THE UNIVERSITY OF WESTERN AUSTRALIA
Achieve International Excellence

ECONOMICS

INTRA-PROVINCIAL INEQUALITY IN CHINA: AN ANALYSIS OF COUNTY-LEVEL DATA

by

Tsun Se Cheong

and

Yanrui Wu

Business School
University of Western Australia

DISCUSSION PAPER 12.17

INTRA-PROVINCIAL INEQUALITY IN CHINA: AN ANALYSIS OF COUNTY-LEVEL DATA*

Tsun Se Cheong and Yanrui Wu

Economics (M251), Business School
University of Western Australia
35 Stirling Highway, Crawley WA 6009

DISCUSSION PAPER 12.17

Abstract: This study applies a decomposition technique to analyze China's regional inequality using county-level data. It is shown that inter-provincial inequality increased significantly during 1997-2007. It is also shown that, although inter-county-level-unit inequality within all the provinces remained more or less the same during the period considered, its contribution to the overall inequality (based on the Theil-T index) amounted to about 60% in 2007. This means that intra-provincial regional inequality is the crux of the problem of regional inequality in China. According to the estimates of the Theil-T index, the increase in intra-provincial regional inequality contributed to 63% of the increase in overall inequality during over the period covered, whereas the provinces of Jiangsu, Hebei and Inner Mongolia together contributed 47%. The county-level data is then divided into city and county subgroups. Further decomposition based on the Theil-T index shows that the inter-county inequality component contributed a much higher proportion than the inter-city inequality component, whereas the component of the inequality between the city and county subgroups contributed the least to the intra-provincial regional inequality. The results from the decomposition also suggest that each province has its own characteristics and evolution pattern of inequality. The decomposition of the intra-provincial regional inequality for each province shows that provinces in the central and western zones should focus on the alleviation of inter-county inequality, while provinces in the north-eastern zone should concentrate on inter-city inequality. The provinces in the eastern zone should focus on both inter-county and inter-city inequalities. The provinces of Fujian, Jiangsu, Henan, Guizhou, and Qinghai should pay attention to the inequality between city and county subgroups.

Key words: China, regional inequality, county-level, decomposition
JEL classification: O16, O18, O53, R10

* We acknowledge the financial support from an Australian Postgraduate Scholarship and an ARC Discovery Project grant (DP 1092913). We also thank Huw McKay, Rod Tyers and participants of economics seminars at UWA for helpful comments on earlier drafts.

Introduction

Many studies have been carried out to investigate China's regional inequality which has increased considerably since the initiation of economic reform. However, most of the studies in the literature are based on provincial level data while intra-provincial inequality has not been examined thoroughly (Cheong 2012). In particular, the patterns and trends of inequality between the county-level units (CUs, including counties and county-level cities) within the provinces are virtually unknown. In order to get a full grasp of the pattern and dynamic trend of the inequality between the county-level units, the data has to be continuous and must have a long time-span. Even though some researchers employ county-level data in their studies, many of these studies are still plagued by either the problem of limited coverage or a short time-span. In-depth studies of intra-provincial regional inequalities are mainly confined to the provinces in China's eastern zone with the rest of the country being ignored. The objective of this chapter is to estimate and decompose regional inequality using county-level data of the provinces in both the inland and coastal regions for an extended period of time.

The county-level data used in this study can provide an opportunity to examine the pattern and evolution of regional inequality in greater detail. Specifically this study decomposes overall inequality into the intra-provincial and inter-provincial components and hence makes it possible to identify the role of each province. Further decomposition of intra-provincial inequality can gain important insights about the effect of sub-regions within each province on regional inequality. The empirical exercise is carried out through a three-tier decomposition process so as to examine the contributions of the components in different spatial levels. The chapter begins with a literature review. Section 3 then discusses the method of decomposition. Section 4 describes the data. Section 5 presents analyses the empirical findings. Section 6 concludes and outlines some policy suggestions.

Literature review

One of the major analytical tools used in the analysis of regional inequality is the decomposition method. This study is based on the decomposition of inequality by subgroups which are defined as different spatial groupings in the literature. The common spatial groupings used in the literature are the provinces, the economic zones (eastern, central, western and northeast) as well as the inland and coastal regions. The focus of this study is on regional inequality measured by gross regional product (GRP) per capita at the county-level. Therefore this literature review is mainly confined to the studies that use regional output in their calculations. The studies are grouped according to the different spatial levels used in the decomposition.

Provincial level decomposition

Tsui (1993) analyzed inter-CU inequality using gross value of industrial and agricultural output (GVIAO) per capita in 1982. He decomposes overall inequality into two components, namely, the inter-provincial and intra-provincial components. Lee (2000) considered data for the year 1994 and compared his findings with

those of Tsui. Lee found that the contribution of inter-provincial inequality to overall inequality increased between 1982 and 1994, while the contribution of intra-provincial inequality decreased. Herrmann-Pillath et al. (2002) also examined the contributions of the inter-provincial and intra-provincial inequalities to overall inequality, but their study was based on GRP per capita amongst the prefectures. They found that the contribution of the inter-provincial inequality component to overall inter-prefectural inequality increased during 1993-1998, whereas the contribution of the intra-provincial inequality component to overall inter-prefectural inequality decreased. Li and Xu (2008) also investigated regional inequality using prefectural level GRP per capita and showed that the contribution of the intra-provincial component declined from 61.6 per cent in 1997 to 59.4 per cent in 2005, while the contribution of the inter-provincial component increased from 38.4 per cent to 40.6 per cent during the period considered. Their results provide further empirical evidence supporting the findings of both Lee (2000) and Herrmann-Pillath et al. (2002). Although overall inequality measures in the aforementioned studies are calculated using data compiled at different spatial levels, the conclusions are very similar. These studies all show that the contribution of the inter-provincial inequality to overall regional inequality increased while the share of the intra-provincial inequality declined.

