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Growth and Regional Inequality in China During the Reform Era

By: Derek Jones, Cheng Li and Ann L. Owen

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Derek Jones
djones@hamilton.edu

Cheng Li
cli@hamilton.edu

Ann L. Owen*
aowen@hamilton.edu

Hamilton College

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Abstract

Chinese city-level data indicate that differences in growth rates are far more severe than indicated in previous studies which typically use data at higher levels of aggregation. We estimate growth equations using city-level data and find that the policy of awarding a special economic zone status enhances growth substantially, increasing annual growth rates by 5.5 percentage points. Annual growth rates of open coastal cities are, on average, 3 percentage points higher. Our qualitative results on the role of policy and the effects of FDI are similar to those of earlier studies that have employed provincial-level data; but, quantitatively, our results are substantially different. We also provide evidence of an indirect role of policy in the growth process through its ability to attract growth-enhancing foreign direct investment.

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*Corresponding author: Department of Economics, Hamilton College, 198 College Hill Road, Clinton, NY 13323, phone: 315-859-4419, fax: 315-859-4477. We are grateful to Belton Fleisher and C. Simon Fan for useful comments. Yinsheng Li and Yiqi Yang provided excellent research assistance.

1 Introduction

Over the past decade, the growth rate of per capita income in China has averaged an astounding nine percent per year.[1] This growth, however, has not been shared equally across China and a large literature has arisen to examine various aspects of these differences. But whereas most recent theoretical literature (e.g., the new economic geography) assumes the city as the natural unit of analysis,[2] most studies of regional inequality in China have used provincial level data (e.g. Chen and Fleisher, 1996; Jian et al, 1996; Lin and Lui, 1999).[3] By using city-level data a key contribution of this paper is thus to provide fresh empirical evidence on the determinants of growth at this neglected level of analysis.[4] Another reason we believe that empirical analysis of growth at the city level is most pertinent in China is that government policy that awards preferential treatment to certain regions is directly enacted at the city level. Thus, examining the performance of cities is the appropriate level to determine the effect of these policies. A final reason city-level empirical analysis is needed is that, as we show later,

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[1]Young (2000a) argues that aggregate growth rates in China are in fact more modest. He attributes the overstatement of China's overall growth to a systematic understatement of inflation.

[2]See Neary (2001) for a review of the new economic geography literature. While we do not include a specific analysis of geographic attributes in our study, Demurger, Sachs, Woo and Bao (2001) point out that policy dummies based on geography also capture the beneficial effects of a coastal location, irrespective of policy. However, when they decompose these effects into a geography effect and a policy effect using province-level data, they find a beneficial role for both. Therefore, it is likely that the estimated coefficients on our policy dummies also include the effects of beneficial geographic locations.

[3] Some studies, however, use household survey data (e.g. Kahn and Riskin, 2001; Riskin et al., 2001).

[4] These have been compiled from various years of *Urban Statistical Yearbook of China* Guojia tongjiju chengshi shehui jingji diaocha zongdui. We should note that Wei (1993) also examines city level data in a growth context.

differences in growth rates are more severe at the city level, suggesting that aggregating data at the province level may disguise some important relationships.

Our empirical approach is to estimate growth equations. While other students of regional inequality in China have used similar approaches (e.g. Fleisher and Chen, 1997) our particular specifications have some novel features. Also, by using city data for the period 1989 to 1999, we investigate a period that is substantially longer than in comparable studies.[5] Our approach enables us to look for causes of the large disparity in both the growth and level of per capita income within China and to examine whether or not existing government policy is exacerbating or reducing regional inequality. Compared to studies that use provincial data, our use of city-level data allows us to more precisely identify the location of the implementation of different policies (e.g., being in an open coastal city vs. a Special Economic Zone) and allows us to draw more stark distinctions. We also gain further understanding of the effect of policy by documenting its indirect effect on growth through its ability to attract growth-enhancing foreign direct investment. Overall, and reassuringly, our results are qualitatively similar to previous findings that examine regional inequality by using data at other levels. However, our city-level analysis refines previous conclusions and finds larger quantitative effects for specific policies. Thus, compared to most studies that are based on provincial-level data, we find that there is far greater variation in growth at the city level. For example, Demurger, Sachs, Woo and Bao (2001) report that the fastest and slowest growing province over the period 1979 to 1998 have annual

[5] For example, Wei (1993) estimates over a much shorter time period (1988-1990) and thus is less able to identify longer-run trends. Furthermore, we use additional independent variables in our analysis (notably domestic as well as foreign investment) that allow us to tie our results into the current growth literature. In some secondary results, Wei does examine growth over the period 1980 to 1990 with city-level data, but data availability limits his sample to between 14 and 43 observations in this part of his analysis.

growth rates that differ by 6.2 percentage points. As we discuss in more detail below, in our city-level data the gap between the fastest and slowest growing city is substantially larger– by over 24 percentage points.[6]

Our main finding is that Chinese government policies that give preferential treatment to several cities by promoting openness can account for a large portion of the differences in growth rates across cities. Specifically, our results suggest that the special economic zone status increases the *annual* growth rate of a city by 5.5 percentage points and the awarding of open coastal status increases annual growth rates by 3 percentage points. These policies have a direct effect on growth by creating an environment that is more responsive to market concerns, and they also have an indirect effect by encouraging profit-driven foreign direct investment that itself is associated with higher growth rates. Somewhat surprisingly, we find no evidence that higher rates of domestic investment are associated with growth rates of per capita income, in spite of the fact that both theory and cross-country evidence find a strong and robust positive correlation between these variables. This finding is consistent with other research which finds that domestic investment in China may not always primarily be profit driven.[7]

In some respects, our city-level study strengthens earlier findings at the province level. For example, Chen and Fleisher (1996) find evidence of conditional convergence among Chinese

[6] Lyons (1998) examines intraprovincial disparities in growth and also finds evidence of growing inequality. However his study is confined to one province (Fujian) and he does not undertake any hypothesis-testing econometric analysis. Studies of inequality in China at the province level are numerous. In addition to those discussed above, further examples of recent papers include, but are not limited to, Aziz and Duenwald (2001), Dayal-Gulati and Husain (2000), Demurger (2000, 2001), Kanbur and Zhang (1999), Li, Liu, and Rebelo (1998), and Raiser (1998).

