Good Inequality and Bad Inequality*

: An Evaluation of the Impact of Income Disparity on Economic Growth in China

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This paper evaluates the impact of income inequality on economic growth in China using provincial-level panel data from household surveys over the period 1986-2001, a period characterized by high growth and high inequality. The results indicate that economic growth was positively affected by inequality from 1986 to 2001, and that a 1% increase in the Gini coefficients leads to a 0.16% increase in GDP per capita growth. However, from 1994 to 2001, with a significant increase in the Gini, inequality diminished economic growth. Consequently, a certain level of inequality is good for economic growth, but it will become detrimental if it exceeds certain levels.

Keywords: China, Economic growth, Egalitarianism, Gini coefficient, Inequality, Panel data

Ⅰ. Introduction

There are two types of inequality: good inequality, which can boost economic growth, and bad inequality, which may produce social and political instability and, in turn, hurt future economic growth. Chinese government is facing a difficult choice regarding income policy making. To relax the serious social and political tension caused by income inequality, the government should raise wages for low-income workers, particularly migrant workers. However, increased wages will raise labor costs and reduce China's international competitiveness, thus inducing a slowdown in economic growth. This paper studies the income inequality in China and its impact on China's economic development in the special period of high growth and high inequality from 1986-2001. We estimate Gini coefficients using provincial panel data from household surveys and demonstrate the effects of income inequality on economic growth in China. We examine whether income disparity plays a positive or negative role in China's high economic growth and attempt to identify a balanced growth path, namely, a good inequality policy for sustainable development.

China was a relatively equal society during the planned economic era. For about 30 years beginning in the 1950s, China had a socialist planned economic system under the slogan, "Make all people equal." Under the egalitarian system, urban workers' wages were set at the same rate and fixed for long periods. Little income disparity existed even in rural areas because farmers' income was distributed nearly equally, irrespective of effort, under the people's commune system. As a result, little inequality existed. However, this injudicious equality did not give people an incentive to work, causing production inefficiencies nationwide and preventing the people from rising out of poverty. Thus, China was dubbed "a poor socialist country with egalitarianism." China began implementing its reform and opening-up policy in 1978, espousing a "let those who would become wealthy first, do so" philosophy, proposed by

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former Chinese leader Deng Xiaoping. The policy was geared toward boosting labor incentives and set markedly divergent incomes among regions, industries, and job types. Free market principles were subsequently introduced, allowing workers' wages and farmers' incomes to be determined by the market.

As a result of economic liberalization and globalization, the Chinese economy began growing rapidly. According to National Bureau of Statistics of China (NBS, 2012), China's GDP grew by 9.8% annually, and the real GDP increased 22.5 times between 1978 and 2012. Meanwhile, the real GDP per capita of Chinese citizens grew at an annual rate of 8.5% and increased 15 times in the same period. China became the world's second largest economy in 2010, surpassing Japan's economy. China's export volume also surpassed Germany's and became the largest in the world in 2011. By comparison with the United States, China's total GDP increased from 8.9% of that of the United States in 1980 to 75.3% in 2011 according to the cross-country statistics released by the World Bank. Moreover, China's ratio of per capita GDP to that of the United States had increased from 2.1% in 1980 to 17.5% in 2011. A newly issued report by the IMF predicted that if China continues its high-speed growth while the US economy stagnates, China will overtake the United States as the world's largest economy in 2016 by international dollars (PPP) and in 2018 by US dollars, much faster than economists and international organizations had previously predicted (IMF, World Economic Outlook 2011).

As the Chinese economy has grown, the income of the Chinese population has doubled and even quadrupled every 10 years. Measured by GDP per capita, income increased from US$ 313 in 1980 to US$ 5445 in 2011, making China an upper-middle class income economy (the World Bank, country data, 2012). In a report delivered at the 18th National Congress of the Communist Party of China on Nov. 8, 2012, China predicted that its GDP per capita would again double by 2015.

However, while China has been improving its industrial and agricultural productivity and enjoying rapid economic growth, the income gap between the country's regions and classes has been widening, causing serious economic and social problems. Studies show that the Gini coefficients rise annually, and income disparity has become a significant problem compared to previous decades and to other countries at the same stage of development as China. Most scholars and government officials inside and outside China consider China to have transformed from a relatively equal socialist country to an extremely unequal country as a result of the inequality in the country.

Against this backdrop, both the public and policymakers are concerned about the potentially negative effects of inequality on economic growth, such as social instability and inadequacy in domestic consumption. To relax social and political tensions and build a "harmonious society," Xi Jinping's administration considered raising the wages of low-income workers, particularly migrant workers, and raising taxes on the wealthy.

However, there is concern that an increase in wages will raise labor costs, reduce China's international competitiveness, and slow economic growth. The idea that income inequality enhances economic performance if that inequality stems from heterogeneous contributions from productive activities is popular in China. However, no evidence supports this idea. Although the factors that produce income inequality have been extensively discussed (e.g., Zhao et al, 2001; Gustafsson et al, 2008; Li et al, 2013), few studies have empirically attempted to determine the effects of income inequality on economic growth.

Enhanced economic performance can produce higher productivity. Higher productivity implies high efficiency in the economy. The contribution of productivity (or total factor

productivity, TFP) to economic growth has been documented by Chow (1993, 2002), Wang and Yao (2003), Young (2003), Hu and Kahn (1997), Borensztein and Ostry (1996), Maddison (1998), Woo (1998), Fleisher and Chen (1997), Wang and Hu (1999), Cowgill (2001), Wu (2000, 2003), and Zheng and Hu (2004), among others. However, no existing research has been directly related to the improvement of productivity and inequality. The aforementioned research has disputed the relative effect of inequality—through the improvement of productivity on economic growth but largely found that the TFP before the reform had been improved significantly over the planned economy era. This finding was attributed to economic transition. These issues beg an important question: what is the effect of inequality on economic growth? The current Chinese government must elucidate whether inequality is good or bad for the Chinese economy.

To answer the above question, this paper examines the relationship between income inequality and economic growth in China from 1986 to 2001, a period characterized by rapid economic growth and widening inequality. In studying this relationship, we calculate Gini coefficients using datasets from the annual urban household survey by province and analyze the effects of income inequality on economic growth (measured by the first order difference of the log of GDP per capita) and productivity (measured by the Malmquist index from Data Envelopment Analysis, DEA). We find that both economic growth and productivity are positively affected by income inequality. The effects of inequality on economic growth are stronger in the first period, between 1986 and 1993, but the effect decreases and becomes extinct in the second period, between 1994 and 2001. Moreover, the effects of inequality on productivity are positive in the first period and negative in the second period. These results indicate that the incentive effects of inequality in the first period benefitted economic growth and that the absence of the incentive effects of inequality in the second period hurt economic growth.

The rest of the paper is organized as follows: section 2 reviews the literature on the relationship between inequality and economic growth; section 3 describes the background and dataset used in the research; section 4 reports the econometric results, and section 5 offers conclusions and policy implications.

Ⅱ. Literature Review

The relationship between inequality and economic growth has long been debated in both the theoretical and the empirical literature. Deininger and Squire (1998) confirmed, with weak statistical significance, the inverted U-shaped relationship proposed by Kuznets (1995). Dollar and Kraay (2002) and Barro (2000) obtained similar results, with weak support. By contrast, Rossi et al. (2001) reported results for Italy that contradicted Kuznets's hypothesis. The causal effects of income inequality and economic growth were proved by the aforementioned scholars as being either positive or negative without insistence.