Zonal level decomposition

The decomposition of inequality into inter-zonal and intra-zonal components is very common in the studies of inequality for China. Yao and Zhang (2001), Bhalla et al. (2003), and Yao et al. (2005) all conducted research on the contributions of the inter-zonal inequality and intra-zonal inequality components to overall inequality using provincial level GRP per capita data. They all come to the same conclusion that the contribution of the inter-zonal inequality component increased, while that of the intra-zonal inequality component decreased. Yao and Zhang (2001) found that the contribution of the inter-zonal component was about 80 per cent in 1997. Cai et al. (2002) studied inter-provincial inequality using GRP per capita during 1978-1998 and they considered three economic zones. They showed that in 1978 the eastern zone's contribution to overall inequality was more than 60 per cent. However, the contribution of the inter-zonal component increased significantly in the following twenty years and was around 60 per cent in 1998. The contribution of the eastern zone component declined dramatically over this period. Therefore, they argued that there was evidence of club convergence within the eastern zone. They also argued that the contributions of the central and western zone components remained very small during that period. Bhalla et al. (2003), who used provincial level data in their study, showed that the eastern zone contributed the most to overall provincial inequality. Li and Xu (2008) decomposed inter-provincial inequality into contributions of four different zones using GRP per capita data during 1978-2005. They observed that the eastern zone component contributed to about 20 per cent of overall inequality in 2005, while the sum of the contributions of the central, western and north-eastern zones was only 10 per cent. Moreover, they also showed that the contribution of the inter-zonal component rose from 40 per cent in 1978 to about 70 per cent in 2005. Therefore, they concluded that inter-provincial inequality was mainly caused by the disparity between the four economic zones. Gries and Redlin (2009) decomposed inequality in provincial GRP per capita during 1978-2004. They showed that the eastern zone component contributed to most of the overall inter-provincial

inequality back in 1978. However, the contribution of this component decreased sharply after 1978. On the contrary, the contribution of the inter-zonal component increased dramatically and became the largest contributor to overall inequality in 2004. Villaverde et al. (2010) found that the contribution of the inter-zonal component increased considerably from below 20 per cent in 1978 to about 50 per cent in 2007, while the contribution of the intra-zonal component declined from 80 per cent to about 50 per cent during the same period. Liu (2006) investigated rural regional inequality using the data of agricultural output (AO), rural non-agricultural output (RNAO) and gross value of rural social product (GVRSP). Liu's findings supported the existing consensus that the contributions of the inter-zonal components to overall inequality during the period of 1980-2002 increased while the contributions of the intra-zonal components decreased.

Inland-and-coastal level decomposition

It is well-known that large disparity between the inland and coastal regions exists in China. Jian et al. (1996), Ying (1999), Tsui (2007) and Hao and Wei (2010) are representative works establishing this notion using provincial GRP per capita data. In these studies it is found that inequality between the inland and coastal regions increased while that within the inland and coastal regions decreased over time. Another study by Fujita and Hu (2001) used regional GRP rather than GRP per capita in their calculation. They also obtained the same conclusion: that there was an increase in the inequality between the inland and coastal regions. Hao and Wei (2010) also considered GRP per worker and showed that inequality between the inland and coastal regions increased sharply during 1978-2004. They repeated their exercises by excluding the municipalities, and their findings remained the same.

Decomposition based on other spatial groupings

Some researchers presented their own definitions in constructing spatial subgroups for decomposition exercises. Herrmann-Pillath et al. (2002) divided the provinces in China into seven 'macro-regions'. Similarly, Huang et al. (2003) divided the provinces into seven 'areas'. Herrmann-Pillath et al. (2002) examined inter-prefectural inequality using GRP per capita and found that the contribution of the inter-regional inequality component to overall inter-prefectural inequality decreased during 1993-1998. Huang et al. (2003) explored inter-provincial inequality during 1991-2001 and found that the contribution of inter-area inequality to overall inter-provincial inequality increased, while the contribution of the intra-area inequality to overall inequality decreased. Huang et al. (2003) thus concluded that inter-area inequality is the major driving force underlying the increase in overall inter-provincial inequality. On the surface it appears that Herrmann-Pillath et al. (2002) and Huang et al. (2003) reached different conclusions. However, their results cannot be compared directly. First, the time-span is not the same. Second, Herrmann-Pillath et al. (2002) is based on prefectural level data, whereas Huang et al. (2003) is based on provincial level data. Third, Herrmann-Pillath et al.(2002) used GRP per capita data in their analysis, whereas Huang et al. (2003) used provincial GRP data unscaled by population. In addition, their methods of categorization of the provinces into seven groups are not exactly the same.

The aforementioned studies show that progress in raising living standards across China has been very uneven amongst the regions. Moreover, it is now well established that spatial groupings play a major role in inequality and thus it is necessary to study inequality with due respect being paid to spatial factors.

Methodology

Overall inequality can be decomposed into several components and the contribution of each component can be computed accordingly. This is an excellent tool for determining the relative importance of each component, which is valuable in determining the priority of government policies. The most common approaches used in the literature are the decompositions by subgroups (Shorrocks, 1980 and 1984) and income sources (Yao, 1997 and 1999). Decomposition by subgroups can be applied to household survey or regional data (for example, see Tsui, 1993, Cheng, 1996b, Yao and Liu, 1998, Kanbur and Zhang, 1999, Yang, 1999, Ying, 1999, Lee, 2000, Cai et al., 2002, Huang et al., 2003, Kanbur and Zhang, 2005, Sicular et al., 2007, Wan, 2007, Li and Xu, 2008, Lin et al., 2008, Gries and Redlin, 2009, Liu, 2010), while decomposition by income sources is mostly used with household survey data to determine the significance of each income component (for instance, Khan et al., 1993, Rozelle, 1994, Cheng, 1996a, Khan and Riskin, 1998, Gustafsson and Li, 2001, Liu and Sicular, 2009, Zhou, 2009, Fang and Rizzo, 2011). Theil-T and Theil-L indices are often employed in the decomposition by subgroups (Theil, 1967, Theil, 1972, Shorrocks, 1980, Cowell, 2000), while the Gini coefficient is popularly used in the decomposition by income sources (for instance, Cheng, 1996a, Yao, 1997, Yao, 1999).

Decomposition of inequality by subgroups

The decomposition of inequality by subgroups is used to determine the contributions of the subgroups to overall inequality (Theil, 1967 and 1972). First, overall inequality is calculated using all the entities. Second, the entities are then divided into two or more subgroups. These subgroups can be defined by spatial relationship, quantifiable data, or qualitative information. Overall inequality for all the entities is then decomposed into the weighted sum of the inequality within these subgroups (the intra-subgroup component) and the inequality between these subgroups (the inter-subgroup component).[1] Theil-T and Theil-L indices are often used in the decomposition of inequality by subgroups because both indices can be decomposed completely into the inter-subgroup and intra-subgroup components (Bourguignon, 1979, Shorrocks, 1980 and 1984). On the contrary, the Gini coefficient does not have this property (Yao, 1999). Therefore, the Gini coefficient has seldom been used in this kind of exercises (Bourguignon, 1979).

