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Globalization and Regional Income Inequality: Empirical evidence from within China

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> 'The debate over globalization is lively, often passionate, and has sometimes been violent.'
>
> (Stanley Fischer 2003:2)

Introduction

How globalization affects inequality is subject to heated debate (Fischer 2003:5). Stiglitz (1998) and Hurrell and Woods (2000), among others, argue that globalization leads to increases in inequality because trade increases differentials in returns to education and skills, globalization marginalizes certain groups of people or geographic regions, and liberalization is not complemented by development of adequate institutions and governance. This view is supported by evidence from China and some transitional economies that are experiencing significant increases in inequality after their having opened up to the outside world (Birdsall 1999; Mazur 2000). In developed countries, rising inequalities are being attributed to trade growth or international specialization as well (Atkinson 2001). To the contrary, Ben-David (1993) and Srinivasan and Bhagwati (1999) conclude that globalization helps to reduce inequality. This is also supported by evidence from a number of countries where inequality decreased when they liberalized their economies (Wade 2001). In between these two opposing views, Lindert and Williamson (2001) and Sala-i-Martin (2002a, 2002b) find that a significant globalization–inequality relationship does not exist. Krugman and Venables (1995:859) deduce a U-shaped pattern between inequality and trade.

A number of factors can explain these mixed findings. First, inequality is measured differently, not only by employing alternative indices.

While some consider inequality among individuals, others focus on inequality between countries. Some explore inequality of one country or a group of countries; others discuss global inequality. Second, there exist differences in the analytical techniques. Most studies use cross-country regressions; however, some simply rely on partial correlations between inequality and globalization defined in various ways.[1] Correlation analysis cannot control for other causal variables, and cross-country regressions may produce different results when different control variables or different model specifications are used. Finally, sample coverage (selection of countries and time periods) differs from study to study.

This chapter contributes to the literature by examining the impact of globalization on regional income inequality in China. Focusing on China requires little justification, especially given China's importance in determining the global inequality trend. In addition, it can help alleviate the heterogeneity and data comparability problems often encountered in cross-country studies (Srinivasan and Bhagwati 1999; Atkinson and Brandolini 2001). To enhance the robustness of our empirical results, we first characterize the underlying income generating process using the flexible Box–Cox model, and then quantify the impact of globalization under all conventional measures of inequality. In decomposing total inequality into components associated with relevant determinants, the Shapley value framework of Shorrocks (1999) is combined with the estimated income generating function. The Shapley methodology is based on the cooperative game theory, and has been recently used by Wan (2004) and Kolenikov and Shorrocks (2005).

To elaborate further, in this chapter we seek to answer two questions: how globalization and regional income inequality are related in China; how much globalization contributes to regional inequality in China. The first question has received some attention. Kanbur and Zhang (2005) obtain a positive relationship between openness (measured by effective tariff rate and the trade/GDP ratio) and interregional inequality. Xing and Zhang (2004) find the same using FDI as a measure of globalization. However, Wei and Wu (2003) conclude with a negative relationship between urban–rural disparity and the trade/GDP ratio. With respect to the second question, little has been published with the exception of Zhang and Zhang (2003), who estimate a labour productivity (GDP/labour ratio) function and decompose inequality (measured by the log variance) in labour productivity into a number of components, including those associated with openness. The log variance measure, however, violates the crucial principle of transfers and the GDP/labour ratio does not necessarily relate to personal income in China (Lin and Liu 2003). Bourguignon and Morrisson (2002) appeal for the use of income rather than GDP data in analyzing inequality.

The remainder of this chapter is organized as follows: the next section presents a background description of China's journey to globalization. We go on to specify and estimate functions that generate income, and discuss inequality decomposition results. Finally, we close the chapter by exploring policy implications.

China's journey to globalization and regional inequality

As an active participant of the third globalization process, China is fast integrating into the world economy at a pace as remarkable as her economic growth. After over 20 years of opening up, China has become the largest recipient of foreign direct investment (FDI) and the fifth largest trader in the world since 2002.

Growing international trade

Before 1979, international trade was under the supervision of central government, which controlled more than 90 per cent of trade by monopolizing the imports and exports of over 3000 kinds of commodities. These commodities can be classified into two categories: government-controlled goods (where both the value and volume of trade were strictly controlled) and government guideline goods (where only the value of trade was controlled). In 1985, the number of goods comprising these categories was cut to about 100 each. By 1991, almost all exports were deregulated, with only 15 per cent controlled by specially appointed trading companies. Imports have also been deregulated. The proportion of government-controlled imports in the total import volume was reduced from 40 per cent in 1985 to 18.5 per cent in 1991. By 1994, almost all control of imports and exports was abolished, with a few exceptions where extremely important goods were traded by especially appointed trading companies.

In pre-reform China, tariffs were high and represented the only form of protection. When China initiated significant trade reforms in 1992, the rates of tariff remained high, averaging 44.05 per cent. Since 1992, China has cut its tariff rates substantially every year. The average tariff rate fell to 17.1 per cent in 1998 (Yin 1998:126). On the other hand, non-tariff barriers were introduced in the early 1980s. Subsequently, an increasing number of goods were placed under licensed trading and quota controls. In 1992, some 25 per cent of imports and 15 per cent of exports were managed under licences. However, the scope of licence and quota management has been narrowed down since 1992. By 1997, only 384 categories of imports – a mere 5 per cent of the total – were managed under quota and licences (Yin 1998:129).

Both exports and imports have experienced remarkable growth. The growth trend was maintained, even during the Asian financial crisis in the late 1990s. In 1978, China ranked 32nd in the world in terms of international trade. The ranking improved to 15th in 1989, 10th in 1997 and 6th in 2001. The ratio of international trade to GDP also rose from 9.85 per cent in 1978 to as high as 42.78 per cent in 2001. In 2002, total trade exceeded US$600 billion, representing more than 50 per cent of China's GDP.[2] This places China as the 5th largest trader in the world. In passing, it is noted that export of manufactured goods has accounted for an increasingly large share since the mid-1980s, while the corresponding import has declined, albeit at a slow rate. Clearly, China has been industrializing and is becoming a major exporter of manufactured commodities.

Increasing cross-border capital flows

In 1979, three Special Economic Zones (SEZs) were set up in Guangdong in order to attract FDI.[3] However, not until 1984 did FDI start to pour in. In the same year, fourteen coastal cities were designated as Open Cities and ten Economic and Technology Development Zones (ETDZs) were established. Since that time, increasingly more SEZs, Open Cities and ETDZs have been developed to attract FDI and technology transfer, and to enhance exports. The second wave of FDI inflow occurred in 1992, when Deng Xiaoping made his well-known tour of South China.

For many years, China was the largest recipient of FDI among developing countries, and the second largest in the world since 1993, next to the United States. In 2002, China attracted US$52.743 billion of FDI and led the world for FDI. The ratio of FDI to GDP was as high as approximately 4 per cent in 2001. Meanwhile, a large amount in foreign loans has been utilized in various areas of development.[4] Also, China has seen an impressive growth of capital outflows in recent years, owing to the rapid growth of domestic enterprises. China's investment abroad nearly tripled from US$2562.49 million in 1997 to US$6885.398 million in 2001.

Further opening up after WTO accession

Since becoming a member of the WTO in 2002, China has taken several steps to promote globalization. On 1 January 2002, China cut import tariffs for more than 5000 goods. The average tariff rate was reduced to 12 per cent from 15.3 per cent in 2001. The rate for manufacturing goods was reduced from 14.7 per cent to 11.3 per cent, while that for agricultural goods (except aquatic products) from 18.8 per cent to 15.8 per cent. At the same time, China abolished quota and licence arrangements for grains, wool, cotton, chemical fertilizers and so on. In addition, China modified or abolished those laws and regulations inconsistent with WTO rules. New laws on anti-dumping and anti-subsidy have been implemented since 1 January 2002.

At about the time of China's entry into the WTO, China issued new laws and regulations concerning service trade, covering legal service, telecommunications, financial institutions, insurance, audio and video products, tourism and so on. Laws regarding the entry of foreign sales companies and joint ventures on the stock exchange were being drawn up. Also, measures were taken to ensure compliance with rules of the WTO on intellectual property, foreign investment and information transmission.

Globalization and regional inequality

Clearly, China, as a whole, has gone a long way in globalizing. However, there exist significant differences in the pace and extent of globalization across regions. This is particularly true when China is divided into three areas: the east, the central region and the west. Figures 1.1 and 1.2 plot the ratios of regional per capita FDI and the regional openness index to the national averages (selected years). It is clear that east China attracts much more FDI and trade than the central region and the west, although convergences appear to have taken place within each area. This pattern also applies to other variables such as income, capital and extent of privatization. Therefore, disparity in globalization is largely an inter-area issue and including area dummies in the income generating functions for later consideration is justified.