Regarding the potential adverse effects of high income inequality on economic growth, Barro (2000) concluded that (1) high income inequality can hamper production investment because the poor have less access to an imperfect credit market (Galor and Zeira, 1993); (2) policies that redistribute resources from the rich to the poor are more likely to be instituted in highly unequal societies, and economic decisions may be distorted (Perrotti, 1993; Alesina and Rodrik, 1994; Persson and Tabellini, 1994); and (3) social unrest and uncertainty are more likely in highly unequal states (Alesina and Perotti, 1996; Benhabib and Rustichini, 1996). However, these effects are unlikely to occur in China because investments in human and physical capital grow rapidly, and income redistribution policies are not determined by a

democratic voting process (as suggested in political economy). The positive effects of income inequality on economic growth may occur with a rise of the savings rate caused by the diminishing marginal propensity of consumption, as Keynes predicted.

The effect of the relationship between income and inequality on economic growth may depend on a country's level of development. Roberto, E. and Andres R (2013) indicated in their cross-country study that there is a positive and significant association between economic globalization and the magnitude of regional disparity. They also reveal that the special impact of economic globalization is greater in low- and middle-income countries, whose levels of regional disparities are, on average, significantly higher than in high-income countries. Barro (2000) found that higher inequality tends to delay economic growth in poor countries and encourage growth in rich countries. Castello-Climent (2010) found that the negative effect of income inequality on economic growth occurred in general and in low-income countries in particular, while the negative effect vanished and even became positive in high-income countries. Voitchovsky (2005) argued that the effects of inequality on economic growth depend on the profile of inequality in a country, finding that inequality at the top end of the distribution is positively associated with growth, while inequality at bottom end of the distribution is negatively related to future growth.

The nexus of inequality on growth over the short term differs from that over the long term. Using panel data at country level, Forbes (2000) found a significant positive relationship between income inequality and economic growth over the short and medium term. Using heterogeneous panel co-integration analysis, Herzer and Vollmer (2012) found that inequality had a negative effect on income growth over the long term.

Some studies research has focused on the relationship between income inequality and economic growth within specific countries. For the United States, Partridge (1997) found that greater income inequality was associated with higher economic growth. By contrast, Panizza (2002) argued that the relationship between income inequality and economic growth was negative, but the results were not robust. Benjamin et al. (2011) studied a Chinese village and found that rural villages with higher inequality experienced lower income growth during 1987-2002.

In China, rapid economic growth has been accompanied over the past three decades with greater equality. However, because of data inadequacy particularly a shortage of inequality measures, insufficient evidence exists to verify the relationship. This paper enriches the literature by proving the relationship between inequality and economic growth and provides policy suggestions for the Chinese government.

In comparison to previous studies, there are at least two advantages in our paper. First, in contrast to cross-country studies, we conduct a single country study of China and explore income disparity and its effect on growth at a provincial level. Second, we choose a period of the economy that developed in a highly unbalanced way across regions, namely a special period featured with high growth and high inequality. The survey data shows that the ratio of GDP per capita of the highest provinces to that of the lowest province ranged from 7 to 11 during the 1986-2001 period, producing sufficient variation in explained and explanatory variables. Third, the social development and institutional structure are similar across provinces in our samples. Definitions of political and sociological variables generally cannot be compared across countries, and the variety of political and sociological features across countries requires researchers to "keep other things unchanged." Therefore, the unified framework in China generates similar political and sociological backgrounds across the

country, minimizing the effects of other variables.

Ⅲ. Background and Data Description

1. Background and Data Description

This paper examines China between 1986 and 2001, a period in which the country experienced rapid economic growth and increased inequality. Figure 1 and Figure 2 show the GDP growth rate at constant prices, with 1978 as a benchmark. The figures show that the annual real growth rates of GDP and GDP per capita experienced fluctuations of approximately 10% between 1986 and 2001. In general, both the economy and the inequality in income distribution grew rapidly throughout this period. According to the official reports (Rural Household Survey Team of the NBS, 2003, p31.), the Gini coefficients increased from 0.304 in 1986 to 0.360 in 2001 in rural China and from 0.19 in 1986 to 0.32 in 2001 in urban China. According to Ravallion and Chen (2007), the rural, urban, and nationwide Gini coefficients increased from 0.2848, 0.2066, and 0.3241, respectively, in 1986 to 0.3648, 0.3232, and 0.4473, respectively, in 2001. Figure 4 shows the trend of regional gaps measured by the ratios of the

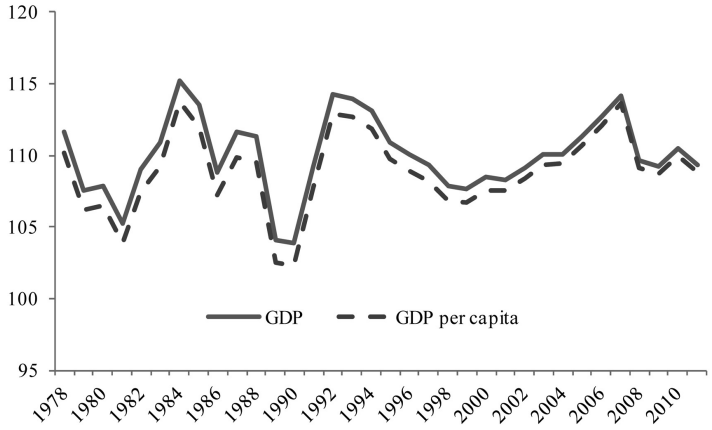

Figure 1: Growth Rate of GDP (preceding year=100)

Source: NBS, various years.

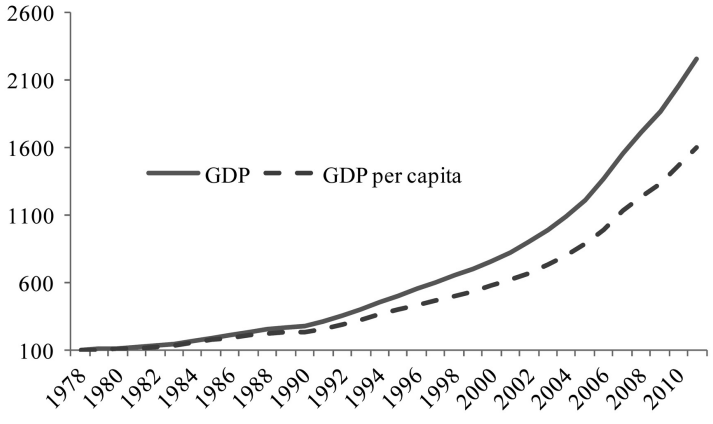

Figure 2: Growth of Real GDP (1978=100)

Source: NBS, various years.

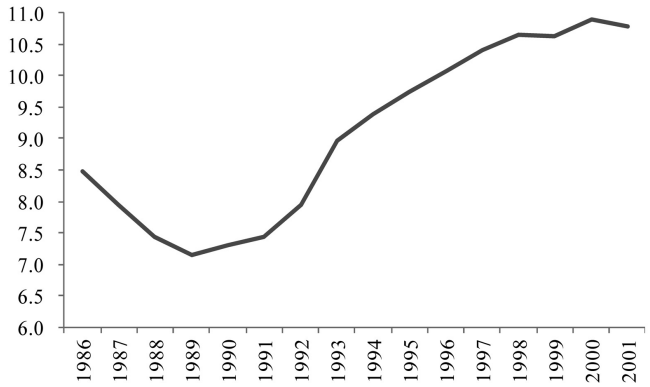

Figure 3: Regional Gap by GDP per Capita (Max/Min)

Source: Author's calculation based on the provincial panel data of household survey from the NBS.

highest income and lowest income provinces during 1986-2001. This period is characterized by a double-high period, namely high growth and high inequality, highlighting the importance of examining the relationship between these two phenomena, as well as the impact of inequality on economic growth.