The decomposition process can be carried out in successive tiers, so that the relationship between the various components can be investigated. There are five spatial levels in our decomposition, namely, the county (level 1), the provincial (level 2), the zonal (level 3), the inland-and-coastal (level 4) and the national (level 5). Let $I_i^{j,k}$ be the inequality index for the k^{th} region at level j. The subscript i and superscript j represent different

[1] For a detailed discussion, the readers may refer to Bourguignon (1979) and Shorrocks (1980, 1984).

spatial levels, where *j* is always higher than *i* by one spatial level. The measurement of inequality is based on population and GRP data compiled at level *i* which is represented by subscript *i*, and represents inequality as measured amongst the level *i* units. Superscript *j* represents the level of the spatial grouping that is used in the measurement of inequality. Every spatial grouping in level *j* is made up of the level *i* units. Generally, there are several spatial groupings in each level (except level 5, which is the national level, and so it has only one entity), and the k^{th} region is one of the many spatial groupings at spatial level *j*. For example, the inter-CU inequality within the a^{th} province can be represented by $I_1^{2,a}$. The subscript 1 (county-level) shows that the inequality measurement is based on the county-level units; while the superscript 2 (provincial level) shows that the county-level units are grouped into province, and the inequality measurement refers to the inequality amongst the county-level units within a province. The *a* behind the comma in the superscript refers to the a^{th} province. Similarly, zonal level is level 3 and thus, the inter-provincial inequality within the b^{th} economic zone can be represented by $I_2^{3,b}$. It should be noted that the overall inequality of the whole nation based on county-level data is represented by I_1^5. There is no region notation after the number 5 in the superscript, because superscript 5 represents the whole nation and it is the only spatial grouping at the national level.

The inequality of the inter-subgroup component measured at any level *i* can be decomposed into the sum of the intra-subgroup component and inter-subgroup component measured at a higher spatial level *j*. Overall inter-CU inequality for China (I_1^5) can be decomposed into the intra-provincial component and the inter-provincial component (I_2^5). The intra-provincial component is equal to the weighted sum of the inter-CU inequalities within all the provinces in the dataset. The inter-CU inequality within the a^{th} province is represented by $I_1^{2,a}$.

$$I_1^5 = \sum_{a=1}^{22} W_a \; I_1^{2,a} + I_2^5 \qquad (1)$$

where a = 1 to 22 since there are 22 provinces in this study and W_a is the weight for the a^{th} province. The weights for the Theil-L and Theil-T decompositions are population and income based, respectively (Gustafsson and Li, 2002). Specifically, the weight for the a^{th} province is n_a/N for the Theil-L decomposition and Y_a/Y for the Theil-T decomposition where n_a and Y_a represent the population and GRP in the a^{th} province while *N* and *Y* denote the total population and GRP of all the regions.

Similarly, the inter-provincial inequality (I_2^5) can then be decomposed into the sum of the intra-zonal component and the inter-zonal component (I_3^5). The intra-zonal component is equal to the weighted sum of the inter-provincial inequalities within all the zones. The inter-provincial inequality within the b^{th} zone is represented by $I_2^{3,b}$.

$$I_2^5 = \sum_{b=1}^{4} W_b \; I_2^{3,b} + I_3^5 \qquad (2)$$

where b = 1 to 4 since there are four economic zones, W_b is the weight for the bth zone.

In the third tier of decomposition, the inter-zonal inequality (I_3^5) can be further decomposed into the sum of the component of the inequalities within the inland and coastal regions, and the component of the inequality between the inland and coastal regions (I_4^5). The component of the inequalities within the inland and coastal regions is equal to the weighted sum of the inter-zonal inequalities within the inland and coastal regions. The inter-zonal inequality within the c^{th} region is represented by $I_3^{4,c}$.

$$I_3^5 = \sum_{c=1}^{2} W_c \; I_3^{4,c} + I_4^5 \qquad (3)$$

where c = 1, 2, since there are two regions, namely the inland and the coastal regions, and W_c is the weight for the c^{th} region.

Substitute (3) into (2) to obtain

$$I_2^5 = \sum_{b=1}^{4} W_b \; I_2^{3,b} + \sum_{c=1}^{2} W_c \; I_3^{4,c} + I_4^5. \qquad (4)$$

Thus equation (1) becomes

$$I_1^5 = \sum_{a=1}^{22} W_a \; I_1^{2,a} + \sum_{b=1}^{4} W_b \; I_2^{3,b} + \sum_{c=1}^{2} W_c \; I_3^{4,c} + I_4^5. \qquad (5)$$

The contribution of the various spatial components to overall inequality in China can be derived from Equation (5). The percentage contribution of each component can then be found by dividing the value of each individual component by overall inequality. Overall inequality can be decomposed into the spatial components at four levels. This form of decomposition is the vertical decomposition, which can be applied across different administrative levels.

All components in Equation (5), except I_4^5, are the weighted sum of the inequality measured at a lower level. These intra-subgroup components can be further decomposed into their constituents within each level. The value of each constituent unit is the inequality of that entity times its weight. For example, the weighted sum of the inter-CU inequalities within all the provinces, which is made up of the contributions of 22 provinces, can be decomposed into the contribution of each province. This can identify major contributors to overall inequality for each spatial grouping. Similarly, the intra-provincial regional inequality (that is, the inter-CU inequality within each province) can be further decomposed into three components within each province, namely, the components of the inter-county inequality, the inter-city inequality, and the inequality between city and county subgroups. The information can reveal the disparity between the cities and counties within each province. Accordingly, intra-provincial development policy can be formulated for each province.

Data

Regional inequality can be investigated using different indicators. Duncan and Tian (1999) noted that it is important to distinguish between studies using livelihood and output indicators, as they can lead to different results. Many inequality studies are based on expenditure, consumption, wages, total earnings, and household income data. These indicators are good measures for the livelihood and economic well-being of the people. On the contrary, output per capita is deemed to be a good measure of economic development for a region. Because the focus of this study is on the regional inequality in economic development, regional output per capita is used in this study. Gross regional product (GRP) per capita is selected as the indicator of economic development in this research because it is the most frequently used indicator of output and is more comprehensive than other measures such as the gross value of industrial and agricultural output (GVIAO) and the national income (NI).

The present study is based on a dataset of real GRP per capita for the counties and county-level cities in China. There are three kinds of county-level units, namely, the counties, the county-level cities and the city districts (or simply 'districts') in the prefectural level cities and municipalities. However, the data of the city districts are unavailable for some provinces in the earlier years of the study period. Moreover, in some cases, only an aggregated value of the city districts, rather than the data of each individual district, is available. Therefore, this study is based on the data of the counties and county-level cities only. Many studies that examine inequality amongst the county-level units do not include city districts but are based on the data of the county-level cities and counties only.[2] In this study, the four municipalities, namely, Beijing, Tianjin, Shanghai, and Chongqing are not included because most of the administrative regions in the municipalities are districts.

