Growth and Regional Inequality in China During the Reform Era

Derek Jones
djones@hamilton.edu

Cheng Li
cli@hamilton.edu

Ann 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 at this level than indicated in previous studies which typically use data at higher levels of aggregation. Using city-level data from 1989 to 1996, we estimate a variety of growth equations. A major finding is that while the policy of awarding a special economic zone status enhances growth (with annual growth rates up to 8.2 percentage points higher), other polices do not have obvious effects. In some respects, our qualitative results are similar to those of earlier studies that have employed provincial-level data; but, quantitatively, our results find an even stronger role for policy. Our findings predict that, without a change in policy, the disparity in levels of average incomes will increase as the Chinese economy continues to grow. Finally, we provide evidence for 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. 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, as residents of certain coastal cities enjoyed substantially higher growth in income than others. A main objective of this paper is to explore these regional differences in growth rates in China, but unlike most of the literature on this topic, we do this by using city-level data (from 206 Chinese cities during the period 1989 to 1996) to estimate growth equations. We look for causes of the large disparity in both the growth and level of per capita income within China and examine whether or not existing government policy is exacerbating or reducing regional inequality. 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, our results are qualitatively similar to previous findings at the provincial level, but our city-level analysis refines previous conclusions and finds substanstially larger quantitative effects for specific policies.

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 8.2 percentage points. These policies have a direct

[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.

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 evidence that higher rates of domestic investment are actually associated with lower 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.[2] Overall, we find no evidence that regional inequality in China is dissipating.[3]

Whereas most previous studies of regional inequality in China have used provincial level data (e.g. Chen and Fleisher, 1996; Fleisher and Chen, 1997; Jian et al, 1996; Lin and Lui, 1999), our study of inequality is unique insofar as it uses city-level data that we have compiled from *Chinese Statistical Yearbooks.*[4] We believe that empirical analysis of growth at the city level is most pertinent in China for three important reasons. First, government policy that awards

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

[3]Interestingly, although we find that regional inequality in China is severe during this time period, inequality at the household level is much less so. 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.

[4]Guojia tongjiju chengshi shehui jingji diaocha zongdui, various years. We should note that Wei (1993) also examines city level data in a growth context. However, he does so 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.

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. Second, differences in growth rates are more severe at the city level, suggesting that aggregating data at the province level may disguise some important relationships.[5] Third, much recent theoretical literature (e.g., the new economic geography) assumes the city as the natural unit of analysis.[6]

Reassuringly, 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 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

[5]For example, Demurger, Sachs, Woo and Bao (2001) report that the fastest and slowest growing province over the period 1979 to 1998 have annual 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–over 50 percentage points.

[6]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.

international trade and foreign direct investment.[7] But while our study generates some findings that complement results from studies of regional inequality in China that are based on provincial-level data, we find that there is far greater variation in growth at the city level and the extent of the problem of inequality looms far larger.[8] 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. Finally, without a change in policy, our findings predict that the disparity in levels of average incomes will increase as the Chinese economy continues to grow.

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.[9] 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. In contrast to these earlier studies, we do not

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[7]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.

[8] 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), Li, Liu, and Rebelo (1998), and Raiser (1998).

[9]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.

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.

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

[10]For an overview of policy changes in China's urban development, see Yang, (1990); Li (2001); and Guo, (1999).

regions simultaneously, both urban development and economic growth have been 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

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

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 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, 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

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[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 (1997).

[13]This figure is based on information found on http://www.chinesenewsnet.com June, 29, 2000

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

[15]*Shijie ribao*, January 12, 2000, A9.

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 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

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

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

study the phenomenon of long-run growth, Mankiw, Romer, and Weil derive an augmented Solow model:

$$\text{growth in real per capita income} = \hat{a}_0 + \hat{a}_1 * \ln(\text{initial income}) + \hat{a}_2 * \ln(\text{savings rate}) + \hat{a}_3 * \ln(\text{population growth}) \text{ rate} + \hat{a}_4 * \ln(\text{human capital savings rate}) + \text{å}$$

where the savings rate, population growth rate, and human capital savings rates are at their steady state values and å 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 secondary school enrollment rate for the human capital savings rate and the actual population growth rate over the period. 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. One important modification 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. Also, secondary school enrollment rates are not available for Chinese cities so we use total number of people in high school divided by total population.[18] 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

[18]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.

population in high school are accumulating human capital at a faster rate. We will later add to this baseline specification to investigate the effects of government policy on the growth of Chinese cities.