The dataset used in this paper is composed of panel data covering 28 provinces[1)] in China from 1986 to 2001, which contains a total of 448 observations. The data are compiled from several sources. Without special specification, the data are taken from the *Comprehensive Statistical Data and Materials on 60 Years of China* compiled by National Bureau of Statistics of China (the NBS).

Until the present, for various reasons, China has not officially released a provincial-level inequality index. Although some studies have attempted to estimate the Gini at a provincial level, there exist problems of small sample sizes and sampling bias. Our study is the first paper to calculate Gini coefficients using the provincial panel data of urban household surveys issued by the NBS for the 1986-2001 period. However, since the NSB has not issued provincial-level data for other years, the data shortage restricts our analysis for the entire period from 1978 to the present (though we can estimate the Gini coefficient for the limited periods). This is unfortunate but also presents a promising avenue for future work.

2. Estimation of Gini Coefficients

The Gini coefficients within provinces for each year of the period are calculated using household income per capita. Figure 4 shows the distribution of provincial Gini coefficients. We observe twin peaks of the histogram, mainly stemming from the time dimension. If we divide the Gini coefficients into two intervals at 0.25, they are less than 0.25 in most provinces before 1992 and exceed 0.25 after 1992. Such a phenomenon is consistent with the trend of increasing inequality, as shown in Figure 5. The mean value of both the provincial Gini coefficients and the national Gini coefficient increase steadily, with a leap at 1992. The line in Figure 5 shows that the national Gini coefficient increased dramatically until the middle of 1990s, then increased steadily after 1993. If we take 1993 as a break point to obtain equally sized subsamples, the mean value of provincial Gini in the first period was 0.224, increasing to 0.322 after 1993. In the later period, we will check the effect of inequality on growth and productivity by dividing the whole period into two sub-periods : the first period of lower inequality with higher

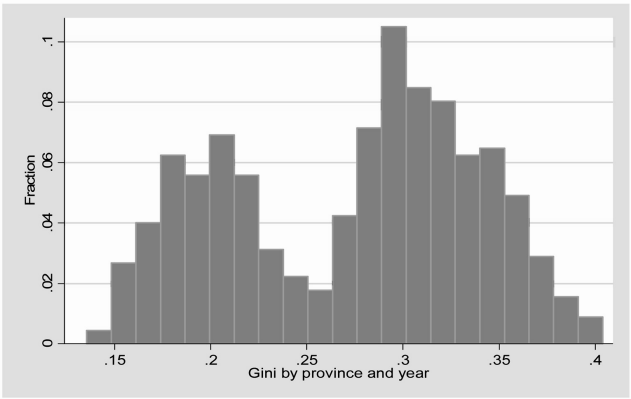

Figure 4: Distribution of Gini Coefficients within Provinces

Source: Author's calculation based on the provincial panel data of household survey from the NBS.

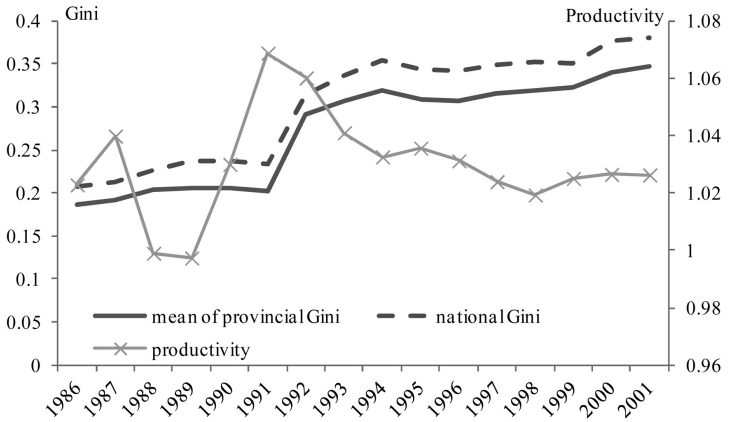

Figure 5: Yearly Gini Coefficients and Productivity within Urban Areas

Source: Author's calculation based on the provincial panel data of household survey from the NBS.

increasing trends from 1986-1993, and the second period of high inequality with decreasing trends from 1993-2001.

The urban Gini coefficients may serve as proxies for inequality as a whole; however, since the Chinese economy is a dual economy and Chinese society is segmented into two parts, namely, urban areas and rural areas, inequality could be deconstructed into two parts, and the inequality within and between urban and rural areas could be calculated. However, there are at least two reasons for using the urban Gini coefficients as proxies for the inequality as a whole: (1) Economic growth is mainly driven by the urban sector. Although no statistical data exist on the contribution of the urban and rural sectors to the total GDP, the Statistics Yearbook of China reported that the relative share of the primary sector in GDP decreased from 27.1% in 1986 to 14.4% in 2001 (NBS, 2012, Table 2-2). In the provincial sample used in this paper, the shares of the primary sector in GDP have been less than 2% since 1998 in Shanghai, and the maximum shares in GDP were 42% in 1986 in Hubei and Guangxi. (2) Urban Gini coefficients are highly correlated with inequality as a whole. On the basis of the CHIPs, reported in Table 1, we

Table 1: Correlation between Gini Coefficients

	CHIPs		Ravallion and Chen (2007)	
	Level (n=48)	Changes (n=33)	Level	Changes
Urban-rural	0.4035	0.0234	0.9677	0.6493
Urban-national	**0.8088**	**0.4568**	**0.9737**	**0.8069**
Rural-national	0.3255	0.4144	0.9730	0.7836

Sources: Authors' calculations based on the CHIPs of 1988, 1995, 2002, and 2007, and Ravallion and Chen (2007). In the CHIPs, due to the differences of sampling cities in every survey, we closed the provinces covering the same urban and rural survey data simultaneously to calculate the correlations.

find a correlation among the urban, rural, and national Gini coefficients. The urban Gini coefficients are highly and positively correlated with the national Gini coefficient, at 0.8088, and the correlation coefficient for the changes in the Gini coefficients is 0.4568. Two World Bank researchers, Ravallion and Chen (2007), estimated the urban, rural, and national Gini coefficients from 1981 to 2001 based on the annual household survey conducted by the NBS and concluded that the urban Gini coefficients were highly and positively correlated with national inequality. Therefore, the urban Gini coefficients may serve as an appropriate proxy of inequality for the provinces.

Another exceptional variable that cannot be directly derived from the statistical yearbook is that of capital stock. Capital stock is crucial for the analysis of economic growth and productivity. As such, several estimations of capital stock have been conducted by Chow (1993), Hu and Kahn (1997), Wang and Yao (2001), and others. In this paper, we adopt the provincial capital stock estimated by Zhang et al. (2005, 2007).

The key variable used in this paper-productivity cannot be derived directly from the official statistics. The literature on productivity analysis in China is growing and replete with various methodologies. In this paper, productivity is measured by the TFP estimated by the Malmquist index based on DEA. Province is taken as the analysis unit. Output is measured by GDP, while labor and capital stock are used as the two inputs[2]. The average productivity for each year is reported in Figure 5. Figure 5 shows that productivity fluctuated during 1986-1991, followed by a downward trend beginning in 1991.