The data is largely compiled from the *Provincial Statistical Yearbook* (State Statistical Bureau, 1998-2008a) of each province. However, where the data is unavailable, the data from the *China Statistical Yearbook for Regional Economy* (State Statistical Bureau, 2004-2008) and the *Provincial Yearbook* (State Statistical Bureau, 1998-2008b) for each province are used. Some cities and counties are dropped from the dataset because of incomplete information in the sources. All the county-level GRP data are adjusted for inflation and expressed in 1997 constant prices. Since the deflator for each individual county-level unit is not available, the provincial deflator is used for all the counties and county-level cities within a province.

Occasionally, there are changes in the administrative divisions in China. Changes at the county-level may affect the GRP per capita of a region, which in turn can affect inequality estimates. The common changes in administrative divisions include the change of the name of a county or city; the upgrade of the administrative status of a county to a city or district; the upgrade of the administrative status of a city to district; and the

[2] Examples include Veeck and Pannell (1989), Rozelle (1994), Lee (2000), Song et al. (2000), Gustafsson and Li (2002), Wei and Kim (2002), Jones et al. (2003), Yu et al. (2007), Li and Xu (2008), Brajer et al. (2010), Zhou and Zou (2010), and Wu and Zhu (2011).

change in boundaries of the county-level units such as the transfer of control of a town or village from one county-level unit to another. Except for the change in the name of a city or county, all the other changes in administrative divisions may affect the measurement of inequality.

To ensure consistency of the data, the database has been thoroughly checked for changing administrative status/boundaries et cetera. Aggregation has been used in some instances, following Fan (1995), where boundaries have changed over time. The shortcoming of aggregation is the underestimation of inequality in the aggregated county-level units, although according to the website of Administrative Divisions in China, there were few changes in administrative divisions during the period covered.

The official website for Administrative Divisions in China (http://www.xzqh.org) is used to check all the changes in administrative divisions that occurred during 1997 – 2007. First, all county-level units are checked for any name change in the study period and then they are all renamed according to their latest names in 2007. Second, every county-level unit is checked for any change in boundary. The change in boundary may affect the measurement of inequality. For example, the transfer of control of a town with a high GRP per capita from one rich county to a poor county may increase the GRP per capita of the latter, while significantly reducing the GRP per capita of the former; thereby giving a false impression of a decline in inequality. With the aim of keeping the data comparable, some modifications to the data are necessary to ensure that the changes in the GRP per capita can only be attributable to economic development rather than any administrative change.

The approach suggested by Fan (1995) is adopted to tackle the problem of boundary changes amongst the county-level units. If the cities and counties have boundary changes in the study period, then they are aggregated so as to ensure comparability across time. However, the aggregation is strictly for boundary changes that involve cities and counties only, and no boundary change involving city districts is allowed. Accordingly, if there is a boundary change that involves city districts with cities or counties, then these counties and cities are deleted from the database as city districts are not included in this study. Similarly, if the counties or cities change their administrative status to city districts, then these cities and counties are deleted as well. All the aggregations which contain both county-level cities and counties are excluded from the analysis because if the aggregation is made up of both cities and counties, it is impossible to decompose overall inequality into the components of inter-county inequality, inter-city inequality and inequality between city and county subgroups. The shortcoming of aggregation is the underestimation of inequality in the aggregated county-level units, although according to the website of Administrative Divisions in China, there were few changes in administrative divisions during the period covered.

Several counties were upgraded to cities within the research period. Accordingly, these county-level units have different administrative statuses across the study period. In order to keep the data comparable in the study, the administrative statuses of all the cities and counties in the database are based on the latest classification, namely, the administrative status in 2007. The county-level units can be grouped into larger

spatial groupings in higher spatial levels for the purpose of analysis. There are four spatial levels for the grouping of the county-level units, namely, the national, inland-and-coastal, economic zonal, and the provincial levels. In this study, the coastal region and the eastern zone are identical, whereas the inland region is defined to comprise all the provinces in the central, western and north-eastern zones. The definition of the inland and coastal regions used in this study is slightly different from the official definition. As the data of some provinces are not available in some of the years, the county-level units within these provinces cannot be included in the measurement of inequality conducted at the national, inland-and-coastal, and economic zonal levels. Eventually only the county-level units in 22 provinces are included in these three levels of analyses, and these provinces are grouped as follows:

- Eastern zone: Hebei, Jiangsu, Zhejiang, Fujian, Guangdong and Hainan. The municipalities of Beijing, Tianjin and Shanghai are excluded in this study. The province of Shandong is not included because of unavailability of data.
- Central zone: Anhui, Jiangxi, Henan, and Hunan. The provinces of Shanxi and Hubei are not included because of unavailability of data.
- Western zone: Inner Mongolia, Guangxi, Sichuan, Guizhou, Yunnan, Gansu, Qinghai, Ningxia and Xinjiang. The municipality of Chongqing is excluded in this study. The provinces of Shaanxi and Tibet are not included because of unavailability of data.
- North-eastern zone: Liaoning, Jilin and Heilongjiang.

The categorization of the zones is based on the *2006 China Statistical Yearbook* (State Statistical Bureau, 2006). The final dataset used in the study is comprised of 1485 counties and county-level cities covering the period of 1997-2007. Population data is compiled from the *Provincial Statistical Yearbook* (State Statistical Bureau, 1998-2008a), *Provincial Yearbook* (State Statistical Bureau, 1998-2008b), and *China Statistical Yearbook for Regional Economy* (State Statistical Bureau, 2004-2008). It is well-known that the provincial population data in China is based on the household registration system (*hukou*) population, whereas the number of temporary migrants is not taken into consideration. This may distort the final results and cannot be resolved given the resources available.[3] HM comment: This point about data quality has been moved to the footnote.

Wan (2008) suggests that China's regional inequality can be divided into two dimensions, namely, the east-central-west divide and rural-urban inequality. The latter contributes to over 70 per cent of the overall inequality. However, the data for rural and urban areas within the county-level units are not available, therefore, it is impossible to study the inequality between the rural and urban areas at the county-level. Tsui

[3] The data of the actual population in 2000 for each county-level unit is available in the County Data of 2000 Census (2000 ren kou pu cha fen xian zi liao) (State Statistical Bureau, 2003). As the census data for 2010 is not yet available, therefore, for the time being, it is impossible to adjust the population data by interpolation because the only data available is for 2000. Further adjustment can be made when the data becomes available in the future. Another concern is the quality of output data in China. Researchers have raised doubts about the reliability and accuracy of China's GDP statistics (Chow, 1986, Wu, 1997, Rawski, 2001, Holz, 2006). However the official source is still the only channel for statistics used in this type of exercises. Thus caution should be exercised in interpreting the results here.

(1993) and Lee (2000) treated the county-level cities as the urban areas, and the counties as the rural areas in their analysis. They decompose overall inter-CU inequality into the contributions of the 'intra-rural', 'intra-urban' and 'rural-urban' components. The same approach will be used in this chapter. To avoid confusion, the components are renamed as the inter-county inequality, inter-city inequality and inequality between city and county subgroups.