The data we use in our analysis are compiled from *Chinese Statistical Yearbooks* 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 206 cities at the prefecture level and above in our analysis. 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 was an impressive 9.3 percent, a greater than 50 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.[19] Large variance in other variables is also evident in our data, underscoring the large differences in standards of living within China. Initial per capita income in the richest city is over 28 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 almost equal to their GDP. Domestic investment rates (where "Domestic" refers to investment by Chinese residents and not only residents of that city)

[19] 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. We should note that we used official population figures to calculate per capita income. To the extent that unofficial migration is from slow to fast growing cities, growth rates of per capita income would be over estimated in the fastest growing cities and underestimated in the slowest growing cities.

have even wider variation, with some cities recording investment greater than their GDP. In the next section we report results from growth equations estimated using this data.

3.2 Factors Affecting Growth of Per Capita Income

The results from some baseline growth regressions reported in Table 2 reveal only 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, domestic investment enters negatively and significantly. Furthermore, although the coefficient on per capita income comes in with a negative sign, it is not statistically significant and therefore provides no evidence for conditional convergence among Chinese cities. Interestingly, the coefficient on human capital (HIGHSCHL) is negative and statistically insignificant.[20]

Results in column 2 of Table 1 replicate those in the first column with a different measure of human capital, initial schooling, as used by Barro and Sala-I-Martin (1995) and others. In this case the coefficient on the human capital variable is still negative but statistically significant at the 10% level and the negative relationship between domestic investment and growth loses its significance. Columns 3 through 5 of Table 1 include foreign direct investment as an explanatory variable pairing it with different measures of human capital and domestic investment. In each case,

[20]Although Wei (1993) does not include domestic investment in his estimations he also 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) find a statistically insignificant relationship between their human capital measure and growth at the province level.

the coefficient retains its positive and significant value. Finally, in column 6, we add two measures of government policy that might affect growth–initial infrastructure (INFRINIT) and initial local government spending (LGE).[21] Neither of these policy variables enter the equation at statistically significant levels nor do they alter the conclusions already drawn. Overall, the results in Table 1 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. However, other results are at odds with this model: a robust correlation between domestic investment and human capital as has been found consistently in cross-country data does not exist. Furthermore, there is no strong evidence that growth rates are related to the initial income level.

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. 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 (FREETRA). These results 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

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

dummy variables are added to incorporate all of these policies simultaneously, they retain their positive sign but lose 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. 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 did not grow faster than the others in this time period. However, we do need to be cautious in the interpretation of this result as this was a policy that was initiated in the middle of the period we observe.

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 3.6 percentage points. The results in column 2 indicate an even more substantial increase of 5.8 percentage points for cities awarded special economic zone status and an increase of 1.7 percentage points for open coastal cities.[22]

Examining the coefficients on the other variables in Table 3 show that many of the conclusions from our baseline specifications do not change. Human capital investment is not robustly correlated with growth. Domestic investment is also not positively correlated with growth as one would expect, but instead, is actually negatively and significantly correlated with

[22]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 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 2.5 percentage points while their results indicate an increase in annual growth of 2.6 to 2.8 percentage points.

growth in four of the five specifications. However, in four of the five specifications, the coefficient on per capita income now enters negatively and significantly, suggesting that after controlling for policy, the process of growth in Chinese cities does exhibit income convergence. As we will show later, this conclusion is strengthened when we employ a robust estimation technique.

A final important point about the results in Tables 2 and 3 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 Tables 2 and 3 suggest that the capital accumulated through foreign direct investment does have declining marginal productivity. Specifically, using the estimated coefficients in column 3 of Table 2 and assuming that the production function takes on a Cobb-Douglas form, $y = Ak^{a}$, 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 .35, which is very close to the implied value of á calculated by Mankiw, Romer and Weil (1992) with cross country data.[23] 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.[24] This finding is

[23]While using the coefficients from other specifications results in slight deviations from this point estimate, taken together, these results still suggest a value of á close to 1/3. The derivation of this estimate is a direct result of the fact that, in this framework, the coefficient on ln(percap89) is $1-e^{-ët}$ (where ë is the rate of convergence) and the coefficient on fdi is $(1-e^{-ët})(á/1-á)$. (See Mankiw, Romer, Weil (1992) for details on the derivation.)