3. Descriptive Statistics of the Variables

The descriptive statistics of all variables used in this paper are listed in Table 2. Both GDP and GDP per capita are deflated by a GDP deflator. The year 1978 is used as the base year to compare these two variables across years. Capital stock and other variables are adjusted by price index. These six variables are generated through information from the statistics yearbook and are potentially important in determining the economic growth and productivity improvement. Therefore, they are used as control variables in the regression analysis. The ratio of employees in state-owned enterprises (SOEs) to the total number of employees is used to capture the process of economic transition. The ratio of investment over GDP measures capital formation. The ratio of government expenditure to GDP denotes government intervention in economic activities. The ratios of total export to total import in GDP (trade ratio) and foreign direct invest to GDP are used to capture the openness of commodity and capital flows, both of which are important for China's economic growth and productivity improvement. Middle school enrollment represents human capital formation.

Table 2: Descriptive Statistics of the Variables

	Obs.	Mean	Standard deviation	Min.	Max.
Log GDP (10,000 Yuan)	448	6.0310	0.9540	3.3183	8.1843
Log capital (10,000 Yuan)	448	6.4458	0.9842	3.9811	8.7309
Log labor (million)	448	7.3969	0.8277	5.2099	8.7582
Log GDP per capita (Yuan)	448	7.1859	0.6875	5.8374	9.5585
Δ log GDP per capita	420	0.0831	0.0372	-0.0377	0.2173
Log capital per labor (10,000 Yuan)	448	-0.9511	0.9209	-3.1720	2.1839
Productivity	448	1.0300	0.0378	0.8970	1.1610
Gini coefficients	448	0.2732	0.0651	0.1354	0.4040
Ratio of employee in SOEs	448	0.7462	0.0821	0.4978	0.8966
Invest/GDP	448	0.3185	0.0840	0.1527	0.6718
Government expenditure/GDP	448	0.1263	0.0504	0.0492	0.3480
Openness: (export + import)/GDP	448	0.0367	0.0883	0.0000	1.0743
Middle school enrollment	448	0.3293	0.1091	0.0195	0.6667

Table 3: Panel Unit Root Tests for the Variables

	Specifications	LLC	IPS
Log GDP	Intercept, trend	-12.1569***	-4.6305***
Log capital	Intercept, trend	-13.4794***	-5.3619***
Log labor	Intercept, trend	-1.1530	5.3750
Δ log labor	Intercept	-5.4423***	-2.5053***
Log GDP per capita	Intercept, trend	-13.9952***	-5.4970***
Δ log GDP per capita	Intercept	-11.0365***	-4.0965***
Log capital per labor	Intercept, trend	-10.3545***	-0.9197
Δ log capital per labor	Intercept	-8.1903***	-3.2680***
Productivity	Intercept, trend	-9.6604***	-4.5381***
Gini coefficients	Intercept, trend	-4.6927***	0.7701
Δ Gini coefficients	Intercept	-6.4649***	-2.6353***
Control Variables			
Ratio of employees in SOE	Intercept, trend	-0.4898	5.4081
Δ Ratio of employees in SOEs	Intercept	-5.4422***	-1.8730**
Invest/GDP	Intercept, trend	-11.8089***	-5.0271***
Government expenditure/GDP	Intercept, trend	7.1833	12.0003
Δ Government expenditure/GDP	Intercept	-3.0944***	-0.9956
Openness: (export + import)/GDP	Intercept, trend	-3.0045***	1.3703
Δ Openness	Intercept	-8.8321***	-4.4331***
FDI/GDP	Intercept, trend	-3.6773***	1.2522
Δ FDI/GDP	Intercept	-7.8909***	-3.4148***
Middle school enrollment	Intercept, trend	-5.1159***	1.6235
Δ Middle school enrollment	Intercept	-7.7346***	-2.9899***

The stationarity of these variables was tested by Levin, Lin, and Chu (2002) and Im, Pesaran, and Shin (2003) (hereinafter LLC and IPS, respectively). All the related variables are stationary (at least after the first order difference), and most of these variables are also detrend stationary, as shown in Table 3.

4. Relationship between Inequality and Economic Growth

The relationships between the Gini coefficients and economic growth and between the Gini coefficients and productivity for each province are shown in Figure 6 and Figure 7, respectively. The log GDP per capita and Gini coefficients change simultaneously in most provinces, which indicates that economic growth is accompanied by an increase in inequality. The changes in productivity in Figure 7 for each province appear as fluctuating movements during the period examined. The profiles for productivity changes vary by province, and it is difficult to determine the common characteristics of the relationship between inequality and productivity across provinces.

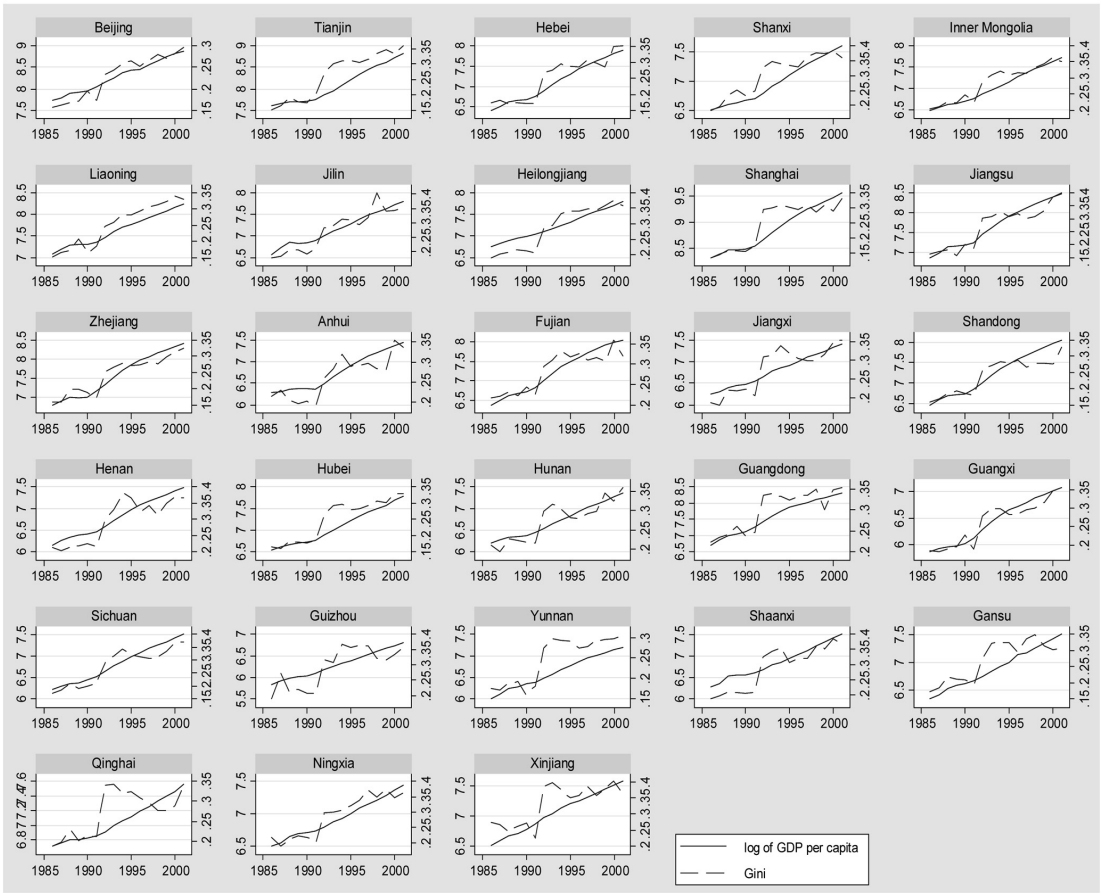

Figure 6: Income Inequality and Economic Growth by Province

Source: Author's calculation based on the provincial panel data of household survey from the NBS.