[7] See Young (2000b), for an analysis of distortions in China during the reform process.

provinces during the period 1978 to 1993 after controlling for a province's coastal location, physical investment, employment growth, foreign direct investment, and human capital investment. Jian, Sachs, and Warner (1996) also examine trends in inequality among the Chinese provinces over the period 1952 to 1993. As we do, they find inequality has responded to government policy, with more market-oriented reforms resulting in reduced inequality. Lin and Liu (2000) and Wang and Hu (1999) study economic growth in the Chinese provinces, focusing on the effects of fiscal decentralization and policy aimed at selectively opening up regions to international trade and foreign direct investment.[8] In contrast to these studies, we do not find income convergence among Chinese regions unless we control for government policy. However, because much economic activity in China is not market-driven, we do not offer our results as a refutation of the Solow model–only as a study of how growth responds to strong government intervention.

In addition to finding greater variation in growth at the city-level, we also find that the extent of the problem of inequality looms far larger than indicated by many studies and that there is no evidence that regional inequality in China is dissipating.[9] As such our findings are more similar to recent studies that use household survey for 1995 (e.g. Riskin, et al., 2001). Typically they reveal that inequality is a bigger problem than is indicated by conclusions emerging from

[8] Berthelemy and Demurger (2000) argue that foreign direct investment has been important in China's growth through its effect on the level of technology. Our study complements the findings in this paper as well, but, makes additional contributions because, 1) we use city-level data to allow us to better identify the effects of specific development policies and 2) empirically, we focus on longer term growth rather than annual growth rates.

[9] For example, Deininger and Squire provide an estimate of the Gini coefficient in China in 1992 (37.80) that is comparable to the U.S. value (37.94 in 1991). Yang (1999), however, argues that using internationally comparable definitions of income increases measured household inequality in China considerably.

studies that use provincial data and earlier studies that use household survey data. Without a change in policy, our findings also predict that the disparity in levels of average incomes will increase as the Chinese economy continues to grow. In addition to confirming the conditional convergence results of provincial studies at the city level, we also explore the indirect role policy plays in generating inequality through its ability to attract profit-driven foreign direct investment.

The structure of our paper is as follows. We continue in Section 2 by reviewing Chinese government policies, especially during the Deng era. In Section 3 our data are described and our main estimation results are reported. In Section 4 we further develop our policy conclusions and conclude.

2 China's Growth Policies: Causes and Consequences

China has undergone three radical policy changes in its urban development during the past five decades: from Mao's redistributive and egalitarian policies to Deng's uneven development model, and to the current initiative to develop China's western regions in order to narrow the widening regional disparity.[10] Both the rate of economic growth and the degree of regional inequality among Chinese cities have changed over time.

Deng's economic reforms have designated the city as the center of the regional economy and an agent of diffusion of economic growth. The pace of urban development during the reform era has corresponded to the rapid growth of the Chinese economy. The urban population in 1997, for example, rose to 29.9 per cent of the national total, which was 12 per cent more than in 1978 (Guo, 1999). Since Deng Xiaoping, the chief architect of China's economic reform, believed that a large country such as China could not achieve rapid economic growth in all its various regions simultaneously, both urban development and economic growth have been

[10]For an overview of policy changes in China's urban development, see Yang, (1990); Li

uneven across the country. By design the Chinese government adopted a trickle-down growth strategy to develop a few regional centers of economic strength, beginning with those that possess initial advantages such as location, infrastructure, human and natural resources. According to this plan, the diffusion of growth would inevitably occur. The famous aphorism, "Let certain regions (and some people) get rich first," reflected the strategic thinking of the Chinese government during the Deng era.

This strategic plan specified that cities of the coastal regions in the south and east parts of China "should make full use of their advantages to speed up the opening to the outside world and quickly develop before others."[11] When the coastal economy has expanded sufficiently, the state should then devote more effort to helping the central and western regions catch up. While Deng and other policy makers were unclear about when and how the state should shift its regional emphasis from the coast to the inland, they had specific guidelines and distinct policies for gradually opening up Chinese cities. Opening (*kaifang*) of these cities means that a favorable environment would be established for attracting foreign investment, stimulating export-led growth, and promoting infrastructure development. The central government granted cities various special economic status. They included the special economic zones (SEZs) of Shenzhen, Zhuhai, Shantou, and Xiamen (1980); 14 open coastal cities (1984); Hainan island (1988) and Shanghai's Pudong District (1990); free trade zones in coastal cities (1993); open border cities and open free trade zones such as the Yangtze Delta and the Pearl River.[12]

These cities and regions were granted "preferential policies" (*qingxie zhence*). They

(2001); and Guo, (1999).

[11]*Beijing Review*, May 29, 2000, p. 22.