[24]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

consistent with the fact that we find evidence for income convergence only after controlling for the preferential status of specific cities.

3.3 Determinants of Foreign Direct Investment

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 4 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.[25] Also, the results in column 1 indicate that higher initial local government spending is associated with more foreign direct investment. The fact that the coefficient on initial infrastructure (INFRINIT) is not significant suggests that a broader range of government

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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.

[25]Its possible that our inability to use enrollment rates are affecting this result. Because we use high school students/total population rather than high school students/those of high school age, its possible that cities might have high values of SCHLINIT because they have a larger proportion of non-traditional aged high school students. Thus, some underdeveloped cities might have higher values for SCHLINIT, but lower levels of human capital overall.

spending and investment may be important.

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 also modified by the results in column 2 and 3 and suggest that is not the level of development per se that is attracting foreign investment, but the SEZ status. Because SEZ cities have relatively high initial per capita incomes the impact of this finding remains–foreign direct investment is more likely to flow to the more developed cities and, through its impact on growth, is likely to exacerbate the current level of inequality. Columns 4 and 5 look at the effect of being in an open city along the Yangtze River, and consistent with our previous conclusion about the effect of this policy on growth, we find that this policy is not associated with higher FDI.

The results in Table 4 argue for an even stronger role for policy in affecting growth through their affect on the ability of the city to attract foreign direct investment. Taking the point estimates in column 2 of Tables 3 and 4, one can calculate that granting an average city special economic zone status would increase the average annual growth rate over this period by 8.2 percentage points–i.e., that city would experience annual growth rates about twice the average.

3.4 Robust Estimation

Although we have over 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 possibility, we present in Tables 5 and 6 the results of estimating the effects of development policy and the

determinants of FDI 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.[26]

The results in Table 5 show that the qualitative conclusions we reached earlier about the determinants of growth remain intact, although a few of the coefficients now have a reduced size or significance level. Even with this robust estimation technique, we still conclude that free trade zones and special economic zones are associated with higher growth rates.

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.

These robust estimates suggest a slightly smaller, but still notable role for policy. Using the coefficients estimated in column 2 of Tables 5 and 6 now predicts that awarding a city special economic zone status increases the annual growth rate by 6.3 percentage points.

4 Conclusion

To investigate regional differences in growth rates in China we provide one of the first empirical analyses that uses city-level data. Specifically, we estimate growth equations using data from 206 Chinese cities during the period 1989 to 1996. A key focus is whether or not existing government policy is exacerbating or reducing regional inequality. Our main finding is that

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

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. 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 much larger than those documented with province-level data; we estimate that cities with preferential treatment have *annual* growth rates of real per capita income between 6.3 and 8.2 percentage points higher.

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.

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.

Table 1: Data Definitions and Descriptive Statistics

Variable	Obs.	Mean	SD	Min	Max	Definition
growth	206	0.093	0.058	-0.259	0.269	average annual growth of real per capita income 1989-1996
percap89	206	31.876	24.145	7.261	208.370	1989 per capita income (in hundreds of 1989 Yuan)
inv	206	0.234	0.154	0.033	1.300	average domestic investment rate (average of domestic investment/GDP in 1989 and domestic investment/GDP in 1996)
popgrow	206	0.021	0.039	-0.197	0.218	average annual population growth rate 1989-1996
highschl	205	0.065	0.014	0.024	0.116	average percent of population enrolled in high school, 1989 & 1996
schlinit	206	0.053	0.013	0.023	0.113	percent of population enrolled in high school, 1989
fdi	206	0.051	0.091	0.001	0.857	average foreign direct investment rate (average of FDI/GDP in 1989 and 1996, FDI converted to Yuan via market exchange rate)
infrinit	206	286.16	371.86	6	2818	city's highway construction in 10,000 square meters in 1989
lgeinit	206	0.089	0.039	0.008	0.253	local government spending/GDP in 1989 (in millions of 1989 Yuan)
freetra	206	0.058	0.235	0	1	equals 1 if in free trade zone
yangtze	206	0.044	0.205	0	1	equals 1 if in Yangtze River economic zone
SEZ	206	0.024	0.154	0	1	equals one if in Special Economic Zone
coast	206	0.068	0.252	0	1	equals one if in coastal open city
border	206	0.034	0.182	0	1	equals one if in border open city