Such differences in globalization may arise through a number of mechanisms and are expected to affect regional inequality. First, some regions have location advantages and thus can better exploit benefits of trade (close to ports, Hong Kong, Macau, Russia and Vietnam). Second, some regions possess more family ties to overseas investors and thus attract more FDI and associated spill over effects. Third, some regions are endowed with more or better resources (infrastructure, human capital, market potential) and thus can better attract FDI and develop trade. Finally, local culture, customs and traditions differ from region to region. These non-economic factors are embedded in the leadership styles of the regional and local governments, thus making regional economies more, or less, receptive to foreign capital and technologies. All the above differences lead to different paces of globalization in different regions,

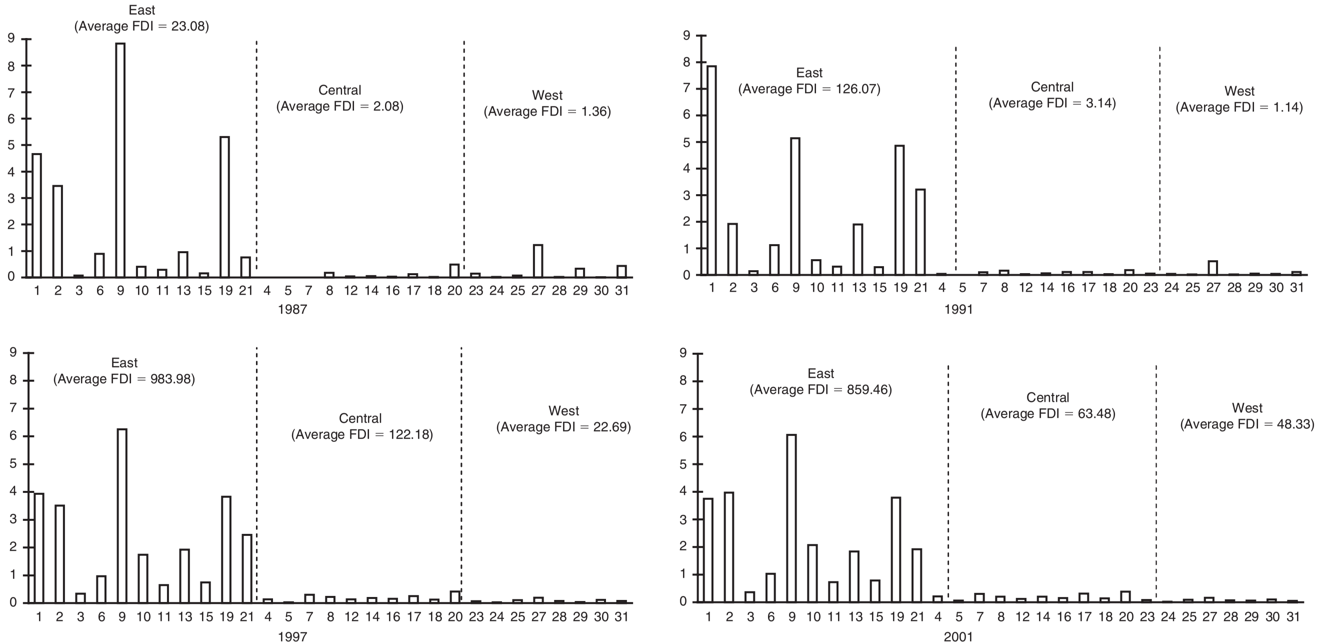

Figure 1.1 Ratio of regional per capita FDI to the national average

Notes: Eastern: 1 = Beijing, 2 = Tianjin, 3 = Hebei, 6 = Liaoning, 9 = Shanghai, 10 = Jiangsu, 11 = Zhejiang, 13 = Fujian, 15 = Shandong, 19 = Guangdong, 21 = Hainan; Central: 4 = Shanxi, 5 = Inner Mongolia, 7 = Jilin, 8 = Heilongjiang, 12 = Anhui, 14 = Jiangxi, 16 = Henan, 17 = Hubei, 18 = Hunan; 20 = Guangxi; Western: 23 = Sichuan, 24 = Guizhou, 25 = Yunnan, 27 = Shaanxi, 28 = Gansu, 29 = Qinghai, 30 = Ningxia, 31 = Xinjiang.

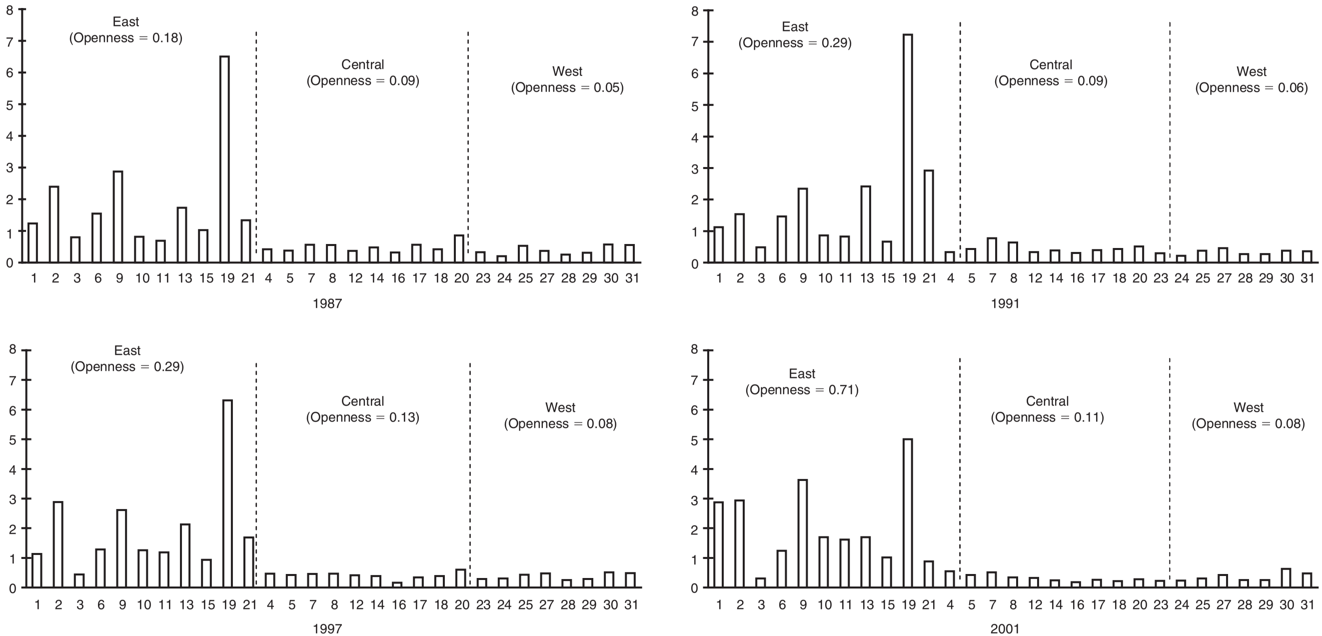

Figure 1.2 Ratio of regional openness to the national average (openness = trade/GDP)

Notes: Eastern: 1 = Beijing, 2 = Tianjin, 3 = Hebei, 6 = Liaoning, 9 = Shanghai, 10 = Jiangsu, 11 = Zhejiang, 13 = Fujian, 15 = Shandong, 19 = Guangdong, 21 = Hainan; Central: 4 = Shanxi, 5 = Inner Mongolia, 7 = Jilin, 8 = Heilongjiang, 12 = Anhui, 14 = Jiangxi, 16 = Henan, 17 = Hubei, 18 = Hunan; 20 = Guangxi; Western: 23 = Sichuan, 24 = Guizhou, 25 = Yunnan, 27 = Shaanxi, 28 = Gansu, 29 = Qinghai, 30 = Ningxia, 31 = Xinjiang.

despite the uniform national policy of opening up and the appeals of central government for local governments to embrace globalization actively.

Needless to say, globalization comes with both benefits and costs, which are not evenly distributed among regions or individuals. It is thus imperative to analyze the impact of globalization on income inequality before policy measures can be designed and implemented to curb the fast rising regional income inequality in China.

Accounting for China's inter-regional income inequality

As the first step of the regression-based decomposition, an income generating function must be obtained. Specification of such a function usually relies on the human capital theory. However, for modelling regional average income in China, consideration must be given to both human capital theory and production theory. This is because variables other than human capital are important in determining income levels across regions in China. These variables include capital input as argued by Yang (1994), government support as argued by Ma and Yu (2003), and deregulation or reform as argued by Démurger *et al.* (2002). Capital will be represented by per capita capital stock, government support by fiscal expenditure excluding administrative fees, and reform or deregulation by a privatization index defined as the proportion of non-state-owned enterprises employees in the total labour force. Meanwhile, it is accepted that geography is important in affecting regional economic development in China. Thus, dummy variables for east, central and west China will be used to control for geography and infrastructure (Démurger 2001). Further, urbanization differs from region to region, and such differences affect regional per capita income and, thus, inequality. This can be controlled by an urbanization index, defined as the proportion of the non-agricultural population. Finally, the conventional variables of labour and education must be considered. Given labour surplus in China and the linear relationship between the variables of labour and dependency ratio, we chose to include the latter. The converging trend in the dependency ratio implies a declining contribution of this variable to inequality.