[12]The status of some cities may overlap. For example, a SEZ city can be part of a free trade zone. For a detailed discussion of China's opening of these cities and regions, see Fan

included: 1) a tax break; 2) favorable terms in loans, credits and subsidies; 3) higher foreign exchange retention rates; 4) greater fiscal autonomy; and 5) faster financial and legal approval. These policies heavily favored coastal regions at the expense of inland China. The emphasis on coastal development has moved the issue of economic inequality between coastal and inland cities to the forefront, especially since Deng's famous southern journey in 1992 when he granted more favorable policy initiatives to the coastal region (Wang and Hu, 1999; and Chen, 1991). In 2000, the per-capita GDP in west China was only about 60% of the national average. According to a survey conducted by China's National Statistics Bureau in 2000, the top 5% of the richest people in the country held almost 50% of private bank savings accounts. These *nouveaux riches* are disproportionately distributed in the coastal region.[13] Meanwhile, according to Chinese official sources, approximately 90 percent of the country's population who live in absolute poverty are located in the western region. [14] The difference in GDP per capita between Shanghai and Guizhou, for example, increased from 7.3 times in 1990 to 12 times in 2000.[15] The growing regional disparities were particularly reflected by consumption expenditures. In 1985 per capita expenditures in Shanghai were 299 yuan higher than the national urban average, but the differential increased to 2,929 yuan in 1995, with a nearly ten-fold increase in 10 years (Davis, 2000).

If growing disparities in Chinese society are not serious enough, there is also high unemployment. The unemployment rate has risen to its highest level since the 1949 Communist Revolution. The Chinese government recently admitted that the country had a total of 16 million urban unemployed workers in 2000, but the real figure was probably much higher. At the

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(1997).

[13]This figure is based on information found in *Urban Statistical Yearbook of China 2000.*

[14]*Beijing Review*, April 10, 2000, p. 14.

[15]*Shijie ribao*, January 12, 2000, A9. See also Wang and Hu (1999) for details of comparison.

National People's Congress annual session held in the spring of 2000, the Chinese government made a far-reaching decision to "shift the focus of economic construction from the eastern coastal provinces to the western region."[16] It is, of course, far too early to assess this new strategic shift because the development of the western region is "a systematic project and a long-term task, which may take the efforts of several generations," borrowing the words of Chinese leaders.[17] But Deng's uneven and spatial development strategy during the past two decades has provided sufficient evidence to test the advantages and pitfalls of targeted and diffusion-oriented economic policies. The availability of time series data on Chinese cities of different sizes, locations and features makes this study possible.

3 Methodology, Data, and Empirical Results

3.1 Empirical Methodology and Data Description

We follow the conceptual framework of the recent growth literature and adapt the approach first used by Mankiw, Romer, and Weil (1992) and later used in some studies of Chinese growth at the provincial level (e.g., Chen and Fleisher, 1996; Lin and Liu, 2000). To study the phenomenon of long-run growth, Mankiw, Romer, and Weil derive an augmented Solow model:

$$\text{growth in real per capita income} = \beta_0 + \beta_1 \text{*ln(initial income)} + \beta_2 \text{*ln(savings rate)} + \beta_3 \text{*ln(population growth) rate} + \beta_4 \text{*ln(human capital savings rate)} + \varepsilon$$

where the savings rate, population growth rate, and human capital savings rates are at their steady state values and ε is a mean zero normally distributed disturbance term. To proxy for the steady state values, they use the average annual savings rate (investment rate), the average

[16] *Beijing Review*, April 10, 2000, p. 14
[17] *Beijing Review*, April 10, 2000, p. 15

secondary school enrollment rate for the human capital savings rate and the actual population growth rate over the period. Thus, Mankiw, Romer, and Weil use cross-country data to study the convergence to the steady state in the Solow model after augmenting it to include human capital as a factor of production. Overall, they find that cross-country data is consistent with the Solow model and conditional convergence.

In order to understand the determinants of growth within China and study the question of convergence in regional incomes, we use this equation, with a few modifications, as a baseline specification. Consistent with the existing cross-country growth literature, one can interpret the changes to the original specification derived by Mankiw, Romer, and Weil as either 1) changes in the way we measure the economic fundamentals such as physical capital or human capital savings rates or 2) factors that may affect the economic environment in which production takes place and, therefore, may have an indirect effect on growth through their influence on the determination of the steady state income level. In particular, if policy creates a higher steady state income level for a given city, after controlling for initial income, the city with the higher steady state should grow faster.[18]

Specifically, one important modification in measurement is that we distinguish between domestic and foreign direct investment and allow their effects to differ. Thus, rather than including a total investment rate, we include both a domestic investment rate and a foreign direct investment rate because domestic and foreign investors may face different incentives. This would be the case if domestic investment is not market driven. Similarly, following Barro (1995) in some of our specifications we also control separately for government spending and

[18]Jones (2000) discusses this point in more detail. Interested readers should also see Temple (1999) for a survey of the empirical growth literature.

investment in infrastructure, on the theory that this type of government investment may also impact growth in a different manner than domestic or foreign investment.

In addition to allowing investment that is done by different segments of the economy to have differential effects, we also deviate slightly from cross-country studies of growth in our measurement of human capital savings. Secondary school enrollment rates are not available for Chinese cities so we use total number of people in high school divided by total population.[19] Although slightly different from the measure commonly used in cross-country analysis, our measure does capture the essential notion that cities that have a larger percentage of their population in high school are accumulating human capital at a faster rate. Of course, even without limitations put on our study by the lack of availability of data, secondary school enrollment rates serve only as a proxy for human capital savings rates.

The third way in which we will augment the base specification is by considering government policy that may affect the environment in which production takes place. Government policy may have an effect on growth over and above the effect of investment in physical and human capital if it influences the efficiency of production. More efficient production creates a higher steady state level of income and, after controlling for initial income, generates faster growth. Later we also examine the effect that policy has on growth through its effect on physical capital accumulation.