Table 2: Baseline growth regressions
Dependent Variable: growth

	(1)	(2)	(3)	(4)	(5)	(6)
ln(percap89)	-0.0129	-0.0146	-0.0270	-0.0244	-0.0318	-0.0240
	(1.31)	(1.56)	(1.56)	(1.42)	(2.12)**	(1.30)
ln(inv)	-0.0172	-0.0098	-0.0165	-0.0163		-0.0179
	(2.70)**	(1.49)	(1.63)	(1.59)		(1.90)*
ln(popgrow)	-0.0066	-0.0047	-0.0107	-0.0100	-0.0143	-0.0126
	(1.08)	(0.80)	(1.93)*	(1.88)*	(2.90)**	(2.07)**
ln(highschl)	0.0066		-0.0010		-0.0142	-0.0026
	(0.35)		(0.05)		(0.66)	(0.14)
ln(schlinit)		-0.0270		-0.0125		
		(1.91)*		(0.78)		
ln(fdi)			0.0144	0.0136	0.0140	0.0138
			(3.17)**	(3.01)**	(2.98)**	(3.17)**
infrinit						0.0000
						(0.34)
lgeinit						0.1162
						(1.05)
Constant	0.0860	0.0142	0.1626	0.1192	0.1527	0.1265
	(1.27)	(0.23)	(1.56)	(1.17)	(1.43)	(1.15)
Observations	409	418	194	195	194	194
Adjusted R-squared	0.08	0.08	0.25	0.25	0.23	0.24

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)	-0.0311	-0.0322	-0.0329	-0.0272	-0.0313
	(1.77)*	(1.81)*	(1.85)*	(1.56)	(1.77)*
ln(inv)	-0.0178	-0.0166	-0.0172	-0.0165	-0.0178
	(1.78)*	(1.65)*	(1.70)*	(1.64)	(1.79)*
ln(fdi)	0.0120	0.0117	0.0113	0.0144	0.0120
	(2.62)**	(2.54)*	(2.45)*	(3.16)**	(2.62)**
ln(popgrow)	-0.0093	-0.0120	-0.0107	-0.0109	-0.0095
	(1.62)	(2.15)*	(1.79)*	(1.95)*	(1.64)
ln(highschl)	0.0031	0.0027	0.0034	-0.0009	0.0032
	(0.17)	(0.15)	(0.18)	(0.05)	(0.17)
Freetra	0.0356		0.0209		0.0354
	(2.66)**		(1.19)		(2.63)**
SEZ		0.0576	0.0416		
		(3.22)**	(1.80)*		
Coast		0.0173	0.0075		
		(1.72)*	(0.62)		
Border		0.0128	0.0128		
		(1.05)	(1.06)		
Yangtze				0.0091	0.0081
				(1.00)	(0.90)
Constant	0.1799	0.1713	0.1776	0.1621	0.1793
	(1.72)*	(1.65)*	(1.70)*	(1.55)	(1.71)*
Observations	194	194	194	194	194
Adjusted R-squared	0.26	0.26	0.26	0.25	0.26

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

Table 4: Determinants of FDI
Dependent variable: ln(fdi)

	(1)	(2)	(3)	(4)	(5)
ln(percap89)	0.4152	0.3394	0.3247	0.6181	0.4152
	(1.86)*	(1.48)	(1.42)	(2.79)**	(1.86)*
ln(inv)	-0.0007	0.0512	0.0364	-0.0110	-0.0006
	(0.00)	(0.29)	(0.21)	(0.06)	(0.00)
ln(popgrow)	0.2017	0.1230	0.1576	0.1674	0.2028
	(1.74)*	(1.10)	(1.35)	(1.42)	(1.72)*
ln(schlinit)	-1.3672	-1.3508	-1.3186	-1.5832	-1.3674
	(4.23)**	(4.12)**	(4.02)**	(4.76)**	(4.22)**
lgeinit	6.0079	4.8317	4.7920	8.1429	6.0005
	(2.53)*	(1.98)*	(1.98)*	(3.23)**	(2.51)*
infrinit	-0.0001	0.0000	0.0000	0.0001	-0.0001
	(0.42)	(0.19)	(0.17)	(0.73)	(0.41)
freetra	1.5067		0.7927		1.5070
	(5.45)**		(2.10)*		(5.45)**
SEZ		2.0205	1.3801		
		(4.68)**	(2.78)**		
Coast		0.9467	0.5880		
		(4.88)**	(2.21)*		
Border		-0.1026	-0.0735		
		(0.28)	(0.20)		
yangtze				-0.0107	-0.0263
				(0.04)	(0.10)
Constant	-9.0094	-8.8996	-8.6204	-10.6449	-9.0042
	(5.83)**	(5.86)**	(5.62)**	(6.85)**	(5.79)**
Observations	195	195	195	195	195
Adjusted R-squared	0.25	0.25	0.25	0.18	0.24