The observations on capital stock are taken from Zhang, Wu and Zhang (2004, ZWZ hereafter). ZWZ do not include inventory as capital stock while Zhang and Zhang (2003, ZZ hereafter) do, although both studies use the same data estimation technique. Also, ZWZ construct the time series of capital stock as from 1952 rather than 1978, as in ZZ. Since the inventory represents only potential rather than effective production input, and biases in the estimate decrease as the time interval expands between the initial year and the current year, data from ZWZ will be used in this chapter. Other data are compiled from *Comprehensive Statistical Data and Materials for 50 Years of New China*, as well as various issues of the *China Statistical Yearbook*, both published by the National Bureau of Statistics (NBS). See the Appendix for details on data construction.

Largely due to the incompleteness of FDI statistics, the modelling exercise is confined to the period 1987–2001. With Taiwan, Hong Kong and Macau excluded, there are 31 provinces or regions in China, including four autonomous municipal cities. Chongqinq – the youngest region in China – was created in 1997 and is merged with Sichuan. Tibet is excluded because of a lack of complete data. Therefore, a total of 29 regions will be covered in this study.

In summary, the following variables are included in the underlying income generating function: per capita income (*Y*), per capita capital input (*K*), the dependency ratio as an alternative to labour (*Dep*),[5] average years of schooling (*Edu*), per capita FDI (*FDI*), trade/GDP ratio (*Trade*), reform or privatization defined as proportion of the labour force working in the non-state-owned enterprises (*Reform*), urbanization defined as the proportion of non-agricultural population (*Urb*) – which also serves as a proxy for industrialization, location dummies (*Central* and *West*),[6] and dummies for the period 1992 onwards (*D92*) and 1996 onwards (*D96*). *D92* is used to capture the effects of Deng Xiaoping's South-China tour and *D96* to capture a number of significant reforms initiated in 1996, especially the labour market reform characterized by the large-scale laying-off of redundant workers (*Xiagang*). Finally, government support is represented by per capita government expenditure excluding administrative fees (*Gov*). This is a proxy of government involvement in economic activities in general, and in public investment in particular. All observations in value terms are deflated by regional CPIs.

Regarding functional form, most empirical studies in human capital theory adopt the semi-log form or the Mincer model. If one relies on the production theory, Cobb–Douglas (double log), CES (constant elasticity of substitution) or translog specifications are the possible candidates (see Wan 1996; Wan and Cheng 2001). In the inequality decomposition literature, Fields and Yoo (2000:145) did not explicitly provide theoretical arguments supporting their semi-log specification, except for the casual remark 'based on human capital theory or some other underlying theoretical model'. Tsui (2007) did exactly the same, with a different remark: 'to render the estimation manageable'. On the other hand, Morduch and Sicular (2002:101) simply used a strictly linear function without much justification. In this paper, we decide to adopt the combined Box-Cox and Box-Tidwell model in order to minimize misspecification error:

$$Y^{(\lambda)} = a_0 + a_1 X_1^{(\theta)} + a_2 X_2^{(\theta)} + \cdots + a_K X_K^{(\theta)} + dummy\ terms + u \tag{1.1}$$

where λ and θ are transformation parameters; other notations are self-explanatory. In this specification, $Y^{(\lambda)} = Y^{\lambda} - 1/\lambda$ and $X_k^{(\theta)} = X_k^{\theta} - 1/\theta$. As λ approaches 0, the limit of $Y^{\lambda} - 1/\lambda$ is *Ln Y* by L'Hôpital's rule. Hence, $Y^{(\lambda)} = Ln\ Y$ when $\lambda = 0$ (Judge *et al.* 1988). The same arguments apply to $X_k^{(\theta)}$. Model (1.1) encompasses many functional forms, including the semilog income generating function of Fields and Yoo (2000) and Tsui (2007) if $\lambda = 0$ and $\theta = 1$, and the standard linear function of Morduch and Sicular (2002) if $\lambda = \theta = 1$. In the case that $\lambda = \theta = 0$, a double-log equation, as used by Zhang and Zhang (2003) is obtained. When $\lambda = -1$ or $\theta = -1$, the relevant variable becomes its reciprocal. Clearly, one can restrict each of the two transformation parameters to be 0, 1, -1 or unrestricted. The 4 by 4 combinations produce 16 different functional forms. Moreover, one can impose $\lambda = \theta$ although they are not restricted to a particular numerical value. Clearly, our specification (1.1) is more general and flexible than what has been used in the inequality decomposition literature as it encompasses at least 17 different models.

These 17 models are fitted to the Chinese data using Shazam, which employs an iterative maximum likelihood (ML) estimation procedure.[7] Model selection can be easily undertaken using the conventional χ^2 test where the test statistic is twice the difference in the loglikelihood values of model (1) and its restricted versions. As reported in Table 1.A1 of the Appendix, the test results indicate rejections of all models with two exceptions. The first case involves imposing $\lambda = 0$ while θ remains a free parameter. This amounts to a log-nonlinear model (the *X*s are subject to a nonlinear transformation). The second case involves restricting $\lambda = \theta$. Statistically speaking, these two models are equivalent to (1) and either of them can be used for inequality decomposition. We choose to use the log-nonlinear model, largely because it is consistent with the human capital theory where almost all empirical studies apply logarithm transformation to the dependent variable in modelling the wage or income generating process.

Could the log-nonlinear model be spurious? After all, the panel data we use contain fifteen years of time series observations, thus the variables may be non-stationary. Employing the popular unit-root test of Im, Pesaran and Shin (2003) or the IPS test for heterogeneous panel data, we found that FDI and education are stationary, but all other variables are non-stationary. Consequently, it is necessary to test for co-integration (McCoskey and Kao 1999). The literature on co-integration tests in panels is large and growing rapidly. Baltagi and Kao (2000) provide a comprehensive survey. For a more recent review, see Breitung and Pesaran (2005). Consequently, many testing procedures are available and each has its own merits and disadvantages. We chose to employ the residual-based test of Im, Pesaran and Shin (2003) or IPS due to its popularity.[8] Relying on IPS, the residual is found to be stationary when the order of lag is set to two. The test statistic is found to be −1.71 while the critical value is −1.66, indicating rejection of the null hypothesis of unit roots. According to this test result, the log-nonlinear model we obtained earlier can be said to represent a valid long-run regression relationship.[9]

One may argue that one or more of the independent variables could be endogenous, such as trade and FDI. Consequently, we re-estimate the log-nonlinear model using the generalized method of moment or GMM technique of Blundell and Bond (1998) and then apply the Hausman test (Hausman 1978). The resultant χ^2 statistic is 0.86, indicating absence of endogeneity in our log-nonlinear model. It is noted that all GMM estimates, except that for government support (*Gov*), possess the same signs as the ML estimates, confirming the robustness of the latter. However, most GMM estimates, including that for *Gov*, are insignificant. This is not surprising as GMM estimation can only guarantee consistency, but not efficiency. Consequently, we disregard the GMM estimation results hereafter as ML estimation of our model is both efficient and consistent.

Table 1.1 reports ML estimation results for the log-nonlinear model. No *t*-ratio is reported for the θ coefficient as it is obtained by grid search. Earlier rejection of the double-log model implies that θ is significantly different from zero. It is clear that the model fits the data quite well, as indicated by the high R^2. All parameters are different from 0 at the 1 per cent or 5 per cent level of significance. Further, the signs of all parameter estimates are consistent with expectations. In particular, the coefficient estimates for the location dummies match the fact that western regions are poorer than central regions, which, in turn, are poorer than eastern regions. In terms of elasticity estimates, income growth is quite responsive to reform, education, government support, urbanization and domestic capital. The low elasticity of FDI is acceptable given its small sample mean value (517 *yuan*) relative to domestic capital (4403 *yuan*). Since per capita domestic capital is 8.5 times that of per capita FDI, the

Table 1.1 Estimated income generating function (sample size = 435)

Variable	Coefficient estimate	*t*-ratio	*p*-value	Elasticity at means	Loglikelihood value	Adj-R^2
Capital	0.034	4.612	0.000	0.105		
Dependency	−0.064	−4.299	0.000	−0.118		
Education	0.151	2.545	0.011	0.195		
Government	0.054	4.976	0.000	0.110		
FDI	0.008	2.405	0.017	0.018		
Trade	0.038	4.350	0.000	0.058		
Reform	0.123	9.024	0.000	0.188	−2533.22	0.935
Urbanization	0.082	4.940	0.000	0.128		
Central	−0.072	−3.297	0.001	−0.025		
West	−0.168	−6.996	0.000	−0.046		
Year 1992	0.083	4.818	0.000	0.056		
Year 1996	0.170	9.527	0.000	0.068		
Constant	4.796	32.950	0.000	4.796		
θ	0.133					

marginal impact of FDI on income is 45 per cent larger than that of domestic capital, which corroborates well with conventional wisdoms.