The data we use in our analysis are compiled from the *Urban Statistical Yearbook of*

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[19]The human capital savings used in Mankiw Romer and Weil are total number of people in high school/number of people of high school age multiplied by the fraction of the working age population that is of school age. Our measure of human capital savings is also used by Chen and Fleisher (1996).

We should also point out that all of our "savings" variables (i.e., investment, fdi, and human capital savings variables) are averages over the entire period. This treatment is consistent

China which contain data on over 600 Chinese cities. Unfortunately, all the variables that are crucial for our analysis are not available for each city and we are able to use only 204 cities at the prefecture level and above in our analysis.[20] Thus, our study focuses on the largest cities in China and we are unable to comment on factors affecting growth in the smallest cities due to data limitations.

Table 1 summarizes the variables available to us and provides some descriptive statistics. As we mentioned at the outset, a striking feature of the data is the large variation in growth rates across cities. Although, the average annual growth rate of per capita income in these 204 cities was an impressive 8 percent over this ten year period, a greater than 24 percentage point spread between the fastest growing and fastest declining city is even more noteworthy. These striking figures imply that reporting growth at levels higher than cities tends to aggregate- out much of the variation.[21] Large variance in other variables is also evident in our data, underscoring the

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with the theoretical framework derived in Mankiw, Romer, and Weil.

[20]We use data for each city that includes the urban area only and not outlying areas. The reader will note that the number of observations used in each specification varies from 200 to 204. Observations are excluded due to lack of availability of all of the independent variables. Restricting all of our estimations to a common set of 200 cities does not materially affect the results presented.

Ideally, we would like to extend our data backwards in time. This would allow us to perform panel estimations and also to examine some of the cities prior to the granting of their special economic status. Since we are interested in studying the phenomena of *long-run* growth, however, it is necessary to examine growth over sufficiently long periods of time and data limitations prevent us from doing so. Furthermore, estimating growth equations with panel data is complicated by econometric problems which can only be solved by using additional time periods in the panel to instrument for the lagged dependent variable. (See Caselli, Esquivel, and LeFort, 1996, or Judson and Owen, 1999, for a discussion of this issue.) Panel analysis of annual fluctuations in growth rates would be possible with our data, however, our results would be unable to shed light on long-run differences in income growth.

[21] Note also that in Table 1 we report descriptive statistics only for those cities which we later use in our regressions. In fact, growth rates over this period are available for another 233 smaller cities. Descriptive statistics on this larger set of cities reveal an even wider range in growth rates.

large differences in standards of living within China. Initial per capita income in the richest city is over 50 times per capita income in the poorest city and wide ranges in investment, population growth, and foreign direct investment are also apparent. Notably, some cities receive virtually no foreign direct investment while others receive an amount equal to half their GDP.[22] Domestic investment rates (where "Domestic" refers to investment by Chinese residents and not only residents of that city) have even wider variation, with some cities recording investment greater than their GDP.

The geographic distribution of cities in our sample of 204 cities (i.e., location of cities in the East, Central or Western part of China) is similar to that in the larger population of 670 cities that are listed in the *Urban Statistical Yearbook of China*. Specifically, approximately 42 percent of the cities in our sample are in the East, 21 percent are in the West, and 37 percent are located in Central China.[23] Descriptive statistics for each geographic region (not reported in Table 1) also highlight the variation in growth rates and incomes with cities in the East having higher average growth rates and incomes (average annual growth rate of 9 percent and average income per capita of 3,965 yuan) and cities in the West and Central region of China having lower growth rates and incomes (average annual growth rates of 8 and 7 percent and income per

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We should note that we use official population figures in our analysis and therefore do not capture unofficial migration. This introduces measurement error into both our dependent variable (growth of per capita income) and in an independent variable, population growth. To address the issue of measurement error in our dependent variable, we implement a hetereoskedasticity correction for our standard errors. Ideally, one would like to instrument for the potentially mismeasured population growth variable, however, suitable instruments are not available and there is likely some attenuation bias in this coefficient.

[22]The Urban Statistical Yearbooks of China report FDI in US dollars. To convert these statistics to yuan we used market exchange rates–with annual rates being averages of daily rates. To the extent that the annual FDI amount flows into the country evenly over the course of the year, this is a reasonable estimate of the value of that FDI in yuan in a particular year.

[23]Geographic classifications of cities follows Wang and Hu (1999).

capita of 2,624 yuan and 2,721 yuan, respectively). Although cities in each region of the country have similar rates of domestic investment, human capital savings, and population growth, cities in the East have higher rates of FDI. The average level of FDI/GDP for cities in the East is 8.6 percent, but for the West and Central regions is only 2.5 percent and 2.4 percent respectively. Furthermore, cities in the East are disproportionately beneficiaries of government policy, with all of the SEZ and open coastal cities being in the East.

3.2 Factors Affecting Growth of Per Capita Income

The results from some baseline growth regressions reported in Table 2 reveal two relatively robust relationships that are consistent with the neoclassical theory–a positive relationship between FDI and growth and a negative relationship between population growth and growth of per capita income. In particular, the first column of Table 1 reports an estimation that mirrors the basic growth equation in Mankiw, Romer, and Weil (1992). Unlike the cross-country results, however, we do not find a statistically significant relationship between domestic investment and growth or human capital and growth. Furthermore, although the coefficient on per capita income comes in with a negative sign, it is statistically significant in only one specification and provides only weak evidence for conditional convergence among Chinese cities.