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

Table 5: Policy Analysis with Robust Regression
Dependent variable: growth

	(1)	(2)	(3)	(4)	(5)
ln(percap89)	-0.0150	-0.0156	-0.0163	-0.0118	-0.0152
	(2.36)**	(2.40)**	(2.48)**	(1.84)*	(2.36)**
ln(inv)	-0.0256	-0.0236	-0.0251	-0.0231	-0.0255
	(4.54)**	(4.14)**	(4.38)**	(3.99)**	(4.50)**
ln(fdi)	0.0117	0.0118	0.0113	0.0139	0.0117
	(4.51)**	(4.45)**	(4.20)**	(5.56)**	(4.50)**
ln(popgrow)	-0.0040	-0.0069	-0.0049	-0.0063	-0.0042
	(1.06)	(1.78)	(1.23)	(1.62)	(1.10)
ln(highschl)	0.0011	0.0014	0.0011	-0.0020	0.0012
	(0.07)	(0.09)	(0.07)	(0.12)	(0.08)
freetra	0.0296		0.0238		0.0295
	(2.21)**		(1.30)		(2.19)**
SEZ		0.0390	0.0206		
		(1.90)*	(0.83)		
Coast		0.0100	-0.0005		
		(0.83)	(0.03)		
Border		0.0092	0.0091		
		(0.58)	(0.58)		
yangtze				0.0042	0.0029
				(0.30)	(0.21)
Constant	0.1288	0.1230	0.1278	0.1140	0.1287
	(2.37)**	(2.23)**	(2.31)**	(2.05)**	(2.35)**
Observations	194	194	194	194	194
Adjusted R-squared	0.29	0.28	0.28	0.26	0.29

Absolute value of 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)	0.4716	0.3381	0.3287	0.7369	0.4721
	(2.47)**	(1.73)*	(1.69)*	(3.83)**	(2.46)**
ln(inv)	-0.0539	0.0276	0.0094	-0.1115	-0.0540
	(0.33)	(0.17)	(0.06)	(0.66)	(0.33)
ln(popgrow)	0.1971	0.1021	0.1368	0.1531	0.1980
	(1.72)*	(0.90)	(1.18)	(1.27)	(1.71)*
ln(schlinit)	-1.2795	-1.2390	-1.2116	-1.4733	-1.2792
	(3.50)**	(3.42)**	(3.35)**	(3.90)**	(3.49)**
lgeinit	5.4919	3.7863	3.7686	7.8431	5.4814
	(2.29)**	(1.53)	(1.53)	(3.21)**	(2.28)**
infrinit	-0.0001	0.0001	0.0000	0.0002	-0.0001
	(0.28)	(0.35)	(0.03)	(0.62)	(0.28)
freetra	1.4703		0.6917		1.4704
	(3.90)**		(1.35)		(3.88)**
SEZ		2.1249	1.5653		
		(3.74)**	(2.23)**		
Coast		0.9853	0.6712		
		(2.89)**	(1.63)		
Border		-0.0671	-0.0391		
		(0.15)	(0.09)		
yangtze				0.0153	-0.0184
				(0.04)	(0.05)
Constant	-8.9894	-8.6240	-8.3757	-10.9034	-8.9851
	(5.73)**	(5.55)**	(5.37)**	(6.89)**	(5.70)**
Observations	195	195	195	195	195
Adjusted R-squared	0.22	0.22	0.22	0.16	0.21

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

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