To analyze inequality of income rather than inequality of logarithm of income, it is necessary to solve the estimated log-nonlinear income generating function for the income variable Y:

$$Y = \exp(\hat{a}_0) \cdot \exp(\hat{a}_1 X_1^{(\theta)} + \hat{a}_2 X_2^{(\theta)} + \cdots + \hat{a}_K X_K^{(\theta)}) \cdot \exp\,(\textit{dummy terms}) \cdot \exp(\hat{u}) \qquad (1.2)$$

The term $\exp(\hat{a}_0)$ is a scalar in (1.2) and can be removed from the equation without any consequence when relative measures of inequality are used, as in this chapter. By the same token, year dummy terms can be removed since inequality will be measured and decomposed on a year-by-year basis.

To decompose total inequality in Y using (1.2), the first step is to identify the contribution of the residual term $\hat{u}$. This can be achieved by adopting the before–after principle of Cancian and Reed (1998). In other words, the contribution can be calculated as the difference between inequality of the original income Y and that of income given by (1.2) when assuming $\hat{u} = 0$. Denote this income by $\tilde{Y}$ and an inequality index by I, the residual contribution is simply equal to $I(Y) - I(\tilde{Y})$, where

$$\tilde{Y} = \exp(\hat{a}_0) \cdot \exp(\hat{a}_1 X_1^{(\theta)} + \hat{a}_2 X_2^{(\theta)} + \cdots + \hat{a}_K X_K^{(\theta)}) \cdot \exp\,(\textit{dummy terms}) \qquad (1.3)$$

Table 1.2 Total inequality and explained proportion

Year	**Total Gini**	**Contribution by**		**Proportion explained* = 100 × (1−|Residual|/Total)**
		Independent variables	**Residual**	
1987	0.172	0.159	0.013	92.4
1988	0.176	0.163	0.012	93.2
1989	0.183	0.167	0.016	91.3
1990	0.174	0.173	0.001	99.4
1991	0.182	0.172	0.011	94.0
1992	0.187	0.172	0.014	92.5
1993	0.201	0.178	0.022	89.1
1994	0.206	0.187	0.019	90.8
1995	0.210	0.198	0.012	94.3
1996	0.206	0.202	0.004	98.1
1997	0.203	0.206	−0.003	98.5
1998	0.199	0.204	−0.004	98.0
1999	0.206	0.209	−0.003	98.5
2000	0.208	0.211	−0.003	98.6
2001	0.214	0.210	0.003	98.6

Note: * A negative (positive) residual contribution implies that variables not considered are (dis-)equalizing forces. As discussed in the chapter, the ratio of the absolute value of residual contribution to the total inequality indicates the proportion of inequality not explained and 1 minus this proportion can be defined as the explained proportion.

Again, the year dummy terms and $\exp(\hat{a}_0)$ can be removed from (1.3) without affecting the analytical results. In passing, it is noted that $\tilde{Y}$ differs from the usual predicted Y under a semilog econometric model by a factor of $\exp(0.5\,\hat{\sigma}^2)$, where $\hat{\sigma}^2$ is the estimated variance of the error term (see Wan 1996).

Using the Gini index as an example measure, total income inequality and the residual contribution for China are tabulated in Table 1.2 (for results using other measures, see Tables 1.A2–A5 in the Appendix). The total inequality displays a clear upward trend, increased over 24 per cent from 1987 to 2001. This increase is also evident when other inequality indices are used. The values of Gini may appear smaller than some would expect. This is because they represent the between component – inequality between regions only, excluding the within component. To calculate the latter requires data at the individual or household level. Also, deflation by regional CPIs produces smaller regional inequality estimates (Wan 2001).

To a large extent, the residual contribution can be interpreted as that part of inequality not accounted for by the included variables. That is, it represents the effect on inequality of excluded variables. In a hypothetical though unrealistic situation where all variables are included and there exists no model misspecification, the residual would disappear so that exactly 100 per cent of total inequality is explained.[10] Generally speaking, it is a rule, rather than exception, that the residual contribution is non-zero. Both negative and positive residual contributions indicate some lack of explanatory power of the estimated model. A positive (negative) contribution implies that the effects of excluded variables are more beneficial to the rich (poor).[11] It is thus reasonable to use the ratio of the absolute value of the residual contribution over total inequality to indicate the proportion of inequality not explained. Consequently, one minus this proportion can be defined as the explained proportion, which reflects the quality of the modelling work. When the model fits the data poorly, the explained proportion would be low and the corresponding research findings would be of little value, as policy initiatives based on these findings would be ineffective.[12] From this perspective, our modelling exercise is quite successful as we can explain up to 99.4 per cent of total inequality (last column of Table 1.2). Even in the worst case of 1993, almost 90 per cent of total inequality is explained.

The difference between the total inequality and the residual contribution equals the contributions of those independent variables included in the income generating function. To obtain contributions of individual variables, the Shapley value procedure of Shorrocks (1999) is adopted here.[13] The full decomposition results are presented in Table 1.4 and in the Appendix as Tables 1.A2–A5, with inequality measured respectively by the Gini coefficient, the generalized entropy measures (GE_0 and GE_1), the Atkinson index, and the squared coefficient of variation (CV). As expected, the decomposition results differ depending on the indicator of inequality used. This is not surprising because different indicators are associated with different social welfare functions and presume different aversions to inequality. They also place different weights to different segments of the underlying Lorenz curve. It is noted, however, that the squared CV violates the principle of transfer and the Atkinson index is ordinally equivalent to the GE measures as its entire family can be expressed as a monotonic transformation of the latter (Shorrocks and Slottje 2002). Consequently, we only use results under the Gini, the Theil Index (GE_1) and the mean logarithmic deviation (GE_0) in the following discussions.

Although pointing to a similar increasing trend in total inequality, different indicators of inequality rank individual variables differently (Table 1.3). Nevertheless, they are largely consistent in ranking the less

Table 1.3 Ranks of inequality contribution by alternative inequality measures

Year	K	Dep	Edu	Gov	FDI	Trade	Reform	Urb	Location
1987	3	9	7,7,6	4	8	5	6,6,7	1	2
1988	3	9	7,7,6	4	8	5	6,6,7	2,1,1	1,2,2
1989	3,3,2	9	7,7,6	4	8	5	6,6,7	2,1,1	1,2,3
1990	3,3,2	9	7,7,6	5,5,4	8	4,4,5	6,6,7	2,1,1	1,2,3
1991	3,3,2	9	7	5,5,4	8	4,4,5	6	2,1,1	1,2,3
1992	3,1,1	9	7,8,8	5,4,4	8,7,7	4,5,5	6	2,3,2	1,2,3
1993	2,1,1	9	7	6,4,4	8	5	4,6,6	3,3,2	1,2,3
1994	2,1,1	9	8	5,4,4	7	6,6,5	4,5,6	3	1,2,2
1995	1	9	8	4,3,2	7	6	3,5,5	5,4,4	2,2,3
1996	1	9	8	4,3,2	7	6	3,5,5	5,4,4	2,2,3
1997	1	9	8	3,2,2	7	6	4,4,5	5,5,4	2,3,3
1998	1	9	8	3,2,2	7	6,5,5	4,6,6	5,4,4	2,3,3
1999	1	9	8	5,2,2	7	4,3,3	3,5,5	6	2,4,4
2000	1	9	8	4,2,2	7	5,3,3	2,4,4	6	3,5,5
2001	1	9	8	5,3,2	7	4,2,3	3,4,4	6	2,5,5

Note: One number indicates consistent ranking; three numbers indicate ranks by Gini, GE_0 and GE_1, respectively.

important contributors. For example, all three indices show that the dependency ratio is the least important variable and they are broadly consistent in ranking FDI and education as the second and third least important factors. Further, some agreement is seen with respect to capital and urbanization as the most important contributors. In the early years, consistent ranking is evident for reform and trade, even government support. In later years, differences in the ranking emerge regarding contributions of variables such as location and government support for economic development.

Faced with the inconsistency, one can either choose a particular measure or take the average across different indicators (only applicable to the percentage contributions, not absolute contributions) and then proceed to interpretation and discussions. We chose to report the decomposition results under the Gini coefficient in Table 1.4. The contributions are calculated using the total explained portion as the denominator, thus they sum to 100 per cent. According to Table 1.4, the least important variable is still the dependency ratio. This is attributable to the converging trend in this variable, partly driven by the nationwide policy of birth control. This result also reflects the fact of surplus labour in China. Thus, differences in dependency ratio across regions are of little significance in driving regional inequality. It must be noted that this is only true at the

Table 1.4 Inequality decomposition results, Gini index

Year	Relative contribution (%)								
	K	Dep	Edu	Gov	FDI	Trade	Reform	Urb	Location
1987	13.49	3.85	6.56	13.35	4.45	11.66	11.03	17.92	17.69
1988	14.16	3.73	6.47	13.06	5.08	12.11	10.38	17.36	17.63
1989	14.67	3.34	6.38	12.59	5.49	12.42	10.43	17.05	17.62
1990	14.92	3.16	7.40	11.97	5.60	12.70	10.45	16.46	17.34
1991	15.39	3.10	6.24	11.91	6.04	12.67	10.64	16.40	17.61
1992	15.90	3.29	6.25	11.44	6.32	12.19	10.91	15.97	17.74
1993	16.04	3.23	6.96	11.29	6.30	11.81	11.87	15.26	17.23
1994	16.19	3.37	5.74	12.57	6.66	11.51	13.07	13.92	16.98
1995	16.72	3.05	5.80	13.51	6.75	10.96	13.85	13.12	16.23
1996	17.18	2.93	5.39	13.59	6.71	11.33	13.98	12.75	16.13
1997	17.30	2.69	5.32	14.20	6.81	11.66	13.94	12.20	15.88
1998	17.95	2.55	5.26	14.43	7.07	11.89	12.54	12.28	16.04
1999	18.08	0.81	5.10	13.72	6.94	13.77	14.28	11.92	15.38
2000	17.82	0.49	4.38	14.37	6.85	14.17	15.27	11.44	15.20
2001	18.37	0.90	4.77	13.32	6.98	14.34	14.77	11.44	15.12

highly aggregate level. Labour input and dependency ratio are still important for income generation and income disparity at the household level.