As we alluded to earlier, our inability to find evidence of a strong relationship between domestic investment and growth may be due to inefficiently allocated investment in this non-market transition economy. Our results for human capital are also puzzling in light of the cross-country growth literature, however, they are consistent with earlier studies of growth within China. For example, although Wei (1993) does not include domestic investment in his estimations, he finds a negative and sometimes statistically significant relationship between human capital and growth using an alternative measure of human capital–the percent of the labor force that has a scientific or technical occupation. Chen and Fleisher (1996) also find a statistically insignificant relationship between human capital savings and growth at the province level. However, using an alternative human capital measure, university level education, Fleisher and Chen (1997) find a positive relationship between human capital and TFP growth. Unfortunately, this measure of human capital is not consistently available to us in city-level data.

Finally, in column 6, we add two measures of government policy that might affect growth–initial infrastructure (INFRA89) and initial local government spending (LGE89).[24] Contrary to cross-country results, LGE89 enters positively and significantly while we cannot find evidence for a role for infrastructure.

Overall, the results in Table 2 indicate that higher rates of foreign direct investment and lower rates of population growth are related to higher growth of per capita income as the Solow model would predict. There is weak evidence for conditional convergence. However, other results are at odds with this model: a robust correlation between domestic investment and growth or human capital and growth that has been found consistently in cross-country data does not exist.

Given the policies implemented by the Chinese government aimed at enriching only a few cities, however, one would not expect the Chinese economy as a whole to exhibit free market behavior. If free-market policies enhance the efficiency of production, cities that benefit from these policies should have higher steady states and should grow faster, after controlling for

[24]Barro and Sala-i-Martin (1995) show that government consumption is negatively related to growth in cross-country data, suggesting that greater government consumption is

fundamental determinants of growth such as initial income or physical and human capital savings rates. In Table 3, we attempt to control for these policies by adding dummy variables indicating whether the city received preferential treatment. Column 1 of Table 3 reports results in which we control for a city being in a free trade zone (FREETRADE). The results in Column 1 suggest that being in a free trade zone has a positive and statistically significant effect on growth. Column 2 reports results after controlling for Special Economic Zone status (SEZ), being in an open coastal city (COAST) or being in an open border city (BORDER) and suggest that cities awarded the special economic zone status and open coastal cities also grew faster. Because free trade zones may also be part of special economic zones, open coastal or border cities, it is difficult to determine exactly which policy is responsible for growth. The results in column 3 show that when dummy variables are added to incorporate all of these policies simultaneously, the coefficient on free trade zones retains its positive sign but loses statistical significance. This allows us to suggest that it is the SEZ status of the city and not just a free trade zone per se that is a more important determinant of growth.[25] Columns 4 and 5 of Table 3 replicate the estimations in columns two and three, this time using the open cities along the Yangtze River as the policy of interest (YANGTZE). These results show that cities given this kind of preferential treatment also grew faster than the others in this time period. Furthermore, the free trade policy also has a separate, positive effect on growth.

Our results for the other coefficients in the growth equations are also slightly different when we control for the policy environment. Specifically, there is now stronger evidence of conditional convergence with the negative coefficient on initial income becoming statistically

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associated with a less efficient allocation of resources.

[25]Though, clearly, the presence of multicollinearity urges caution in this interpretation.

significant in all five estimations. It is interesting that both the positive coefficients on FDI and on our policy variables remain even when the two variables are entered into the regressions simultaneously, suggesting that the effects of these policies extends beyond that of encouraging FDI.

It is important to note that the effects of preferential treatment by the Chinese government are substantially larger than those of comparable studies at the provincial level. The results in column 1 of Table 3 indicate that being in a free trade zone raised the annual growth rate of per capita income by 2.4 percentage points. The results in column 2 indicate an even more substantial increase of 4 percentage points for cities awarded special economic zone status.[26] These results also shed light on the discrepancies between city growth rates in the East, Central, and Western regions of China. Earlier we noted that the average FDI/GDP is much higher in the East than in the West and Central regions. The results in Table 3 suggest that increasing FDI from the average level in the West and Central regions to the average level in the East would increase annual growth rates by a full percentage point.

Although we have approximately 200 cities in each of our estimations, we are concerned that some of the policy variables we analyze apply to only a small number of cities in our sample, and therefore, our results might be influenced by outliers. In order to address this

[26]The most closely related empirical study to ours is that of Chen and Fleisher (1996). Because they use province-level data, their specification is slightly different from ours and does not include a SEZ dummy in addition to a coastal dummy (the majority of SEZ zones are in one province–Guangdong). When we replicate their specification with our city-level data and use only a coastal dummy, our results with city level data are remarkably close to theirs. With our data and their specification, we find that being on the coast increases annual growth rates by 2.2 percentage points while their results indicate an increase in annual growth of 2.6 to 2.8 percentage points. This highlights the importance of using city-level data to assess city-level policies because, at this level of aggregation, we are able to identify the effects of different types of policies.

possibility, we present in Table 4 the results of estimating the effects of development policy and using a robust estimation technique. To control for the influence of outliers, we used an iterative technique in which we downweight outliers. Essentially, our technique removes observations for which Cook's D > 1 and then iteratively selects weights for the remaining observations, with the observations that have the largest residuals being awarded the lowest weight.[27]

The results presented in Table 4 confirm many of our major findings from our original estimations. Initial income remains negatively related to subsequent growth as does population growth, consistent with the predictions of the Solow model. The coefficients on FDI remain positive and significant and of comparable size, while the coefficients on domestic investment are insignificant, consistent with the results reported in Table 2. The impact of higher levels of human capital savings after controlling for policy also remains unclear as the positive coefficients are not statistically significant at conventional significance levels. Results using the robust estimation technique also find a slightly more modest role for policy. The estimates in column 2 of Table 4 now indicate that SEZ status increases annual growth rates by 3.2 percentage points and open coastal cities have annual growth rates 1.7 percentage point higher. Furthermore, the coefficients on the YANGTZE dummy variable lose statistical significance.[28]

A final important point about the results in Table 4 is that because equation 1 is derived from a production function framework, it is possible to infer properties of the production process from our estimated coefficients. In particular, estimated coefficients in Table 4 suggest that the capital accumulated through foreign direct investment does have declining marginal productivity. Specifically, using the estimated coefficients in column 3 of Table 4 and assuming

[27]See Hamilton (1991) for details on this procedure.