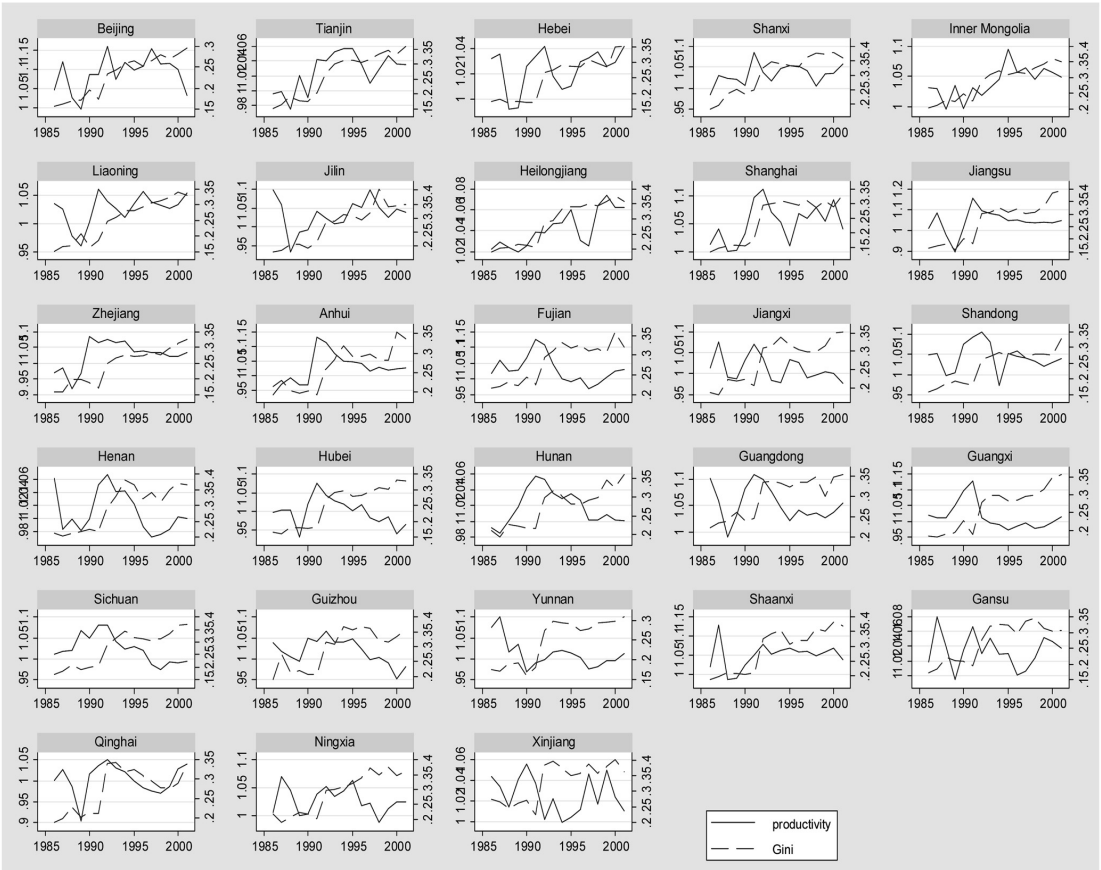

Figure 7: Income Inequality and Productivity by Province

Source: Author's calculation based on the provincial panel data of household survey from the NBS.

Ⅳ. Econometric Results

1. Examining the Kuznets curve for China

The Kuznets hypothesis proposes a trade-off relationship between inequality and economic growth, and many Chinese scholars have used this relationship to shape China's Kuznets curve. According to the hypothesis, the turning point in the inequality trajectory should have occurred automatically and should have been accompanied by long-term economic development. However, little empirical evidence exists to support this hypothesis in the Chinese context (or generally). In our study, from the scatter plots of the Gini coefficients and log GDP per capita shown in Figure 6, we cannot find a clear inverted-U curve, as we expected, but we do observe positive slopes from 1985 to 2001. Consequently, high inequality in China is accompanied by higher GDP per capita at the provincial level.

The relationship between inequality and economic development is estimated in Table 3 by the first order and squared term of log GDP per capita, which are taken as explanatory variables. The estimated coefficients for the first order difference of GDP per capita (in log form) are positive and negative for the squared term, which supports the inverted-U curve. However, we find that the inverted-U relationship is diminished when other variables are controlled for. Even for the regression results without control variables, the so-called "turning point" is incredible. The F test for specific

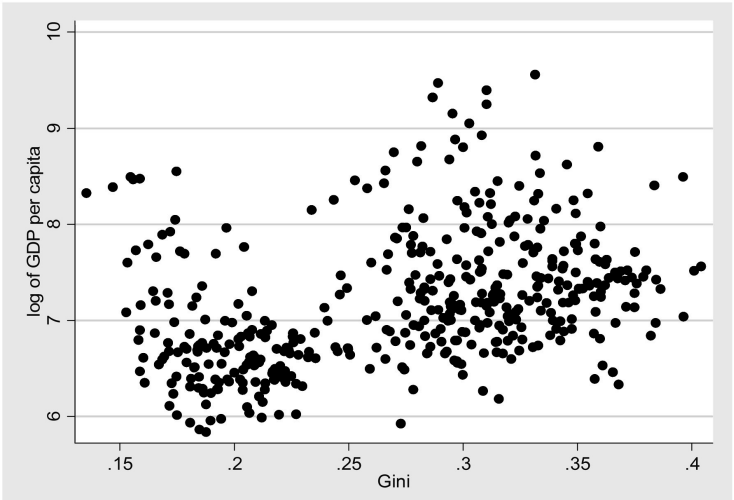

Figure 8: Scatter Plots of Gini Coefficients and log GDP Per Capita

Source: Author's calculation based on the provincial panel data of household survey from the NBS.

individual effects and the Hausman test suggest that the fixed effect model is a better choice, compared to the other two alternatives. As a result, the turning point implied in the fixed effect model is 14.64 (=0.2577/(2*0.0088) in log form or 2,285,385.9 Yuan. If we convert the turning point by the exponent operator, it is more than 160 times the GDP per capita in Shanghai, the highest income city in 2001. Therefore, the results in Table 4 cannot be considered empirical evidence of an inverted-U curve. Additionally, we check the regressions by year (cross-sectional data) and province (time-series data for each province) but do not find evidence supporting the inverted-U curve for China[3].