Results and discussion

The dataset used in this research is comprised of the data of the counties and county-level cities. The terms 'county-level city' and 'city' are used interchangeably hereafter. The term 'inter-county-level-unit inequality' or simply 'inter-CU inequality' refers to the inequality amongst all the counties and county-level cities within a region. The term 'intra-provincial regional inequality' or simply 'intra-provincial inequality' refers to the inequality amongst the county-level units within a province (that is, the inter-CU inequality within each province). This section has two parts. The results based on decomposition of overall inequality into different spatial components are presented first. Then intra-provincial inequality is further decomposed into three components, namely, the inter-county inequality, the inter-city inequality, and the inequality between city and county subgroups.

Decomposition of inequality into spatial components

Table 1 shows the three-tier decomposition of inequality. The first tier is the decomposition of overall inter-CU inequality into the intra-provincial component (that is, the weighted sum of the inter-CU inequalities within all the provinces) and the inter-provincial component as shown in Equation (1). The contribution of each component is expressed as a percentage of the overall inter-CU inequality. The second tier is the decomposition of inter-provincial inequality into the intra-zonal component (that is, the weighted sum of the inter-provincial inequalities within all the zones) and the inter-zonal component as shown in Equation (2). The contribution at this level is expressed as a fraction of the inter-provincial inequality. The third tier is the decomposition of the inter-zonal inequality into the component of inter-zonal inequality within the inland and coastal regions (that is, the weighted sum of the inter-zonal inequalities within the inland and coastal regions) and the component of the inequality between the inland and coastal regions as shown in Equation (3). The contributions of the components are expressed as a percentage of the inter-zonal inequality.

The first tier decomposition in Table 1 shows that the contributions of the inter-CU inequality within all the provinces and the inter-provincial inequality to overall inter-CU inequality remain relatively constant during the period of 1997-2007. It is interesting to note that the contribution of the inter-provincial inequality (Theil-T is used in this calculation) decreased slightly between 1997 and 2007, but it increased slightly when Theil-L is used. However, the difference is very small. On the contrary, the contribution of the inter-provincial inequalities within all the zones to overall inter-provincial inequality increased substantially according to either Theil-T or Theil-L measure, as shown in the second tier decomposition in Table 1. In

1997, the contributions were about 26 per cent and 28 per cent according to Theil-T and Theil-L measures, respectively. These contributions increased enormously to reach about 48 per cent in both cases in 2007, while the contribution of the inter-zonal inequality decreased significantly. Finally, the third tier decomposition results illustrate the changes in the contributions of the components are relatively small. The contribution of the inter-zonal inequality within the inland and coastal regions dropped about 4 per cent, whereas the contribution of inequality between the inland and coastal regions increased slightly during 1997-2007. The contribution of inequality between the inland and coastal regions to overall inter-zonal inequality reached about 90 per cent in 2007.

Table 1 Three-Tier Decomposition of Inter-CU Inequality into Spatial Components

			1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
First tier	Theil-T	Inter-CU inequality within all the provinces (%)	59.49	57.84	57.04	57.58	57.53	56.79	56.77	57.28	59.75	60.56	60.74
		Inter-provincial inequality (%)	40.51	42.16	42.96	42.42	42.47	43.21	43.23	42.72	40.25	39.44	39.26
	Theil-L	Inter-CU inequality within all the provinces (%)	57.19	55.55	54.93	55.70	55.71	54.67	54.14	54.08	55.98	56.56	56.46
		Inter-provincial inequality (%)	42.81	44.45	45.07	44.30	44.29	45.33	45.86	45.92	44.02	43.44	43.54
Second tier	Theil-T	Inter-provincial inequality within all the zones (%)	26.19	22.98	22.75	25.80	26.61	28.27	29.67	33.02	42.70	45.71	48.90
		Inter-zonal inequality (%)	73.81	77.02	77.25	74.20	73.39	71.73	70.33	66.98	57.30	54.29	51.10
	Theil-L	Inter-provincial inequality within all the zones (%)	28.28	24.38	23.44	26.27	26.92	28.06	29.11	32.94	41.85	44.95	48.26
		Inter-zonal inequality (%)	71.72	75.62	76.56	73.73	73.08	71.94	70.89	67.06	58.15	55.05	51.74
Third tier	Theil-T	Inter-zonal inequality within the inland and coastal regions (%)	14.07	14.94	14.91	12.63	12.02	11.98	10.89	10.70	10.71	9.10	10.03
		Inequality between the inland and coastal regions (%)	85.93	85.06	85.09	87.37	87.98	88.02	89.11	89.30	89.29	90.90	89.97
	Theil-L	Inter-zonal inequality within the inland and coastal regions (%)	17.34	18.49	18.40	15.66	14.97	14.93	13.72	13.51	13.49	11.60	12.56
		Inequality between the inland and coastal regions (%)	82.66	81.51	81.60	84.34	85.03	85.07	86.28	86.49	86.51	88.40	87.44

Source: Authors' own calculation. Note: The coastal region is treated the same as the eastern zone. The inland region includes the central, western, and north-eastern zones.

Table 2 shows the overall result of the decomposition into different spatial components using Equation (5). The contribution of each component is expressed as a percentage of the overall inter-CU inequality. Although there are some minor differences in the percentage contribution derived from the two indices, the magnitude and trend are similar. The component of inter-CU inequality within all the provinces contributed the most to overall inter-CU inequality and was about 60 per cent in 2007. The contributions of the inter-provincial inequality within all the zones and the inequality between the inland and coastal regions were very close in 2007, being 19 per cent and 18 per cent according to the Theil-T measure. The component of inter-zonal inequalities within the inland and coastal regions contributed about 2 per cent of overall inequality in 2007.

Table 3 shows the changes in the contributions of the spatial components to overall inter-CU inequality. It can be observed that the contribution of the inter-CU inequality within all the provinces to overall inter-CU inequality remained fairly constant over time. The contribution of inter-provincial inequality within all the zones increased, while the contributions of the inequality between the inland and coastal regions and the inter-zonal inequality within the inland and coastal regions were found to decrease. According to the Theil-T method, the percentage increase in the contribution of the inter-provincial inequality within all the zones was about 8.6 per cent during 1997-2007 while the inter-zonal inequality within the inland and coastal regions had a decline of 2.2 per cent and the inequality between the inland and coastal regions had a decline of 7.7 per cent. This finding highlights the importance of monitoring the increase in inequality amongst the provinces within the economic zones.