[28]We do need to be cautious in the interpretation of this result as this was a policy that

that the production function takes on a Cobb-Douglas form, $y = Ak^{\alpha}$, where y is per capita income and k is the per capita stock of foreign capital, one can calculate a point estimate of the implied value of alpha of .46, which is consistent with the implied value of α calculated by Mankiw, Romer and Weil (1992) with cross country data.[29] The presence of diminishing returns calls into question the efficiency of a trickle-down development policy. The increased inequality that results from policies that encourage foreign investment in only a limited number of geographic locations does not seem to be justified by increased efficiency.[30] This finding is consistent with the fact that we find evidence for income convergence only after controlling for the preferential status of specific cities.[31]

3.3 Determinants of Foreign Direct Investment

was initiated in the middle of the period we observe.

[29]While using the coefficients from other specifications results in slight deviations from this point estimate, taken together, these results still suggest similar values of α. The derivation of this estimate is a direct result of the fact that, in this framework, the coefficient on ln(percap89) is $1-e^{-\lambda t}$ (where λ is the rate of convergence) and the coefficient on fdi is $(1-e^{-\lambda t})(\alpha/1-\alpha)$. Mankiw, Romer, and Weil report implied values of α ranging from .38 to .48. (See Mankiw, Romer, Weil (1992) for details on the derivation.)

[30]In trying to determine the overall effect of these policies on growth, one may be tempted to consider an indirect effect between inequality and growth. Whereas earlier empirical literature found a negative relationship between inequality and growth (e.g., Persson and Tabellini 1994), more recently that relationship has been called into question. (See for example, Banerjee and Duflo 2000 for a discussion of this literature.) One would want to be cautious in applying any of these results to China, however, as 1) most theoretical explanations between inequality and growth are based on inequality at the household level which is not the focus of our study, and 2) these theories have been developed to explain behavior in free market, usually democratic, economies.

[31]The effect of foreign direct investment reported by the province-level study of Chen and Fleisher (1996) is much larger than the one we obtain using city-level data. In our specification, a one standard deviation increase in the log of FDI/GDP results in approximately a 1.3 percentage point increase in annual growth rates. The coefficients reported in Chen and Fleisher (1996) suggest that a similar increase in FDI/GDP would result in a 13.7 percentage

The growth regressions discussed above find that foreign direct investment is an important determinant of growth. Summary statistics in Table 1, however, show that foreign direct investment varies widely across the cities. In this section, we explore the determinants of foreign direct investment and comment on factors that may be indirectly influencing growth through their effects on FDI. Table 5 presents the results of this investigation, suggesting overall that foreign direct investment is responding to non-market forces. The results in column 1 show that cities that have higher per capita income received more foreign direct investment. Not surprisingly, cities with free trade zones also had higher foreign direct investment rates, but it is interesting that cities with more human capital investment (a larger percentage of the population in high school) received less. Also, the results in column 1 do not find a role for local government spending or infrastructure in attracting foreign direct investment.

Further results in columns 2 through 5 reinforce the effects of policy on attracting foreign direct investment. Unsurprisingly, the significant positive coefficient on special economic zones (SEZ) show that these cities are particularly attractive to FDI as are open coastal cities. Our conclusion that FDI is flowing to cities with high initial per capita incomes is still supported by these estimations which also control for policy.

The results in Table 5 argue for an even stronger role for policy in affecting growth through its affect on the ability of the city to attract foreign direct investment. Taking the point estimates in column 2 of Tables 3 and 5, one can calculate that granting an average city special economic zone status would increase the average annual growth rate over this period by about 5.5 percentage points–i.e., that city would experience annual growth rates substantially above the average. Open coastal cities also benefit. Incorporating both the direct effects of this policy

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point increase in annual growth rates.

on growth from Table 3 and the indirect from Table 5, we find that open coastal cities have annual growth rates approximately 3 percentage points higher.

Table 6 shows the results of robust estimation on the determinants of FDI which are similar to the results we presented earlier. Overall, these results suggest that foreign direct investment is responding to a profit motive, but that government policy is able to affect the profits and direct investors to specific regions. The magnitudes of the effects suggested by these robust estimates are similar to those reported earlier.

4 Conclusion

To investigate regional differences in long-run growth rates in China we provide one of the first empirical analyses that uses city-level data. Compared to most studies that are based on the more commonly-used provincial-level data, we find that a different picture emerges when the issues of growth and equity are examined using city-level data. At root we find that there is far greater variation in growth at the city level. As with recent studies based on household survey data for 1995 , (though unlike some findings based on provincial data and earlier household survey studies), city-level data indicate that recent years in China have witnessed a "retreat from equality" (Riskin, et al., 2001).[32] In our empirical analysis, we estimate growth equations using data from 204 Chinese cities during the period 1989 to 1999. A key focus is whether or not existing government policy is exacerbating or reducing regional inequality. Our main finding is that Chinese government policies that give preferential treatment to several cities by promoting openness can account for a large portion of the differences in growth rates across

[32] For example, Fan (1997) concludes that provincial inequalities were decreasing as reform progressed. By contrast Yao and Zhang (2001) use provincial data and find evidence of increasing inequality between regions. We reach a conclusion similar to Yao and Zhang but also establish that sometimes there is increasing intra-regional inequality.

cities. These policies affect growth directly by creating an environment more conducive to production and indirectly by encouraging foreign direct investment to flow to these cities. The magnitudes of these effects we find with our city-level analysis are larger than those documented with province-level data; we estimate that the effect of awarding SEZ status is a 5.5 percentage point increase in the *annual* growth rate of real per capita income.