The stock of physical capital has always been important. Its importance has increased over time and it now constitutes almost 20 per cent of total inequality, making it the largest contributor since 1995. On the other hand, urbanization was rated as the number one or two factor until 1992, but its role quickly declined. It dropped to the third or fifth position and finally settled at the sixth position. This reflects well the converging trend in urbanization across China. Despite this, urbanization still contributes about 12 per cent to total inequality. Sharing a similar trend with urbanization, location has become less important, its ranking having dropped from first place until 1994 (second, in 1987) to second place since 1995. The declining contribution does not necessarily mean narrowing gaps in factors associated with location (natural resources, weather, proximity to markets and ports). It means that other factors have become more unequally distributed across China.

It is clear that FDI ranks as the second least important determinant of regional inequality in China up until the early 1990s. However, it has gained importance in recent years. The impact of trade on total inequality has been moderate. If one combines trade and FDI as an overall indicator of globalization, the contribution is quite substantial, particularly

Table 1.4 continued

Absolute contribution								
K	**Dep**	**Edu**	**Gov**	**FDI**	**Trade**	**Reform**	**Urb**	**Location**
0.021	0.006	0.010	0.021	0.007	0.019	0.018	0.029	0.028
0.023	0.006	0.011	0.021	0.008	0.020	0.017	0.028	0.029
0.024	0.006	0.011	0.021	0.009	0.021	0.017	0.028	0.029
0.026	0.005	0.013	0.021	0.010	0.022	0.018	0.028	0.030
0.026	0.005	0.011	0.020	0.010	0.022	0.018	0.028	0.030
0.027	0.006	0.011	0.020	0.011	0.021	0.019	0.027	0.031
0.029	0.006	0.012	0.020	0.011	0.021	0.021	0.027	0.031
0.030	0.006	0.011	0.024	0.012	0.022	0.024	0.026	0.032
0.033	0.006	0.011	0.027	0.013	0.022	0.027	0.026	0.032
0.035	0.006	0.011	0.027	0.014	0.023	0.028	0.026	0.033
0.036	0.006	0.011	0.029	0.014	0.024	0.029	0.025	0.033
0.037	0.005	0.011	0.029	0.014	0.024	0.026	0.025	0.033
0.038	0.002	0.011	0.029	0.015	0.029	0.030	0.025	0.032
0.038	0.001	0.009	0.030	0.014	0.030	0.032	0.024	0.032
0.039	0.002	0.010	0.028	0.015	0.030	0.031	0.024	0.032

in the later years. The combined contribution was around 16 per cent earlier but now runs at around 22 per cent, surpassing the capital variable. It is important to note that this finding is robust to inequality measures. Therefore, globalization does deserve serious consideration owing to its large and increasing effects on regional inequality, which has implications for poverty and poverty reduction in China. The increasing contribution of globalization is a result of increased trade and FDI inflow.

Over time, a number of factors gained prominence. Reform or privatization was placed sixth in importance but moved up to third position, highlighting the unequal pace in privatizing state-owned entities and the importance of privatization on income growth. It is interesting to observe that government support for economic development is diverging. The positive contribution implies less (more) developed areas provide less (more) support. The diverging trend may have to do with the taxation reform initiated in 1994, which significantly enhances the budgeting and spending power of local governments. The reform allows rich regions to collect more taxes and fees to finance economic activities.

The small and stable contribution of education is most probably attributable to the many years of public provision of basic education in China, particularly in the urban areas. A surprising result is that the contribution of education only ranks the second or third from the last, a finding not inconsistent with ZZ. Conversely, the impacts of reform and urbanization on inequality are expected to decline in the long run because slow reformers or latecomers are bound to catch up. After all, these two variables have a maximum value of 100. It should be noted that the role of location will diminish as development of technology in the transportation and communications sectors are helping to downplay the importance of physical isolation or distance. This diminishing role is reinforced by the historical campaign of western development characterized by considerable investment in disadvantaged regions. As known, the effects of investment in infrastructure on development are typically lagged.

It is worth noting that a declining percentage contribution does not necessarily mean a decreasing absolute contribution. A careful examination of Table 1.4 and Tables 1.A2–A5 reveals that, apart from the dependency ratio and urbanization, all other variables contribute progressively more to total inequality. The dependency ratio is the only variable with declining contribution in both relative and absolute terms. Urbanization more or less maintained its absolute contribution but displayed a declining relative contribution because of the increasing trend in total inequality.

It may seem sensible to discuss our findings in relation to ZZ. However, this is not appropriate for a number of reasons. First, we focus on income inequality while ZZ focus on partial labour productivity. Second, ZZ employ a double log model which is rejected in this chapter. Third, ZZ relies on the logarithmic variance as the only measure of inequality. Our results are robust to inequality measures and based on a flexible modelling strategy. An indication of inadequacy of ZZ lies in that domestic capital is more productive than FDI, which is difficult to justify.

Conclusion

This chapter provides an accounting for China's regional income inequality, with a special emphasis on the impact of globalization. Relying on a carefully constructed panel data set, the flexible Box–Cox specification is adopted to minimize modelling errors. The income generating function is estimated successfully and the decomposition results are based on a recently developed methodology of Shorrocks (1999). It is found that (a) globalization constitutes a positive and substantial share of China's regional inequality and the share rises over time;[14] (b) capital is one of the largest and increasingly important contributors to regional inequality; (c) economic reform characterized by privatization exerts a significant impact on regional inequality; and (d) the relative contributions of education, location, urbanization and the dependency ratio to regional inequality have been declining.

A number of major policy implications are readily derivable from our empirical results. Further globalization will lead to higher regional inequality in China unless concerted efforts are devoted to promote trade in and FDI flows to west and central China. Thus, it is suggested that policy biases that promoted trade and FDI but which are gradually being phased out in coastal China should be implemented in other parts of China. Market potential and location considerations place the poor regions in a disadvantageous position with regard to attracting FDI and promoting trade. However, a converging trend in FDI and trade is encouraging. More important is the domestic capital, equalization of which across regions will cut regional inequality by 20 per cent. To narrow gaps in capital distribution, it is necessary – though difficult – to break the vicious circle existing in the creation of capital. This calls for the development of a financial market in China, especially in poor rural areas. Again, policy support for investment in the poor regions is needed in terms of tax concessions and bank lending. In particular, continued financial reforms are necessary in order to eliminate discrimination against small farmers and rural activities. Finally, changes are needed in the collection and allocation of fiscal resources that so far have favoured the developed regions. An equalization in fiscal support would lead to an almost 15 per cent drop in regional inequality and a progressive fiscal scheme would result in a considerably greater impact. Combined, globalization, domestic capital stock and government fiscal support contribute over half of the total regional inequality in China.

Notes

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1 The concept of globalization has many dimensions, ranging from interdependence of economic activities in different countries to flows of ideas across national borders. In this chapter, we focus on economic globalization through exchanges of goods and services, and flows of foreign capital. Flows of labour, information, ideology, culture and living styles are not considered, as relevant data are unavailable or incomplete. To be more precise, we use openness (trade/GDP ratio) and per capita FDI to represent globalization in this chapter.
2 Unless indicated otherwise, data quoted in this section are all from the National Bureau of Statistics (NBS) (various years).
3 Another SEZ was opened in Xiamen, Fujian province in 1980. See table 3 in Démurger *et al*. (2002) for the timeline of policy initiatives.