Table 2 Decomposition of Inter-CU Inequality into Spatial Components

		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Theil-T	Inequality between the inland and coastal regions (%)	25.70	27.62	28.24	27.50	27.42	27.28	27.09	25.55	20.59	19.46	18.05
	Inter-zonal inequality within the inland and coastal regions (%)	4.21	4.85	4.95	3.98	3.75	3.71	3.31	3.06	2.47	1.95	2.01
	Inter-provincial inequality within all the zones (%)	10.61	9.69	9.77	10.94	11.30	12.21	12.82	14.11	17.19	18.03	19.20
	Inter-CU inequality within all the provinces (%)	59.49	57.84	57.04	57.58	57.53	56.79	56.77	57.28	59.75	60.56	60.74
Theil-L	Inequality between the inland and coastal regions (%)	25.38	27.40	28.16	27.55	27.52	27.74	28.05	26.63	22.14	21.14	19.70
	Inter-zonal inequality within the inland and coastal regions (%)	5.32	6.22	6.35	5.12	4.85	4.87	4.46	4.16	3.45	2.77	2.83
	Inter-provincial inequality within all the zones (%)	12.10	10.84	10.57	11.64	11.92	12.72	13.35	15.13	18.43	19.53	21.01
	Inter-CU inequality within all the provinces (%)	57.19	55.55	54.93	55.70	55.71	54.67	54.14	54.08	55.98	56.56	56.46

Source: Authors' own calculation. Note: The coastal region is treated the same as the eastern zone. The inland region includes the central, western, and north-eastern zones.

Table 3 Changes (%) in the Contributions of the Spatial Components to Inter-CU Inequality

		1997 (%)	2007 (%)	Differences (%)
Theil-T	Inequality between the inland and coastal regions	25.70	18.05	-7.65
	Inter-zonal inequality within the inland and coastal regions	4.21	2.01	-2.19
	Inter-provincial inequality within all the zones	10.61	19.20	8.59
	Inter-CU inequality within all the provinces	59.49	60.74	1.25
Theil-L	Inequality between the inland and coastal regions	25.38	19.70	-5.68
	Inter-zonal inequality within the inland and coastal regions	5.32	2.83	-2.50
	Inter-provincial inequality within all the zones	12.10	21.01	8.91
	Inter-CU inequality within all the provinces	57.19	56.46	-0.73

Source: Authors' own calculation. Note: The coastal region is treated the same as the eastern zone. The inland region includes the central, western, and north-eastern zones.

Decomposition techniques can also be applied to analyse the *changes* in inequality itself. This extends the conventional decomposition of inequality. The decomposition of changes in inequality can provide detailed information about the contributions of the changes in different components to the change in overall inequality. The conventional approach shows the significance of the component to the absolute level of inequality. The results of the decomposition of the changes in overall inter-CU inequality over the period 1997–2007 are shown in Table 4. The increase in the inter-CU inequality within all the provinces contributed substantially to the change in overall inequality during the period considered (63 per cent and 55 per cent according to Theil-T and Theil-L measures respectively), followed by the increase in the inter-provincial inequality within all the zones (35 per cent and 43 per cent according to Theil-T and Theil-L). A comparison of Table 4 with Table 3 shows that inequality between the inland and coastal regions registered a decrease in its contribution to overall inequality in Table 3, whereas Table 4 shows that 4 per cent (given Theil-T) of an increase in overall inequality can be explained by the increase in the inequality between the inland and coastal regions. This information is quite revealing. It suggests that inequality between the inland and coastal regions increased in the study period, but the increase was not as dramatic as those of other components and hence led to a decline in its total contribution. Therefore, this component should not be overlooked just because it had a decline in total contribution.

All the county-level units in a province can be further divided into city and county subgroups, and an additional tier of decomposition can be performed to investigate the contribution of the city and county subgroups to intra-provincial regional inequality. The latter can be further decomposed into three intra-provincial components, namely, the inter-county inequality, the inter-city inequality, and the inequality between the city and county subgroups in each province.[4] The results are shown in Table 5. It is observed that inter-county inequality within all the provinces has the largest contribution to the overall inequality,

[4] The decomposition of inequality into city and county subgroups cannot be conducted for Ningxia because there is only one county-level city in Ningxia, and there is also a change in the boundary of this city which makes the data incomparable. This city is thus removed from the dataset.

namely, 23 per cent and 31 per cent in 2007 according to the Theil-T and Theil-L measures respectively. The changes in the contributions of these components are shown in Table 6. It is shown that the changes of the three intra-provincial components were very small and remained fairly constant over the whole period.

Table 4 Decomposition of the Changes in Inter-CU Inequality (1997–2007)

Changes in	Contribution to inter-CU inequality change		Contribution to inter-CU inequality change (%)	
	Theil-T	Theil-L	Theil-T	Theil-L
Inequality between the inland and coastal regions	0.005	0.004	4.072	5.447
Inter-zonal inequality within the inland and coastal regions	-0.002	-0.003	-1.999	-3.426
Inter-provincial inequality within all the zones	0.039	0.034	34.892	43.338
Inter-CU inequality within all the provinces	0.070	0.042	63.035	54.641

Source: Authors' own calculation. Note: The coastal region is treated the same as the eastern zone. The inland region includes the central, western, and north-eastern zones.

Table 7 shows the contributions of the changes in different spatial components (first three rows in the table) and the three intra-provincial components (last three rows in the table) to the change in overall inequality. It is shown that the contributions of the changes in the three intra-provincial components (inter-county, inter-city and between city and county subgroups) were respectively 25 per cent, 26 per cent and 12 per cent according to the Theil-T technique (or 33 per cent, 13 per cent and 9 per cent if Theil-L indices are used). It is worth noting that in Table 6 the contribution of inequality between city and county subgroups within all the provinces exhibited a declining trend while the increase in this component still contributed to 12 per cent (as measured by Theil-T) of the increase in overall inequality. Similarly, though in Table 6 the changes in the contributions of the other two intra-provincial inequality components remained constant, the increases in these two components contributed to more than 50 per cent (as measured by Theil-T) of the change in overall inequality during the period of 1997-2007. Therefore, these inequality components should not be overlooked and efforts should also be made to mitigate these intra-provincial inequalities.

.