Whether or not China's trickle-down approach to development and the resulting increase in regional inequality will eventually result in the highest per capita income for all depends on the presence of increasing returns. However, our results suggest that capital accumulated through foreign direct investment is in fact subject to diminishing returns. Thus, a policy that promotes more equitable development would also produce faster growth. Overall, our results suggest that without policy that gives preferential treatment to certain cities, the process of growth in China would generate income convergence and more regional equality.

More broadly, our results contribute to the literature on openness and growth, providing some evidence that more open economies grow faster particularly when domestic investment is influenced by political considerations.[33] In addition to cross-country studies, studies of regional convergence have been used as a test of neoclassical growth theory. Barro and Sala-I-Martin (1991, 1992, 1995) have found evidence of convergence among the U.S. states, the Japanese prefectures, and among Western European regions.

Of course, data availability and data quality remain issues for the study of growth in China. A natural extension of the results we have presented in this paper is to consider additional city-level variables that might affect the process of growth as well as to construct comparable data sets at the provincial level. This work is currently in progress.

[33] Ben-David (1993), Dollar (1991), and Rodrik and Rodriguez (1999) are just a few of the papers that have examined the effects of openness on long-run growth.

Table 1: Data Definitions and Descriptive Statistics

Variable	Obs.	Mean	SD	Min	Max	Definition
growth	204	7.96	3.73	-3.41	20.65	average annual growth of real per capita income 1989-1999
percap89	204	3232	3232	376	20837	1989 per capita income (in 1989 Yuan)
inv	204	31.31	15.71	7.23	130.80	average domestic investment rate (average of domestic investment/GDP in 1989 through 1999)
popgrow	204	3.26	3.81	0.11	22.36	average annual population growth rate 1989-1999
highschl	204	6.58	1.15	3.49	10.88	average percent of population enrolled in high school, 1989 through 1999
fdi	204	5.10	7.57	0.00	51.57	average foreign direct investment rate (average of FDI/GDP, 1989 through 1999, FDI converted to Yuan via market exchange rate)
infra89	204	274.37	361.23	16	2818	city's highway construction in 10,000 square meters in 1989
lge89	204	10.34	5.27	1.19	55.44	local government spending/GDP in 1989
freetrade	204	0.054	0.226	0	1	equals 1 if in free trade zone
yangtze	204	0.044	0.206	0	1	equals 1 if in Yangtze River economic zone
SEZ	204	0.024	0.155	0	1	equals one if in Special Economic Zone
coast	204	0.069	0.253	0	1	equals one if in coastal open city
border	204	0.039	0.195	0	1	equals one if in border open city

Table 2: Baseline Growth Regressions
Dependent Variable: Growth

	(1)	(2)	(3)	(4)
ln(percap89)	-0.5771	-1.3170	-1.3433	-0.8123
	(0.76)	(1.54)	(1.65)*	(1.17)
ln(inv)	-0.2525	-0.3895		-0.6793
	(0.34)	(0.47)		(0.96)
ln(popgrow)	-1.0861	-1.2400	-1.2366	-1.4052
	(2.50)**	(2.97)**	(3.01)**	(3.69)**
ln(highschl)	0.7746	1.8578	1.7246	1.6612
	(0.46)	(1.12)	(0.97)	(1.03)
ln(fdi)		1.0205	1.0144	0.9414
		(4.33)**	(4.25)**	(3.88)**
infra89				0.0003
				(0.38)
lge89				14.2915
				(1.74)*
Constant	12.7785	16.2840	15.4409	12.2675
	(2.84)**	(3.52)**	(3.02)**	(2.78)**
Observations	204	200	200	200
Adjusted R-squared	0.05	0.15	0.16	0.18

Robust t-statistics in parentheses
**significant at 5% level; * significant at 10% level

Table 3: Effects of Development Policies on Growth of Per Capita Income
Dependent Variable: growth

	(1)	(2)	(3)	(4)	(5)
ln(percap89)	-1.5715	-1.7157	-1.7192	-1.3636	-1.6161
	(1.82)*	(1.98)**	(1.97)**	(1.58)	(1.86)*
ln(inv)	-0.4842	-0.5160	-0.5185	-0.3948	-0.4890
	(0.61)	(0.64)	(0.65)	(0.48)	(0.61)
ln(fdi)	0.9027	0.8276	0.8266	1.0117	0.8945
	(3.71)**	(3.27)**	(3.26)**	(4.27)**	(3.65)**
ln(popgrow)	-1.2149	-1.3318	-1.3265	-1.2660	-1.2405
	(2.94)**	(3.28)**	(3.18)**	(3.02)**	(2.98)**
ln(highschl)	2.2070	2.1011	2.1100	1.9352	2.2815
	(1.33)	(1.27)	(1.27)	(1.18)	(1.39)
freetrade	2.4348		0.1708		2.4238
	(2.67)**		(0.15)		(2.64)**
SEZ		3.9891	3.8533		
		(3.26)**	(2.65)**		
coast		2.0982	2.0153		
		(2.57)**	(2.05)**		
border		1.3136	1.3138		
		(1.51)	(1.51)		
yangtze				1.2703	1.2486
				(1.91)*	(1.96)**
Constant	17.9193	19.3615	19.3775	16.4970	18.1213
	(3.85)**	(4.20)**	(4.18)**	(3.55)**	(3.88)**
Observations	200	200	200	200	200
Adjusted R-squared	0.17	0.18	0.18	0.16	0.17