Table 4: Estimation for the Kuznets curve

	Pooled OLS	Fixed Effects	Random Effects	Pooled OLS	Fixed Effects	Random Effects
Log GDP per capita	0.4623	0.2577	0.3880	0.0182	-0.0470	-0.0319
	[7.43]***	[5.49]***	[6.89]***	[0.43]	[0.80]	[0.64]
Square term,	-0.0287	-0.0088	-0.0196	-0.0024	0.0024	0.0008
log GDP per capita	[6.87]***	[2.73]***	[5.12]***	[0.89]	[0.68]	[0.24]
Other controls	No	No	No	Yes	Yes	Yes
Constant	-1.5546	-1.1200	-1.4913	0.1075	0.3213	0.2936
	[6.74]***	[6.57]***	[7.25]***	[0.69]	[1.35]	[1.57]
F/Wald Chi2 statistics	63.61	649.37	609.92	130.21	171.60	1529.44
Overall R-sq	0.2188	0.1536	0.1781	0.7351	0.7202	0.7361
Obs.	448	448	448	420	420	420
F test for individual effects		40.40			6.95	
Hausman test			290.01			1.92

Note: Absolute value of t statistics are presented in [ ]; ***, **, and * denote that the results are statistically significant at the 1%, 5%, and 10% levels, respectively. Control variables include ratio of workers employed in SOEs, invest/GDP, government expenditure/GDP, openness, FDI/GDP, and gross rate of middle school enrollment. All the control variables are transformed according to the results of the unit root tests from LLC and IPS reported in Table 3.

2. Effect of Inequality on Economic Growth

The effect of inequality on economic growth is identified as follows:

$$\Delta \ln(y_{it}) = \alpha + \beta Gini_{it} + \gamma X_{it} + \varepsilon_{i,t}$$

where $\Delta \ln(y_{it}) \triangleq \ln(y_{it+1}) - \ln(y_{it})$ denotes the first order difference of log GDP per capita, the Gini coefficients are measured for the initial periods, and X_{it} indicates the control variables, as listed in Table 3. The resolution of unit roots are opposite according to the unit root tests from LLC and IPS. Thus, both the Gini coefficients and the first order difference of Gini coefficients are regressed on $\Delta \ln(y_{it})$. Meanwhile, the income inequality and economic growth are feasibly interacted. To obtain one side effect of inequality on economic growth, we take the Gini coefficients at time t to t+1.

Table 5: Inequality and Economic Growth

	I	II	III	IV
Panel (a): 1986-2001				
Model selected	FE	RE	FE	FE
Gini	0.1550		0.1593	
	[5.52]***		[3.21]***	
ΔGini		0.2721		0.1400
		[4.70]***		[2.93]***
Other controls	No	No	Yes	Yes
F/Wald Chi2 statistics	30.5	22.07	30.68	30.36
Overall R-sq	0.041	0.0466	0.0091	0.0123
F test for individual effects	2.91		8.11	7.64
Hausman test	7.82	0.09	184.16	146.00
Panel (b): 1986-1993				
Model selected	FE	RE	FE	FE
Gini	0.3920		-0.0313	
	[4.36]**		[0.33]	
ΔGini		0.5202		0.1509
		[5.92]***		[2.17]***
Other controls	No	No	Yes	Yes
F/Wald Chi2 statistics	18.99	35.08	27.44	28.74
Overall R-sq	0.0578	0.136	0.0527	0.0628
F test for individual effects	1.70	1.67	5.69	5.53
Hausman test	4.59	8.12	110.77	110.72
Panel (c): 1994-2001				
Model selected	RE	FE	FE	FE
Gini	-0.1349		0.0664	
	[2.45]***		[1.31]	
ΔGini		-0.0931		-0.0344
		[1.49]		[0.81]
Other controls	No	No	Yes	Yes
F/Wald Chi2 statistics	5.98	2.23	27.67	27.39
Overall R-sq	0.0393	0.0031	0.0266	0.0263
F test for individual effects		3.31	9.98	9.95
Hausman test	0.05	3.17	350.4	727.67

Note: (1) The explanatory variable is the real growth rate of GDP per capita.
(2) Control variables include ratio of workers employed in SOEs, invest/GDP, government expenditure/GDP, openness, FDI/GDP, and gross rate of middle school enrollment. All the control variables are transformed according to the results of the unit root tests from LLC and IPS reported in Table 3. Log of GDP per capita in proceeding years and time are also controlled for.
(3) Absolute value of t statistics are presented in [ ].
(4) ***, **, and * denote that the statistics are significant at the 1%, 5%, and 10% levels, respectively.

Inequality at the initial stage cannot be a result of economic growth. The fixed effect model and random effect model are selectively reported according to the Hausman test. If the Hausman test is statistically insignificant at the 10% level, the random effect model will be reported. Otherwise, the fixed effect model is selected. The regression results on the effects of inequality on economic growth are reported in Table 5. The results for the entire period are reported in Panel (a), while Panel (b) and Panel (c) report the effects of inequality on economic growth for the two periods of 1986-1993 and 1994-2001, respectively.

The estimated coefficients for the measures of inequality are consistently and positively significant for the entire period from 1986 to 2001, as reported in Table 5, Panel (a). These regression results indicate that higher inequality induces higher economic growth. This relationship holds even when other variables are controlled for. In conclusion, a 1% increase in the Gini coefficients leads to a 0.16% increase in GDP per capita growth.

However, when we test the effects of inequality on economic growth by dividing the observed period into two sub-periods, 1986-1993 and 1994-2001, we find that the effects are negative for the two periods. In the subsample for these periods, economic growth is also positively and significantly affected by inequality in most of the cases. Based on the estimated coefficients on inequality measures, it is reasonable to assume that the effects of inequality on economic growth are much stronger in the first subperiod period. Without controlling for other variables, a 1% increase in the Gini coefficient leads to 0.39% to 0.52% growth in GDP. This effect decreases when other variables are controlled for. However, the regression coefficient for ΔGini is positive and significant and even a bit higher than the ΔGini in the regression for the entire period from 1986 to 2001. For 1994-2001, the estimated coefficients for inequality are insignificant, except for the negative coefficient for the Gini when other variables are not controlled for.

The results in Table 5 indicate that economic growth was positively affected by inequality from 1986 to 2001. However, this effect does not hold for the other periods. From 1986 to 1993, inequality promoted economic growth, while from 1994 to 2001, inequality diminished economic growth.

3. Effect of Inequality on Productivity

We conduct a second regression with the same specifications as the first, but with different explained variables. We follow the methodology used in the previous regression and replace economic growth with productivity, which is a measure used by the Malmquist index for DEA, as previously mentioned. Table 6 reports the effect of inequality on productivity. The results are similar to those reported in Table 5. During 1986-1993, inequality positively affected productivity, while the positive effect diminished in 1994-2001.

There are two possible explanations for differences in the effect of inequality on productivity. The first one of these is the initial conditions of income distribution. In the first period of 1986-1993, China began to do away with egalitarianism by providing economic stimulation to workers through wage differences. This lead to a steady increase of the Gini coefficient to a certain extent, or within a tolerable range. However, when the inequality increased to a range beyond social tolerance, instead boosting economic growth, it became a factor detrimental to economic growth. The second factor is the reform strategy between the two periods. The first period features gradual reform because most people benefit from the reforms and society is in Pareto improvement. However, in the second period, the government conducted radical reform of state-owned enterprises, which led a huge number of laid off workers and unemployment. These measures improved labor productivity but, in

turn, led to an increase in the numbers of low income households and the poverty population. Consequently, the rapid reform benefitted a smaller group of people but hurt the majority. This is one important factor behind the higher income inequality in the later period.

