at least college education						0.28						3.68**
						(0.28)						(3.40)
Number of observations	455	455	455	455	455	455	455	455	455	455	455	455
Adjusted R^2	0.07	0.24	0.25	0.25	0.25	0.25	0.18	0.22	0.22	0.23	0.23	0.25

Note: t-statistics are provided in parenthesis. * and ** represent significance at the 10% and 5% levels respectively.

Table 5

Determinants of City Output Growth, 1985-99

	1985-90		1985-94		1985-99		1990-99	
Intercept	2.418***	2.284***	3.395***	4.454***	3.647***	4.672***	5.460***	2.665***
	(4.95)	(3.41)	(7.14)	(8.62)	(8.10)	(9.00)	(3.52)	(4.04)
Log (gross output value of industry per	-0.242***	-0.270***	-0.384***	-0.429***	-0.421***	-0.457***	-0.674***	-0.811***
capita in 1990)	(-5.09)	(-5.78)	(-7.04)	(-8.15)	(-8.73)	(-9.95)	(-3.66)	(-7.82)
Log (Population in 1990)	-0.006	0.006	0.121*	0.063	0.124**	0.079	0.145**	0.124**
	(-0.09)	(0.10)	(1.89)	(1.13)	(0.062)	(1.42)	(2.52)	(2.12)
Coastal dummy		0.296***		0.226*		0.375***		0.329***
		(2.76)		(1.70)		(2.75)		(2.52)
Central dummy		0.180		-0.282**		0.019		0.035
		(0.94)		(-2.26)		(0.14)		(0.29)
The share of FDI in total fixed capital		0.120		2.355***		2.058**		0.480***
investment		(0.11)		(2.72)		(2.26)		(3.19)
The share of state economy		0.283		-0.736**		-1.052***		-0.830**
		(0.49)		(-1.99)		(-2.78)		(-2.09)
The fraction of employees in science and		-1.152		0.851		0.563		2.994*
technology		(-1.07)		(0.80)		(0.52)		(1.74)
The fraction of people with at least								1.697***
element school education								(2.09)
Government expenditure per capita								0.502***
								(4.49)
Observation	220	220	220	220	220	220	220	220
R-square	0.04	0.05	0.24	0.44	0.26	0.45	0.580	0.756

Note: t-statistics are provided in parenthesis. *, ** and *** represent significance at the 10%, 5%, and 1%, levels respectively.

Table 6

Determinants of City Population Growth, 1985-99

	1985-90		1985-94		1985-99		1990-99	
Intercept	-0.004	0.147	-0.046	0.195	0.136	0.443	0.263	-0.401**
	(-0.03)	(1.23)	(-0.34)	(1.09)	(0.52)	(1.48)	(1.16)	(-2.03)
Log (gross output value of industry per capita in 1990)	0.057***	0.073***	0.116***	0.138***	0.151***	0.171***	0.069***	0.028*
	(3.97)	(3.76)	(5.75)	(5.54)	(5.77)	(5.35)	(3.01)	(1.73)
Log (Population in 1990)	-0.082***	-0.087***	-0.160***	-0.159***	-0.252***	-0.258***	-0.163***	-0.126***
	(-5.66)	(-5.46)	(-7.26)	(-7.24)	(-6.75)	(-7.11)	(-4.86)	(-3.92)
Coastal dummy		-0.076		-0.156**		-0.150**		-0.065
		(-1.45)		(-2.42)		(2.09)		(-1.48)
Central dummy		-0.006		-0.007		-0.009		0.022
		(-0.16)		(-0.13)		(-0.14)		(0.47)
The share of FDI in total fixed capital investment		0.204		0.575		0.785*		0.020
		(0.55)		(1.27)		(1.66)		(0.44)
The share of state economy		-0.372***		-0.540***		-0.601***		-0.145*
		(-2.91)		(-3.09)		(-3.49)		(-1.84)
The fraction of employees in science and technology		0.657**		0.554*		0.813*		0.693*
		(2.57)		(1.66)		(1.74)		(1.66)
The fraction of people with at least element school education								0.240
								(1.09)
Government expenditure per capita								0.136***
								(5.16)
Observation	321	321	320	320	315	315	456	456
R-square	0.09	0.13	0.17	0.21	0.25	0.29	0.15	0.21

Note: t-statistics are provided in parenthesis. *, ** and *** represent significance at the 10%, 5%, and 1%, levels respectively.

Figure 1

Industrial GDP Share of Chinese Cities, 1990-99

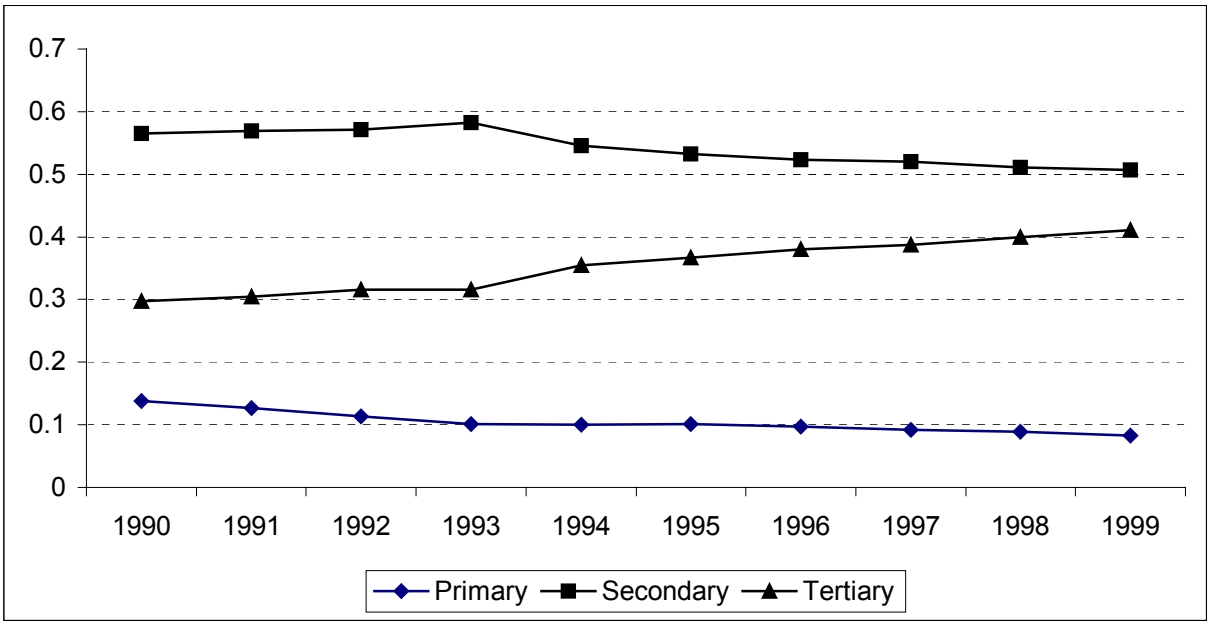

Figure 2

The Coefficient of Variation of Industrial GDP Share