Robust t-statistics in parentheses
** significant at 5% level; * significant at 10% level

Table 4: Policy Analysis with Robust Regression
Dependent Variable: growth

	(1)	(2)	(3)	(4)	(5)
ln(percap89)	-0.9614	-1.0824	-1.0892	-0.7884	-1.0230
	(1.93)*	(2.15)**	(2.15)**	(1.61)	(2.05)**
ln(inv)	-0.7384	-0.7410	-0.7430	-0.6880	-0.7091
	(1.31)	(1.30)	(1.30)	(1.21)	(1.25)
ln(fdi)	1.0378	0.9675	0.9666	1.1349	1.0345
	(5.15)**	(4.70)**	(4.67)**	(5.78)**	(5.11)**
ln(popgrow)	-1.3053	-1.4047	-1.3956	-1.3655	-1.3406
	(4.76)**	(5.03)**	(4.91)**	(4.93)**	(4.86)**
ln(highschl)	1.6256	1.5444	1.5538	1.4095	1.7349
	(1.11)	(1.04)	(1.04)	(0.95)	(1.18)
freetrade	1.9581		0.2456		1.9528
	(1.78)*		(0.15)		(1.77)*
SEZ		3.2269	3.0334		
		(1.99)**	(1.47)		
coast		1.6624	1.5429		
		(1.73)*	(1.25)		
border		1.3342	1.3350		
		(1.13)	(1.12)		
yangtze				1.1317	1.1123
				(1.01)	(1.00)
Constant	14.9243	16.0252	16.0622	13.7953	15.0773
	(3.95)**	(4.16)**	(4.15)**	(3.68)**	(3.97)**
Observations	200	200	200	200	200
Adjusted R-squared	0.20	0.20	0.20	0.20	0.20

Absolute value of t-statistics in parentheses
* significant at 5% level; ** significant at 1% level

Table 5: Determinants of FDI
Dependent Variable: ln(fdi)

	(1)	(2)	(3)	(4)	(5)
ln(percap89)	0.7048	0.5950	0.5950	0.8777	0.6992
	(3.12)**	(2.52)**	(2.52)**	(4.10)**	(3.09)**
ln(inv)	0.0597	0.0660	0.0628	0.0814	0.0589
	(0.25)	(0.28)	(0.26)	(0.34)	(0.25)
ln(popgrow)	0.1396	0.0918	0.0996	0.1338	0.1330
	(1.62)	(1.10)	(1.16)	(1.50)	(1.53)
ln(highschl)	-0.9376	-0.8957	-0.8818	-1.1670	-0.9240
	(1.83)*	(1.74)*	(1.71)*	(2.21)**	(1.80)*
lge89	1.7055	1.0708	1.0506	2.9398	1.7439
	(0.96)	(0.61)	(0.60)	(1.60)	(0.98)
infra89	-0.0001	0.0000	-0.0000	0.0002	-0.0001
	(0.29)	(0.21)	(0.07)	(1.19)	(0.36)
freetrade	1.3985		0.3738		1.3985
	(5.21)**		(1.39)		(5.15)**
SEZ		1.7595	1.4591		
		(4.19)**	(3.35)**		
coast		1.1271	0.9636		
		(5.37)**	(3.80)**		
border		0.0691	0.0837		
		(0.25)	(0.30)		
yangtze				0.2353	0.2357
				(0.92)	(0.96)
Constant	-3.4661	-2.6653	-2.6728	-4.6098	-3.4506
	(1.98)**	(1.46)	(1.46)	(2.76)**	(1.97)**
Observations	200	200	200	200	200
Adjusted R-squared	0.16	0.18	0.18	0.12	0.16

Robust t-statistics in parentheses
** significant at 5% level; * significant at 10% level

Table 6: FDI Determinants, Robust Regression
Dependent Variable: ln(fdi)

	(1)	(2)	(3)	(4)	(5)
ln(percap89)	0.8198	0.6766	0.6861	1.0364	0.8056
	(4.49)**	(3.63)**	(3.67)**	(5.71)**	(4.39)**
ln(inv)	0.0881	0.1148	0.1086	0.0716	0.0904
	(0.47)	(0.63)	(0.59)	(0.37)	(0.48)
ln(popgrow)	0.1548	0.1064	0.1146	0.1430	0.1496
	(1.60)	(1.11)	(1.19)	(1.42)	(1.53)
ln(highschl)	-0.6699	-0.6017	-0.5725	-0.7908	-0.6727
	(1.36)	(1.23)	(1.17)	(1.57)	(1.36)
lge89	0.9739	0.1576	0.1062	1.9850	1.0268
	(0.59)	(0.10)	(0.06)	(1.19)	(0.62)
infra89	-0.0000	0.0001	0.0001	0.0002	-0.0000
	(0.07)	(0.40)	(0.22)	(0.99)	(0.11)
freetrade	1.2581		0.3235		1.2665
	(3.24)**		(0.58)		(3.25)**
SEZ		1.6595	1.3984		
		(3.05)**	(1.99)*		
coast		1.0093	0.8564		
		(3.12)**	(2.12)*		
border		-0.0477	-0.0392		
		(0.12)	(0.10)		
yangtze				0.1496	0.1560
				(0.38)	(0.41)
Constant	-4.8680	-3.9028	-4.0005	-6.4112	-4.7659
	(3.49)**	(2.75)**	(2.81)**	(4.58)**	(3.40)**
Observations	200	200	200	200	200
Adjusted R-squared	0.21	0.22	0.22	0.19	0.20

Absolute value of t-statistics in parentheses
** significant at 5% level; * significant at 10% level

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