Regression Results for the Effect of Inequality on Productivity

For the entire observed period, the estimated Gini coefficients are insignificant but positive, regardless the other variables that are controlled for. The estimated coefficients for ΔGini are always positive and significant, indicating that the increase in inequality is associated with an improvement in productivity. This effect is more obvious and significant for the period from 1986 to 1993. Consequently, the estimated effect of both Gini and ΔGini are positive and statistically significant, indicating

Table 6: Inequality and Productivity

	I	II	III	IV
Panel (a): 1986-2001				
Model selected	RE	RE	FE	FE
Gini	0.0286		0.0419	
	[1.09]		[1.19]	
ΔGini		0.1728		0.1141
		[3.07]***		[2.09]**
Other controls	No	No	Yes	Yes
F/Wald Chi2 statistics	1.19	9.42	8.69	9.17
Overall R-sq	0.0007	0.0182	0.0430	0.0586
F test for individual effects			4.66	4.61
Hausman test	0.99	0.02	28.79	23.23
Panel (b): 1986-1993				
Model selected	RE	RE	FE	FE
Gini	0.1695		0.2029	
	[3.11]***		[2.90]***	
ΔGini		0.2104		0.1570
		[2.47]**		[1.95]**
Other controls	No	No	Yes	Yes
F/Wald Chi2 statistics	9.66	6.11	8.45	7.60
Overall R-sq	0.0374	0.0285	0.1880	0.1903
F test for individual effects			1.61	1.53
Hausman test	1.41	0.31	2071.15	29.87
Panel (c): 1994-2001				
Model selected	RE	FE	FE	RE
Gini	-0.0143		0.0588	
	[0.23]		[0.80]	
ΔGini		0.0061		0.0129
		[0.10]		[0.21]
Other controls	No	No	Yes	Yes
F/Wald Chi2 statistics	0.05	0.01	2.72	36.51
Overall R-sq	0.0037	0.0011	0.1903	0.2965
F test for individual effects		14.05	8.43	
Hausman test	0.19	4.04	34.63	1.84

Note: (1) The explained variable is TFP as calculated by DEA.
(2) Other control variables include ratio of workers employed in SOEs, invest/GDP, government expenditure/GDP, openness, FDI/GDP, and gross rate of middle school enrollment. All the control variables are transformed according to the results of the unit root tests from LLC and IPS reported in Table 3.
(3) Absolute value of t statistics are presented in [ ].
(4) ***, **, and * denote that the statistics are significant at the level 1%, 5%, and 10% levels, respectively.

that the improvement in productivity was positively driven by inequality between 1986 and 1993. However, the effects of inequality on productivity are insignificant from 1994 to 2001.

Inequality in the Cobb−Douglas Production Function

In addition to the above analysis, we apply the Cobb-Douglas production function as a robust check to examine the effect of inequality on productivity. We assume that the production function is homogeneous of degree one and that inequality is a factor that affects the production process. Thus, the regression can be identified as follows:

$$\ln(Y/L)_{it}=\alpha+\beta\ln(K/L)_{it}+\gamma Gini_{it}+\delta t+\varepsilon_{it}$$

where Y, L, and K indicate total products (GDP), labor, and capital, respectively, and t is time, setting 1986 at one as the initial year and continuing from there. By this specification, the effect of inequality on production can be drawn from the estimated γ. According to Solow's TFP analysis approach, the Solow residual term $\gamma Gini_{it}+\delta t+\varepsilon_{it}$ can be calculated by TFP. Therefore, the estimated γ indicates the potential effects of inequality on TFP and total output.

The regression results are reported in Table 7. The fixed effect model and random effect model are selected according to the Hausman test. Table 7 contains the results of the production function with and without inequality measures. The estimated indicates that, under the Cobb-Douglas production function, a 1% increase in the Gini will lead to a 0.423% increase in GDP growth per labor. This effect was stronger from 1986-1993, reaching 0.6028%. The effect then gradually decreased from 1994-2001 and became insignificant. In summary, the results demonstrate that changes in inequality are consistent with economic growth and the improvement of productivity.

Ⅴ. Conclusion

Previous studies have used cross-country panel data to examine the relationship between inequality and economic growth. For example, Barro (2000) and Castello-Climent (2010) con-

Table 7: Inequality in the Cobb-Douglas Production Function

	Full sample: 1986−2001		***Subsample: 1986−1993***		***Subsample: 1994−2001***	
Fixed (FE) or Random (RE) effects model reported	RE	RE	RE	RE	FE	FE
α	-1.1176	-1.1702	-1.1428	-1.2589	-1.0535	-1.0780
	[16.52]***	[17.75]***	[13.41]***	[14.84]***	[23.63]***	[18.58]***
β	0.5450	0.5569	0.5150	0.5001	0.3834	0.3836
	[29.51]***	[30.32]***	[13.48]***	[13.66]***	[10.33]***	[10.32]***
γ		0.4230		0.6028		0.0836
		[4.11]***		[4.68]***		[0.66]
δ	0.0318	0.0257	0.0269	0.0182	0.0450	0.0446
	[16.52]***	[11.12]***	[9.49]***	[5.57]***	[10.56]***	[10.34]***
Obs.	448	448	224	224	224	224
F/Wald Chi2 statistics	17369.74	17926.72	1432.53	1587.72	3919.72	2605.75
Overall R-sq	0.7910	0.7867	0.6785	0.6659	0.7335	0.7322
F test for individual effects					673.83	634.95
Hausman test	0.17	1.47	0.27	0.17	7.74	8.10

Note: Absolute value of t statistics are presented in [ ]; ***, **, and * denote that the statistics are significant at the 1%, 5%, and 10% levels, respectively.

ducted a non-linear analysis on this relationship. However, their findings only proved that the negative effect of inequality on economic growth occurs in lower-income countries. By contrast to previous studies focusing on cross-country contexts, we use China as a case study to analyze the causal effects of income distribution and economic development within a single country. Using China's provincial panel data from household surveys, we analyze the relationship between income inequality and economic growth, as well as the effect of inequality on productivity in China from 1986-2011. Through regression analysis and production function decomposition, we find a positive correlation between inequality and economic growth from 1986 to 2001, a period characterized by high economic growth and rapid expansion of inequality in China. In dividing the observed period into two periods, however, we find that the correlation between inequality and economic growth is mainly positive from 1986 to 1993 but decrease and vanishes from 1994 to 2001.

To examine the quality of economic growth between 1986 and 2001, we verify the effects of inequality on productivity. We find that during 1986-1993, inequality exerts a positive effect on productivity but that this effect decreases and vanishes during 1994-2001 (this effect is also observed for economic growth). These findings indicate the existence of a previously ignored channel, indicating that inequality may be positively associated with growth by producing an incentive effect on economic growth. During the initial stage of economic reform, the iron rice bowl (tiefangwan), namely, egalitarianism, was broken, which created motivation and efficiency in workers and, in turn, stimulated economic growth. Heterogeneity of individual endowments produced various returns on production factors, resulting in an increase in both income and income inequality. However, such effects have decreased and gradually vanished since the mid-1990s, when dramatic reform measures and radical economic restructuring were introduced in SOEs. Consequently, the effect of inequality on economic growth was diminished.

We can summarize the policy implications of this study in the following points:

First, egalitarianism, or absolute equality, negatively affects economic growth because it fails to economically stimulate individuals and enterprises. From an economic vantage point, egalitarianism is *unfair* because it distributes economic outcomes equally but ignores differences in individual effort. Consequently, it is easy to create an inefficient, low-growth economy or poor socialism, such as the type that occurred in China before 1978.

Second, inequality can be divided into two types: good inequality and bad inequality. Good inequality distributes income relatively unequally but respects the effort of individuals and provides returns to production factors equally. However, if inequality rises too much, it can hurt the majority of people, reduce incentives to work harder, and cause social and political instability. Thus, ultimately, bad inequality hurts future economic development.