Table 5 Decomposition of Inter-CU Inequality into Spatial Components and the Three Intra-Provincial Components

		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Theil-T	Inequality between the inland and coastal regions (%)	25.70	27.62	28.24	27.50	27.42	27.28	27.09	25.55	20.59	19.46	18.05
	Inter-zonal inequality within the inland and coastal regions (%)	4.21	4.85	4.95	3.98	3.75	3.71	3.31	3.06	2.47	1.95	2.01
	Inter-provincial inequality within all the zones (%)	10.61	9.69	9.77	10.94	11.30	12.21	12.82	14.11	17.19	18.03	19.20
	Inter-county inequality within all the provinces (%)	22.23	21.64	21.92	22.07	22.24	21.19	20.47	20.83	22.25	22.66	23.31
	Inter-city inequality within all the provinces (%)	20.85	20.79	20.19	20.69	20.47	20.88	21.39	21.41	22.26	22.75	22.62
	Inequality between city and county subgroups within all the provinces (%)	16.41	15.41	14.93	14.82	14.83	14.72	14.92	15.04	15.24	15.15	14.81
Theil-L	Inequality between the inland and coastal regions (%)	25.38	27.40	28.16	27.55	27.52	27.74	28.05	26.63	22.14	21.14	19.70
	Inter-zonal inequality within the inland and coastal regions (%)	5.32	6.22	6.35	5.12	4.85	4.87	4.46	4.16	3.45	2.77	2.83
	Inter-provincial inequality within all the zones (%)	12.10	10.84	10.57	11.64	11.92	12.72	13.35	15.13	18.43	19.53	21.01
	Inter-county inequality within all the provinces (%)	29.66	28.87	29.12	29.44	29.81	28.80	28.22	28.32	29.92	30.38	30.57
	Inter-city inequality within all the provinces (%)	12.61	12.71	12.33	12.91	12.49	12.51	12.39	12.24	12.49	12.74	12.72
	Inequality between city and county subgroups within all the provinces (%)	14.93	13.96	13.49	13.35	13.41	13.36	13.52	13.52	13.56	13.43	13.17

Source: Authors' own calculation. Note: The coastal region is treated the same as the eastern zone. The inland region includes the central, western, and north-eastern zones.

Table 6 Changes (%) in the Contributions of Inequality Components

		1997 (%)	2007 (%)	Differences (%)
Theil-T	Inequality between the inland and coastal regions	25.70	18.05	-7.65
	Inter-zonal inequality within the inland and coastal regions	4.21	2.01	-2.19
	Inter-provincial inequality within all the zones	10.61	19.20	8.59
	Inter-county inequality within all the provinces	22.23	23.31	1.08
	Inter-city inequality within all the provinces	20.85	22.62	1.78
	Inequality between city and county subgroups within all the provinces	16.41	14.81	-1.60
Theil-L	Inequality between the inland and coastal regions	25.38	19.70	-5.68
	Inter-zonal inequality within the inland and coastal regions	5.32	2.83	-2.50
	Inter-provincial inequality within all the zones	12.10	21.01	8.91
	Inter-county inequality within all the provinces	29.66	30.57	0.92
	Inter-city inequality within all the provinces	12.61	12.72	0.11
	Inequality between city and county subgroups within all the provinces	14.93	13.17	-1.75

Source: Authors' own calculation. Note: The coastal region is treated the same as the eastern zone. The inland region includes the central, western, and north-eastern zones.

Table 7 Decomposition of the Change in Inter-CU Inequality (1997-2007)

Changes in each component	Contribution to overall changes		Contribution to overall changes (%)	
	Theil-T	Theil-L	Theil-T	Theil-L
Inequality between the inland and coastal regions	0.005	0.004	4.072	5.447
Inter-zonal inequality within the inland and coastal regions	-0.002	-0.003	-1.999	-3.426
Inter-provincial inequality within all the zones	0.039	0.034	34.892	43.338
Inter-county inequality within all the provinces	0.028	0.025	25.277	32.876
Inter-city inequality within all the provinces	0.029	0.010	25.875	12.985
Inequality between city and county subgroups within all the provinces	0.013	0.007	11.882	8.780

Source: Authors' own calculation. Note: The coastal region is treated the same as the eastern zone. The inland region includes the central, western, and north-eastern zones.

Further decomposition analyses

Further analysis can be performed to gain more insights into inequality in each province. Decomposition can be conducted horizontally amongst the provinces so as to identify the contributions of individual provinces. The results are shown in Tables 8 and 9 (corresponding to the Theil-T and Theil-L methods). As the two sets of results are similar, our discussions are based on the Theil-T results in Table 8. The values in column CU in Table 8 represent percentage contributions of individual provinces to overall inequality and they sum to 100. Individual provinces' contributions are then decomposed into three components reported in columns Co, Ci and Co-Ci in Table 8. According to this table, in 2007 Jiangsu had the largest contribution to overall inequality. This finding is in agreement with the results of Sakamoto and Fan (2010) who showed that Jiangsu contributed considerably to the income disparity within the Yangtze River delta and that its contribution was growing. Other large contributors in 2007 are in turn Hebei, Henan, Inner Mongolia and Zhejiang. Together these top five contributors have a share of about 63 per cent. These provinces are situated close to each other. That may imply that spatial factors play major roles in inequality in China. Table 8 also shows that inter-county inequality in Hebei, Henan and Inner Mongolia dominates each province's contribution while inter-city inequality in Jiangsu is the most important contributing factor. The inter-city inequality within Fujian, Guangdong, Hebei, Zhejiang, Henan, and Xinjiang also contributed greatly to overall inequality. Most of these provinces belong to the eastern zone. It shows that the great disparity amongst the cities in the eastern zone further reinforced overall inequality. The inequality between city and county subgroups in Fujian, Hebei, Jiangsu, Zhejiang, Henan, and Xinjiang all contributed significantly to overall inequality. Four of these provinces also belong to the eastern zone.

Table 10 shows the changes in the contributions of the three intra-provincial components of the provinces to overall inequality during 1997-2007. It is observed that inter-CU inequality in Jiangsu had the largest increase in its contribution (using the Theil-T technique) which is largely attributed to the increase in the inter-city inequality component. However, the contribution of inter-county inequality did not change significantly though that of inequality between city and county subgroups increased moderately. It is also observed that inter-CU inequality in Inner Mongolia had the second largest increase in its contribution (according to Theil-T). This change was mainly caused by the increase in the contribution of inter-county inequality component. However, the results using the Theil-L method show that inter-CU inequality in Hebei had the largest increase in its contribution which was mainly due to the increase in the contribution of the inter-county inequality component. Table 10 also shows that inter-CU inequality in Guangdong had the largest decrease in its contribution (3.46 per cent according to Theil-T) which was mainly due to the decline in the contribution of the inter-city inequality component (2.04 per cent) and a modest decline in the inter-county inequality component (0.96 per cent). According to the Theil-L method, inter-CU inequality in Sichuan had the largest decrease in its contribution (3.05 per cent).