4 The stock market represents another avenue for attracting foreign capital.
5 We tried to add per capita labour input or household size, but neither of them is significant.
6 Consistent with most studies, central provinces refer to Shanxi, Guangxi, Inner Mongolia, Jilin, Heilongjiang, Anhui, Jiangxi, Henan, Hubei and Hunan, and western provinces include Sichuan, Guizhou, Yunnan, Shaanxi, Gansu, Qinghai, Ningxia and Xinjiang.
7 Ideally, one should estimate these models for each region or for every year. Due to the limited sample size, and also given the flexibility of our functional form, we choose to pool the data for model estimation. As shown later, a re-estimation by GMM under the specification of a dynamic panel data model supports our choice.
8 IPS is the only unit roots test for panel models that is coded in TSP and Stata.
9 Caution must be exercised here as the IPS test, as with many other co-integration tests, cannot guarantee co-integration in all units/groups in the panel when the null hypothesis of unit roots is rejected.
10 An identity, expressing total income as a sum of source incomes, can be thought of as a special income generating function (not an econometric function) with no residual term. In this case, our decomposition can explain 100 per cent of the total inequality.
11 It is possible, at least hypothetically, that the residuals are all positive for the poor and negative for the rich. In this case, the contribution of the residual term must be negative as it is an equalizing factor.
12 It can be shown that when $R^2 = 1$ or 0, the explained proportion is 100 or 0 per cent. In the case that CV^2 is used as the measure of inequality, the explained proportion is always identical to the R^2.
13 For this purpose, a Java programme has been developed by the World Institute for Development Economics Research of the United Nations University (UNU-WIDER). This programme allows decomposition of inequality of a dependent variable into components associated with any number of independent variables and under any functional form. Readers interested in the Shapley procedure should consult Shorrocks (1999) for technical details and Wan and Zhou (2005) for an intuitive explanation.
14 One of the referees suggested confirming this conclusion by running a regression of inequality on a set of regressors. This useful suggestion was not taken up because we can only have a total of fifteen observations on regional inequality (one for each year) for this kind of regression. Even with five or six explanatory variables, the degrees of freedom would drop below ten. Such a model is rather unreliable. More importantly, our decomposition results are sufficient for gauging the impact of globalization on regional inequality in China.

References

Atkinson, A.B. (2001) ‘A Critique of the Transatlantic Consensus on Rising Income Inequality’, *World Economy*, 24: 433–552.

Atkinson, A.B. and Brandolini, A. (2001) ‘Promise and Pitfalls in the Use of “Secondary” Data-sets: Income Inequality in OECD Countries as a Case Study’, *Journal of Economic Literature*, 39, 3: 771–99.

Baltagi, B.H. and Kao, C. (2000) 'Nonstationary Panels, Cointegration in Panels and Dynamic Panels: A Survey', Centre for Policy Research Working Paper 16, Syracuse University.

Ben-David, D. (1993) 'Equalizing Exchange: Trade Liberalization and Income Convergence', *Quarterly Journal of Economics*, 108, 3: 653–79.

Birdsall, N. (1999) 'Globalization and the Developing Countries: The Inequality Risk', Remarks at Overseas Development Council Conference, International Trade Center, Washington, DC.

Blundell, R. and Bond, S. (1998) 'Initial Conditions and Moment Restrictions in Dynamic Panel Data Models', *Journal of Econometrics*, 87: 115–43.

Bourguignon, F. and Morrisson, C. (2002) 'Inequality Among World Citizens: 1820–1992', *American Economic Review*, 92, 4: 727–44.

Breitung, J. and Pesaran, M.H. (2005) 'Unit Roots and Cointegration in Panels', Discussion Paper Series 1: Economic Studies 42/2005, Deutsche Bundesbank.

Cancian, M. and Reed, D. (1998) 'Assessing the Effects of Wives Earning on Family Income Inequality', *Review of Economics and Statistics*, 80: 73–9.

Démurger, S. (2001) 'Infrastructure Development and Economic Growth: An Explanation for Regional Disparities in China?', *Journal of Comparative Economics*, 29: 95–117.

Démurger, S., Sachs, J.D., Woo, W.T., Bao, S., Chang, G. and Mellinger, A. (2002) 'Geography, Economic Policy, and Regional Development in China', *Asian Economic Papers*, 1: 146–205.

Fields, G.S. and Yoo, G. (2000) 'Falling Labor Income Inequality in Korea's Economic Growth: Patterns and Underlying Causes', *Review of Income and Wealth*, 46: 139–59.

Fischer, S. (2003) 'Globalization and Its Challenges', *American Economic Review*, 93, 2: 1–30.

Hall, R.E. and Jones, C.I. (1999) 'Why do some Countries Produce So Much More Output Per Worker than Others?', *Quarterly Journal of Economics* 114, 1: 83–116.

Hausman, J. (1978) 'Specification Tests in Econometrics', *Econometrica* 46: 1251–71.

Hurrell, A. and Woods, N. (2000) 'Globalization and Inequality', in R. Higgott (ed.), *The New Political Economy of Globalization* (Cheltenham: Edward Elgar).

Im, K.S., Pesaran, M.H. and Shin, S. (2003) 'Testing for Unit Roots in Heterogeneous Panels', *Journal of Econometrics*, 115: 53–74.

Judge, G., Hill, R., Griffiths, W., Lütkepohl, H. and Lee, T. (1988) *Introduction to the Theory and Practice of Econometrics*, 2nd edn (New Jersey: Wiley).

Kanbur, R. and Zhang, X. (2005) 'Fifty Years of Regional Inequality in China: A Journey Through Central Planning, Reform and Openness', *Review of Development Economics* 9, 1: 87–106.

Kolenikov, S. and Shorrocks, A. (2005) 'A Decomposition Analysis of Regional Poverty in Russia', *Review of Development Economics*, 9, 1: 25–46.

Krugman, P. and Venables, A. (1995) 'Globalization and the Inequality of Nations', *Quarterly Journal of Economics*, 110, 4: 857–80.

Lin, Y. and Liu, P. (2003) 'China's Economic Development Strategy and Regional Income Disparity', (in Chinese), *Economic Research Journal* (*Jingji Yanjiu*), 3: 19–25.

Lindert, P.H. and Williamson, J.G. (2001) 'Does Globalization Make the World More Unequal', NBER Working Paper 8228 (Cambridge, MA: NBER).

Ma, Shuanyou and Yu, H. (2003) 'Fiscal Transfer and Convergence of Regional Economy', (in Chinese), *Economic Research Journal* (*Jingji Yanjiu*), 3: 26–33.
Mazur, J. (2000) 'Labor's New Internationalism', *Foreign Affairs*, 81, 1: 79–93.
McCoskey, S. and Kao, C. (1999) 'Testing the Stability of a Production Function with Urbanization as a Shift Factor', *Oxford Bulletin of Economics and Statistics*, 61: 671–90.
Morduch, J. and Sicular, T. (2002) 'Rethinking Inequality Decomposition, with Evidence from Rural China', *Economic Journal*, 112: 93–106.
NBS (National Bureau of Statistics) (various years) *China Statistical Yearbook* (Beijing: China Statistical Publishing House).
NBS (National Bureau of Statistics) (1999) *Comprehensive Statistical Data and Materials for 50 Years of New China* (Beijing: China Statistical Publishing House).
Sala-i-Martin, X. (2002a) 'The Disturbing "Rise" of Global Income Inequality', NBER Working Paper 8904 (Cambridge, MA: NBER).
Sala-i-Martin, X. (2002b) 'The World Distribution of Income', NBER Working Paper 8933 (Cambridge, MA: NBER).
Shorrocks, A.F. (1999) 'Decomposition Procedures for Distributional Analysis: A Unified Framework Based on the Shapley Value', Unpublished manuscript, Department of Economics, University of Essex.
Shorrocks, A.F. and Slottje, D. (2002) 'Approximating Unanimity Orderings: An Application to Lorenz Dominance', *Journal of Economics*, Supplement 9: 91–117.
Srinivasan, T.N. and Bhagwati, J. (1999) 'Outward-Orientation and Development: Are Revisionists Right?', Economic Growth Center Discussion Paper 806, Yale University.
Stiglitz, J.E. (1998) 'More Instruments and Broader Goals: Moving Toward the Post-Washington Consensus', WIDER Annual Lecture 2 (Helsinki: UNU-WIDER).
Tsui, K.Y. (2007) 'Forces Shaping China's Interprovincial Inequality', *Review of Income and Wealth*, 53, 1: 60–92.
Wade, R.H. (2001) 'The Rising Inequality of World Income Distribution', *Finance and Development*, 38, 4.
Wan, G.H. (1996) 'Measuring Input Substitution and Output Expansion Effects: A Nonparametric Approach with Application', *Empirical Economics*, 21, 3: 361–80.
Wan, G.H. (2001) 'Changes in Regional Inequality in Rural China: Decomposing the Gini Index by Income Sources', *Australian Journal of Agricultural and Resource Economics*, 45, 3: 361–82.
Wan, G.H. (2004) 'Accounting for Income Inequality in Rural China: A Regression Based Approach', *Journal of Comparative Economics*, 32, 2: 348–63.
Wan, G.H. and Cheng, E.J. (2001) 'Effects of Land Fragmentation and Returns to Scale in the Chinese Farming Sector', *Applied Economics*, 33, 2: 183–94.
Wan, G.H. and Zhou, Z.Y. (2005) 'Income Inequality in Rural China: Regression-based Decomposition Using Household Data', *Review of Development Economics*, 9, 1: 107–20.
Wei, S. and Wu, Y. (2003) 'Globalization and Inequality: Evidence from Within China', NBER Working Paper 8611 (Cambridge, MA: NBER).
Xing, Y. and Zhang, K.H. (2004) 'FDI and Regional Income Disparity in Host Countries: Evidence from China', *Economia Internazionale/International Economics*, 57, 4: 363–79.
Yang, K. (1994) 'On the Change in Regional Economic Disparity' (in Chinese), *Economic Research Journal* (*Jingji Yanjiu*), 12: 19–33.