Third, good inequality and bad inequality can be defined differently by different conditions at different stages. At the early stage of economic development, when inequality is relatively low, inequality may be good and may promote economic growth. However, as time goes on, the efficiency of inequality in stimulating productivity will decrease gradually. When the degree of inequality increases beyond the range tolerated by the public, inequality may diminish productivity and hinder further economic development.

However, the effect of inequality on economic growth after 2001 should be examined in future research when variable data becomes available. At same time, some may have doubts regarding our conclusions on the basis of inequality not being a factor caused by high growth but a result of high growth. In fact,

the explanation of a relationship between income inequality and economic growth is like the unexplainable conundrum about "Which came first, the hen or the egg". We cannot deny that income inequality is a sub-product of high growth and more studies are needed to examine the causal relationship between inequality and growth by studying long-term datasets. However, our study shows the effect of inequality on economic growth through panel data analysis and the results provide clear answers on this.

China is facing a difficult choice: maintain some level of inequality to continue its high growth or equalize its income distribution to promote societal and political stability. In our view, considering the experiences of some developed countries, it is still too early for China to equalize income distribution and increases taxes for the rich, because China is still a developing country with an upper-middle class income standard that is in a stage of high growth. Thus, China should not to greatly reduce the degree of income disparity and should continue its long-term economic growth by further stimulating individual enthusiasm and productivity. We recommend, on the basis of our study, that China balance equality and efficiency by maintaining certain level of income disparity.

Notes

1) Chongqing is combined with Sichuan, and Hainan and Tibet are dropped because of data missing in some years.
2) The estimation on TFP is undertaken by the DEAP 2.1 software package.
3) The detailed results for the regressions are omitted.

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References

Alesina, A., and Rodrik, D. (1994), "Distributive Politics and Economic Growth", *Quarterly Journal of Economics*, Vol.109, pp.465-490.

Barro, R. (2000), "Inequality and Growth in a Panel of Countries", *Journal of Economic Growth*, Vol.5, pp.5-32.

Benabou, R. (1996), "Inequality and Growth", *NBER Macroeconomics Annual*, Vol.11, pp.11-74.

Benhabib, J. and Rustichini, A. (1996), "Social Conflict and Growth", *Journal of Economic Growth*, Vol.1, pp.129-146.

Benjamin, D., Brandt, L. and Giles, J. (2011), "Did Higher Inequality Impede Growth in Rural China", *Economic Journal*, Vol.121, pp.1281-1309.

Castello-Climent, A. (2010), "Inequality and Growth in Advanced Economies: an empirical investigation", *Journal of Economic Inequality*, Vol.8, pp.293-321.

Chow, G. (1993), "Capital Formation and Economic Growth in China", *Quarterly Journal of Economics,* Vol.114, pp.243-266.

Chow, G. and Lin, A. (2002), "Accounting for Economic Growth in Taiwan and Mainland China: a comparative analysis", *Journal of Comparative Economics*, Vol.30, No.3, pp.507-530.

Deininger, K. and Squire, L. (1996), "A New Data Set Measuring Income Inequality", *World Bank Economic Review*, Vol.10, No.3, pp.565-591.

Dollar, D. and Kraay, A. (2002), "Growth Is Good for the Poor", *Journal of Economic Growth*, Vol.17, No.3, pp.195-225.

Forbes, K. (2000), "A Reassessment of the Relationship between Inequality and Growth", *American Economic Review*, Vol.90, No.4, pp.869-887.

Galor, O. and Tsiddon, D. (1996), "Income Distribution and Growth: the Kuznets Hypothesis Revisited", *Economica*, Vol.63, pp.S103-S117.

Gustafsson, B., Li, S. and Sicluar, T. (eds.) (2008),

Inequality and Public Policy in China, New York: Cambridge University Press.

Herzer, D. and Vollmer, S. (2012), "Inequality and Growth: evidence from panel cointegration", *Journal of Economic Inequality*, Vol.10, pp.489-503.

Hu, Z. and Kahn, M. (1997), "Why is China Growing So Fast?", *Staff Papers-the International Monetary Fund*, pp.103-131.

Im, K. S., Pesaran, M. H. and Shin, Y. (2003), "Testing for Unit Roots in Heterogeneous Panels", *Journal of Econometrics*, Vol.115, pp.53-74.

Kuznets, S. (1955), "Economic Growth and Income Inequality", *American Economic Review*, Vol.45, No.1, pp.1-28.

Levin, A., Lin, C. F. and Chu, C. S. J. (2002), "Unit Root Tests in Panel Data: asymptotic and finite-sample properties", *Journal of Econometrics*, Vol.108, pp.1-24.

Li, S., Sato, H. and Sicular, T. (eds.) (2013), *Rising Inequality in China: challenges to harmonious so－ciety,* New York: Cambridge University Press.

National Bureau of Statistics (NBS), (2013), *China Statistical Yearbook 2012*, Beijing: China Statistical Press. (In Chinese)

National Bureau of Statistics (NBS), (2010), *Comprehensive Statistical Data and Materials on 60 Years of China*, Beijing: China Statistical Press. (In Chinese)

Panizza, U. (2002), "Income Inequality and Economic Growth: evidence from American data", *Journal of Economic Growth*, Vol.7, pp.25-41.

Partridge, M. (1997), "Is Inequality Harmful For Growth? Comment", *American Economic Review,* Vol.87, No.5, pp.1019-1032.

Perotti, R. (1993), "Political Equilibrium, Income Distribution and Growth", *Review of Economic Studies*, Vol.60, pp.755-776.

Persson, T. and Tabellini, G. (1994), "Is Inequality Harmful for Growth? Theory and Evidence", *American Economic Review*, Vol.84, pp.600-621.

Ravallion, M., and Chen, S. (2007), "China's (Uneven) Progress against Poverty", *Journal of Development Economics*, Vol.82, No.1, pp.1-42.

Riskin, C., Zhao, R. and Li, S. (2001), *China's Retreat from Equality ― Income Distribution and Economic Transition*, New York: M. E. Sharpe.

Rossi, N., Toniolo, G. and Vecchi, G. (2001), "Is the Kuznets Curve Still Alive? Evidence from Italian Household Budgets, 1881-1961", *Journal of Economic History*, Vol.64, No.4, pp.904-925.

Rural Household Survey Team of NBS, (2003), *China Yearbook 2003: Rural Household Survey*, Beijing: China Statistics Press.

Ezcurra, R. and Rodriguez-Pose, A. (2013), "Does Economic Globalization affect Regional Inequality? A Cross-country Analysis", *World Development*, Vol.52, pp.92-103.

Wang, Y. and Yao, Y. (2003), "Sources of China's Economic Growth 1952-1999: incorporating human capital accumulation", *China Economic Review*, Vol.14, pp.32 -52.

Voitchovsky, S. (2005), "Does the Profile of Income Inequality Matter for Economic Growth?: distinguishing between the effects of inequality in different parts of the income distribution", *Journal of Economic Growth*, Vol. 10, pp/273-296.

Zhang, J., Wu, G. and Zhang, J. (2004), "The Estimation of China's Provincial Capital Stock: 1952-2000", *Economic Research Journal*, Vol.10, pp.35-44. (In Chinese)

Zhang, J., Wu, G. and Zhang, J. (2007), "Estimating China's Provincial Capital Stock", *Working Paper Series, China Center for Economic Studies, Fudan University*.

Zheng, J. and Hu, A. (2006), "An Empirical Analysis of Provincial Productivity in China (1979-2001)", *Journal of Chinese Economic and Business Studies*, Vol.4, No.3, pp.221-239.

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