Yin, X. (1998) *The Procedure and Effects of China's Reform of International Trade* (in Chinese) (Shanxi: Shanxi Economic Publishing House).
Young, A. (2000) 'Gold into Base Metals: Productivity Growth in The People's Republic of China during the Reform Period', NBER Working Paper 7856 (Cambridge, MA: NBER).
Zhang, J., Wu, G. and Zhang, J.P. (2004) 'Estimation of Provincial Capital Stock in China: 1952–2000' (in Chinese), *Economic Research Journal* (*Jingji Yanjiu*), 3: 35–44.
Zhang, X. and Zhang, K.H. (2003) 'How Does Globalization Affect Regional Inequality Within a Developing Country? Evidence from China', *Journal of Development Studies*, 39, 4: 47–67.

Appendix

(1) Unless indicated otherwise, data for the period 1987–98 are all from *Comprehensive Statistical Data and Materials for 50 Years of New China* (NBS, 1999). Data for years 1999–2001, unless indicated otherwise, are from *China Statistical Yearbook*, *2000*, *2001* and *2002* (NBS, various years).

(2) *Income*: Regional income is the weighted average of urban and rural per capita incomes, with non-agricultural and agricultural population shares as weights. Both urban and rural incomes are deflated by regional urban and rural CPIs. For Shanghai, Beijing and Tianjin, urban and rural CPIs are the same.

(3) *Capital*: Using the perpetual stock method, Zhang *et al*. (2004) constructed capital stock data at the 1952 price. They provide estimates for 1952–2000, and the authors extend the data to 2001. Capital stock in 1952 is given by

$$K_0 = \frac{I_0}{\delta + r}$$

where K_0 is the capital stock in 1952, I_0 investment in the same year, δ the depreciation rate, and r the average growth rate of real investment before 1952. This method is used in Hall and Jones (1999), Young (2000) and also ZZ.

(4) *Dependency*: The dependency ratio is computed as

$$Dependency = \frac{total\ population - employment}{employment} \times 100\%$$

(5) *Education* (*edu*): *China Population Yearbooks* report regional population by educational attainment as from 1987. Unfortunately, such

data were not published for 1989, 1991 and 1992, and data for 1987 and 1988 are incomplete as the illiterate population are not reported. Also, unlike data for other years, the 1994 data did not consider members of the population below the age of 15. To estimate data for these years, we compute average years of schooling using data for the other years and then fit the model:

$$\ln(edu) = f(\cdot) \times \mu$$

where *edu* is per capita years of schooling, $f(\cdot)$ is simply a linear function of time trend and regional dummies, μ the error term. This model is estimated by the GLS technique, allowing for heteroscedasticity in the panel data. The R^2 of the estimated equation is 0.966. To denote the predicted value by ˆ, we have:

$$\hat{edu} = \exp[\ln(\hat{edu})]\exp(0.5\hat{\sigma}^2)$$

where $\ln(\hat{edu})$ denotes the predicted values of $\ln(edu)$ and $\hat{\sigma}^2$ is the estimated variance of μ. Data for 1987–89, 1991, 1992 and 1994 are estimated by the above model.

(6) *FDI*: *FDI* is defined as per capita FDI. The 1987–89 data for Sichuan are from the *China Statistical Yearbook*. The Qinghai data for 1988 and 2000 are the average of the neighbouring two years. FDI data are converted into RMB, using the medium exchange rate available in the *China Statistical Yearbook*s.

(7) *Trade*: *Trade* is computed as the trade/GDP ratio. Trade data are converted into RMB.

(8) *Reform*: *Reform* is computed as the proportion of workers and staff in non-state-owned entities.

(9) *Urbanization*: Urbanization is defined as the proportion of the non-agricultural population in the total. Except for Hebei, Heilongjiang and Gansu, the 1999–2001 data of the agricultural and non-agricultural population are from provincial statistical yearbooks. Total population of Hebei, Heilongjiang and Gansu in 2000 are from the *China Statistical Yearbook, 2001*. For these three regions, the 1999 population data are the averages of the neighbouring two years, and the 2001 data are forecast based on data in 2000 and the growth rate during 1999–2000.

(10) *Gov*: This is per capita government expenditure excluding administration fees, deflated by regional CPI.

Table 1.A1 Results of χ^2 test with H_0: model 1 = each of models 2–17

Model	**Restrictions**		**Loglikelihood value**	**χ^2-value**	**Test result***
	Λ	**θ**			
1	Unrestricted	Unrestricted	−2531.93		
2	1	1	−2597.98	132.10	Reject H_0
3	0	1	−2549.73	35.60	Reject H_0
4	−1	1	−2626.91	189.96	Reject H_0
5	Unrestricted	1	−2548.54	33.22	Reject H_0
6	1	0	−2736.61	409.36	Reject H_0
7	0	0	−2538.43	13.00	Reject H_0
8	−1	0	−2639.73	215.60	Reject H_0
9	Unrestricted	0	−2537.98	12.10	Reject H_0
10	1	−1	−2881.56	699.26	Reject H_0
11	0	−1	−2623.64	183.42	Reject H_0
12	−1	−1	−2616.71	169.56	Reject H_0
13	Unrestricted	−1	−2585.36	106.86	Reject H_0
14	1	Unrestricted	−2590.62	117.38	Reject H_0
15	0	Unrestricted	−2533.22	2.58	**Not Reject H_0**
16	−1	Unrestricted	−2626.87	189.88	Reject H_0
17		$\lambda = \theta$	−2532.72	1.58	**Not Reject H_0**

Note: * level of significance = 1 per cent.

Table 1.A2 Inequality decomposition results, GE_0

Year	Relative contribution (%)								
	K	Dep	Edu	Gov	FDI	Trade	Reform	Urb	Location
1987	14.94	4.38	7.05	14.27	4.80	11.73	7.35	18.82	16.65
1988	15.53	4.14	6.91	13.85	5.47	12.20	7.06	18.15	16.69
1989	16.06	3.67	6.79	13.36	5.88	12.40	7.39	17.79	16.66
1990	16.24	3.42	7.79	12.60	6.01	12.62	7.82	17.12	16.37
1991	16.59	3.35	6.58	12.50	6.41	12.57	8.31	16.98	16.70
1992	16.99	3.55	6.53	12.09	6.66	12.07	8.86	16.46	16.79
1993	16.99	3.51	7.10	11.73	6.56	11.71	10.42	15.68	16.29
1994	17.06	3.71	5.85	13.45	6.87	11.52	11.60	14.21	15.73
1995	17.58	3.43	5.88	14.56	6.90	10.94	12.45	13.41	14.85
1996	18.13	3.17	5.49	14.69	6.90	11.30	12.56	13.01	14.75
1997	18.24	2.90	5.32	15.42	7.02	11.63	12.50	12.44	14.52
1998	18.94	2.62	5.27	15.61	7.29	11.83	11.19	12.57	14.68
1999	19.04	0.33	5.26	14.80	7.16	14.11	13.15	12.20	13.96
2000	18.81	−0.24	4.52	15.27	7.11	14.57	14.32	11.71	13.94
2001	19.34	0.25	4.84	14.17	7.24	14.65	14.16	11.55	13.80

Table 1.A3 Inequality decomposition results, GE_1

Year	Relative contribution (%)								
	K	Dep	Edu	Gov	FDI	Trade	Reform	Urb	Location
1987	15.42	4.91	7.04	14.74	4.99	11.62	6.28	19.01	16.00
1988	16.01	4.57	6.90	14.33	5.64	12.11	6.05	18.34	16.06
1989	16.52	4.10	6.80	13.85	6.05	12.26	6.45	17.96	16.01
1990	16.73	3.87	7.78	13.06	6.13	12.42	6.95	17.33	15.73
1991	17.06	3.76	6.62	12.91	6.52	12.34	7.51	17.19	16.09
1992	17.42	3.96	6.56	12.51	6.75	11.84	8.13	16.66	16.17
1993	17.36	4.00	7.05	12.10	6.62	11.50	9.86	15.88	15.62
1994	17.39	4.16	5.85	13.93	6.90	11.38	10.97	14.44	14.98
1995	17.89	3.92	5.89	15.06	6.91	10.81	11.82	13.64	14.06
1996	18.47	3.61	5.54	15.22	6.89	11.16	11.92	13.26	13.92
1997	18.61	3.32	5.31	16.01	7.00	11.49	11.87	12.71	13.67
1998	19.33	3.02	5.20	16.20	7.26	11.67	10.68	12.84	13.80
1999	19.35	0.48	5.33	15.34	7.13	14.06	12.71	12.45	13.16
2000	19.16	−0.09	4.56	15.74	7.09	14.50	13.95	11.95	13.14
2001	19.63	0.41	4.83	14.71	7.21	14.56	13.85	11.74	13.05

Table 1.A2 continued

Absolute contribution								
K	**Dep**	**Edu**	**Gov**	**FDI**	**Trade**	**Reform**	**Urb**	**Location**
0.006	0.002	0.003	0.006	0.002	0.005	0.003	0.008	0.007
0.007	0.002	0.003	0.006	0.002	0.005	0.003	0.008	0.007
0.007	0.002	0.003	0.006	0.003	0.005	0.003	0.008	0.007
0.008	0.002	0.004	0.006	0.003	0.006	0.004	0.008	0.008
0.008	0.002	0.003	0.006	0.003	0.006	0.004	0.008	0.008
0.008	0.002	0.003	0.006	0.003	0.006	0.004	0.008	0.008
0.009	0.002	0.004	0.006	0.003	0.006	0.005	0.008	0.008
0.010	0.002	0.003	0.008	0.004	0.006	0.006	0.008	0.009
0.011	0.002	0.004	0.009	0.004	0.007	0.008	0.008	0.009
0.012	0.002	0.004	0.009	0.004	0.007	0.008	0.008	0.010
0.012	0.002	0.004	0.010	0.005	0.008	0.008	0.008	0.010
0.012	0.002	0.003	0.010	0.005	0.008	0.007	0.008	0.010
0.013	0.000	0.004	0.010	0.005	0.010	0.009	0.008	0.010
0.013	0.000	0.003	0.011	0.005	0.010	0.010	0.008	0.010
0.014	0.000	0.003	0.010	0.005	0.010	0.010	0.008	0.010

Table 1.A3 continued

Absolute contribution								
K	**Dep**	**Edu**	**Gov**	**FDI**	**Trade**	**Reform**	**Urb**	**Location**
0.007	0.002	0.003	0.007	0.002	0.005	0.003	0.008	0.007
0.007	0.002	0.003	0.007	0.003	0.006	0.003	0.008	0.007
0.008	0.002	0.003	0.007	0.003	0.006	0.003	0.009	0.008
0.008	0.002	0.004	0.007	0.003	0.006	0.004	0.009	0.008
0.008	0.002	0.003	0.006	0.003	0.006	0.004	0.009	0.008
0.009	0.002	0.003	0.006	0.003	0.006	0.004	0.008	0.008
0.009	0.002	0.004	0.007	0.004	0.006	0.005	0.009	0.008
0.010	0.003	0.004	0.008	0.004	0.007	0.007	0.009	0.009
0.012	0.003	0.004	0.010	0.005	0.007	0.008	0.009	0.010
0.013	0.003	0.004	0.011	0.005	0.008	0.008	0.009	0.010
0.014	0.002	0.004	0.012	0.005	0.008	0.009	0.009	0.010
0.014	0.002	0.004	0.012	0.005	0.008	0.008	0.009	0.010
0.015	0.000	0.004	0.012	0.005	0.011	0.010	0.009	0.010
0.015	0.000	0.004	0.012	0.005	0.011	0.011	0.009	0.010
0.015	0.000	0.004	0.011	0.006	0.011	0.011	0.009	0.010

Table 1.A4 Inequality decomposition results, Atkinson index (e = 0)

Year	Relative contribution (%)								
	K	Dep	Edu	Gov	FDI	Trade	Reform	Urb	Location
1987	14.93	4.38	7.04	14.27	4.79	11.73	7.37	18.83	16.66
1988	15.53	4.13	6.89	13.84	5.46	12.20	7.08	18.16	16.70
1989	16.06	3.66	6.78	13.36	5.87	12.39	7.41	17.79	16.67
1990	16.24	3.42	7.78	12.60	5.99	12.62	7.84	17.13	16.39
1991	16.60	3.34	6.57	12.50	6.40	12.57	8.32	16.99	16.71
1992	17.00	3.54	6.51	12.08	6.65	12.06	8.87	16.46	16.81
1993	17.01	3.51	7.09	11.72	6.54	11.71	10.43	15.69	16.31
1994	17.08	3.70	5.84	13.45	6.85	11.51	11.62	14.21	15.74
1995	17.60	3.42	5.86	14.56	6.88	10.93	12.46	13.41	14.86
1996	18.16	3.16	5.47	14.69	6.89	11.29	12.58	13.01	14.76
1997	18.27	2.89	5.31	15.43	7.01	11.62	12.51	12.44	14.53
1998	18.96	2.62	5.25	15.62	7.27	11.82	11.20	12.56	14.70
1999	19.07	0.34	5.24	14.79	7.14	14.11	13.16	12.19	13.97
2000	18.83	−0.23	4.50	15.27	7.09	14.56	14.33	11.70	13.95
2001	19.37	0.25	4.82	14.17	7.22	14.65	14.17	11.54	13.81

Table 1.A5 Inequality decomposition results, squared CV

Year	Relative contribution (%)								
	K	Dep	Edu	Gov	FDI	Trade	Reform	Urb	Location
1987	15.90	5.47	7.06	15.20	5.18	11.52	5.12	19.19	15.36
1988	16.49	5.02	6.94	14.83	5.82	12.02	4.93	18.53	15.42
1989	16.99	4.55	6.85	14.35	6.23	12.11	5.41	18.15	15.36
1990	17.22	4.33	7.81	13.54	6.28	12.19	6.00	17.55	15.08
1991	17.54	4.19	6.70	13.33	6.63	12.08	6.63	17.42	15.47
1992	17.85	4.38	6.63	12.95	6.85	11.59	7.31	16.89	15.54
1993	17.73	4.52	7.06	12.49	6.69	11.26	9.23	16.10	14.91
1994	17.70	4.65	5.89	14.44	6.94	11.21	10.26	14.71	14.19
1995	18.18	4.43	5.95	15.57	6.92	10.65	11.12	13.92	13.25
1996	18.78	4.10	5.65	15.78	6.89	10.99	11.20	13.56	13.05
1997	18.95	3.79	5.34	16.63	7.00	11.29	11.18	13.04	12.78
1998	19.67	3.46	5.18	16.81	7.24	11.46	10.13	13.17	12.88
1999	19.65	0.60	5.46	15.91	7.12	13.94	12.18	12.78	12.36
2000	19.48	0.04	4.66	16.25	7.09	14.38	13.48	12.29	12.33
2001	19.90	0.54	4.88	15.28	7.21	14.42	13.45	12.04	12.28

Table 1.A4 continued

Absolute contribution								
K	**Dep**	**Edu**	**Gov**	**FDI**	**Trade**	**Reform**	**Urb**	**Location**
0.006	0.002	0.003	0.006	0.002	0.005	0.003	0.008	0.007
0.007	0.002	0.003	0.006	0.002	0.005	0.003	0.008	0.007
0.007	0.002	0.003	0.006	0.003	0.005	0.003	0.008	0.007
0.007	0.002	0.004	0.006	0.003	0.006	0.004	0.008	0.008
0.008	0.002	0.003	0.006	0.003	0.006	0.004	0.008	0.008
0.008	0.002	0.003	0.006	0.003	0.006	0.004	0.008	0.008
0.008	0.002	0.003	0.006	0.003	0.006	0.005	0.008	0.008
0.009	0.002	0.003	0.007	0.004	0.006	0.006	0.008	0.009
0.011	0.002	0.004	0.009	0.004	0.007	0.008	0.008	0.009
0.011	0.002	0.003	0.009	0.004	0.007	0.008	0.008	0.009
0.012	0.002	0.003	0.010	0.005	0.008	0.008	0.008	0.009
0.012	0.002	0.003	0.010	0.005	0.008	0.007	0.008	0.009
0.013	0.000	0.004	0.010	0.005	0.009	0.009	0.008	0.009
0.013	0.000	0.003	0.010	0.005	0.010	0.010	0.008	0.009
0.013	0.000	0.003	0.010	0.005	0.010	0.010	0.008	0.009

Table 1.A5 continued

Absolute contribution								
K	**Dep**	**Edu**	**Gov**	**FDI**	**Trade**	**Reform**	**Urb**	**Location**
0.016	0.005	0.007	0.015	0.005	0.011	0.005	0.019	0.015
0.017	0.005	0.007	0.015	0.006	0.012	0.005	0.019	0.016
0.018	0.005	0.007	0.015	0.007	0.013	0.006	0.019	0.016
0.019	0.005	0.009	0.015	0.007	0.014	0.007	0.020	0.017
0.019	0.005	0.007	0.015	0.007	0.013	0.007	0.019	0.017
0.020	0.005	0.007	0.014	0.008	0.013	0.008	0.019	0.017
0.021	0.005	0.008	0.015	0.008	0.014	0.011	0.019	0.018
0.024	0.006	0.008	0.020	0.009	0.015	0.014	0.020	0.019
0.028	0.007	0.009	0.024	0.011	0.016	0.017	0.021	0.020
0.030	0.007	0.009	0.025	0.011	0.018	0.018	0.022	0.021
0.032	0.006	0.009	0.028	0.012	0.019	0.019	0.022	0.022
0.032	0.006	0.009	0.028	0.012	0.019	0.017	0.022	0.021
0.035	0.001	0.010	0.028	0.013	0.024	0.021	0.022	0.022
0.035	0.000	0.008	0.029	0.013	0.026	0.024	0.022	0.022
0.035	0.001	0.009	0.027	0.013	0.025	0.024	0.021	0.022

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Notes: f = figure; n = note; t = table; **bold** = extended discussion or heading emphasized in the main text.