Table 8 Decomposition of Inter-CU Inequality within the Provinces in 1997 and 2007 (Theil-T)

			1997				2007			
			CU	Co	Ci	Co-Ci	CU	Co	Ci	Co-Ci
Coastal	Eastern	Fujian	6.76	1.23	2.78	2.75	4.13	0.64	1.86	1.63
		Guangdong	6.47	2.28	3.72	0.47	3.01	1.32	1.68	0.00
		Hainan	0.27	0.09	0.05	0.13	0.12	0.05	0.04	0.02
		Hebei	7.33	3.57	1.39	2.37	10.46	4.98	2.96	2.52
		Jiangsu	23.31	1.21	14.40	7.70	30.09	1.39	18.96	9.74
		Zhejiang	6.62	2.98	1.86	1.78	5.32	2.39	1.78	1.15
Inland	Central	Anhui	2.58	1.54	0.36	0.68	1.20	0.88	0.18	0.14
		Henan	8.94	3.21	1.99	3.75	9.43	4.19	2.05	3.18
		Hunan	2.74	2.24	0.38	0.13	3.29	2.46	0.54	0.29
		Jiangxi	1.14	0.90	0.18	0.05	1.94	1.33	0.44	0.16
	Western	Gansu	2.02	1.55	0.08	0.39	1.92	1.32	0.14	0.46
		Guangxi	2.47	1.98	0.47	0.02	1.32	1.19	0.12	0.00
		Guizhou	1.28	0.72	0.08	0.48	1.28	0.64	0.14	0.49
		Inner Mongolia	2.04	1.33	0.42	0.28	7.66	6.79	0.85	0.02
		Qinghai	0.49	0.25	0.03	0.22	0.81	0.21	0.06	0.55
		Sichuan	7.51	4.26	1.15	2.09	4.42	2.82	0.71	0.89
		Xinjiang	4.99	2.38	1.78	0.83	4.69	2.02	1.63	1.04
		Yunnan	5.13	2.45	1.08	1.59	2.72	1.62	0.43	0.67
	North-eastern	Heilongjiang	1.75	0.92	0.48	0.35	2.31	0.84	0.86	0.61
		Jilin	0.82	0.30	0.38	0.14	1.05	0.40	0.61	0.03
		Liaoning	5.16	1.76	2.00	1.40	2.70	0.75	1.18	0.77

Source: Authors' own calculation. Note: The coastal region is treated the same as the eastern zone. The inland region includes the central, western, and north-eastern zones. CU: Inter-CU inequality. Co: Inter-county inequality. Ci: Inter-city inequality. Co-Ci: Inequality between city and county subgroups.

Table 9 Decomposition of Inter-CU Inequality within the Provinces in 1997 and 2007 (Theil-L)

			1997				2007			
			CU	Co	Ci	Co-Ci	CU	Co	Ci	Co-Ci
Coastal	Eastern	Fujian	3.76	0.99	1.11	1.65	3.10	0.74	1.01	1.35
		Guangdong	6.05	2.57	3.04	0.44	4.42	2.04	2.37	0.01
		Hainan	0.31	0.12	0.04	0.14	0.19	0.09	0.06	0.04
		Hebei	6.20	3.47	0.86	1.87	9.44	5.37	1.87	2.20
		Jiangsu	13.78	1.46	6.83	5.49	15.25	1.66	7.21	6.38
		Zhejiang	3.94	2.09	0.91	0.95	3.13	1.65	0.86	0.62
Inland	Central	Anhui	2.95	2.01	0.22	0.72	2.64	2.08	0.27	0.29
		Henan	10.45	4.57	1.58	4.30	10.52	5.57	1.53	3.42
		Hunan	3.60	3.02	0.42	0.17	5.36	4.13	0.74	0.49
		Jiangxi	1.86	1.52	0.25	0.09	3.44	2.59	0.57	0.28
	Western	Gansu	5.07	4.24	0.08	0.75	4.50	3.55	0.11	0.83
		Guangxi	3.45	2.84	0.58	0.03	2.57	2.34	0.22	0.01
		Guizhou	3.36	2.06	0.13	1.16	3.59	2.04	0.27	1.29
		Inner Mongolia	2.53	1.83	0.37	0.33	5.17	4.65	0.50	0.02
		Qinghai	0.75	0.46	0.02	0.27	0.96	0.39	0.02	0.55
		Sichuan	10.36	6.35	1.23	2.79	7.31	4.96	0.86	1.49
		Xinjiang	4.70	2.72	1.14	0.84	5.14	2.91	1.05	1.18
		Yunnan	8.61	5.19	1.04	2.38	5.67	3.94	0.52	1.21
	North-eastern	Heilongjiang	1.93	1.18	0.40	0.35	3.63	1.77	0.94	0.92
		Jilin	0.92	0.38	0.38	0.16	1.04	0.42	0.58	0.04
		Liaoning	4.84	2.19	1.42	1.22	2.66	0.97	0.97	0.71

Source: Authors' own calculation. Note: The coastal region is treated the same as the eastern zone. The inland region includes the central, western, and north-eastern zones. CU: Inter-CU inequality. Co: Inter-county inequality. Ci: Inter-city inequality. Co-Ci: Inequality between city and county subgroups.

Table 11 presents the results of the decomposition of the change in overall inter-CU inequality into the changes in the three components of intra-provincial inequality for each province. According to the estimates using Theil-T, the increase in the inter-CU inequality in Jiangsu contributed to 26.35 per cent of the change in overall inequality in China. The increase in inter-city inequality accounted for 16.91 per cent, while the increase in the inequality between the city and county subgroups accounted for 8.37 per cent. It implies that more than one quarter of the increase in inter-CU inequality in China over the study period may be due to the increase in the intra-provincial inequality in Jiangsu. Furthermore, it is observed that the increases in the inter-CU inequalities in Hebei and Inner Mongolia also contributed significantly to the overall inequality. These three provinces combined contributed to about 47 per cent of the increase in overall inequality according to the Theil-T estimates. It means that if the levels of the inter-CU inequalities in these provinces had remained unchanged during the entire study period, then the overall increase in inequality in China would have been reduced by nearly one half.

The relative importance of the three intra-provincial inequality components in every province can also be estimated. In Table 12 the contributions of inter-county inequality, inter-city inequality and inequality between city and county subgroups in every province are expressed as a percentage of the sum of these three components. For example, inter-county inequality in Hainan contributed to 34.58 per cent of the intra-provincial inequality of Hainan in 1997 while this figure increased to 43.88 per cent in 2007 according to the Theil-T estimates. The contribution of inter-city inequality increased from 18.61 per cent to 35.63 per cent while that of inequality between city and county subgroups decreased from 46.81 per cent to 20.49 per cent during the same period. The contribution of the inter-city component increased substantially in this period. This may have important policy implications for local government as well as the central government.

Table 12 also provides additional information about the characteristics of the provinces in each zone. According to the Theil-T measurement, inter-county inequality in 2007 contributed to more than 50 per cent of the intra-provincial regional inequality in Anhui, Hunan, Jiangxi, Gansu, Guangxi, Guizhou, Inner Mongolia, Sichuan and Yunnan. These provinces are all in the central and western zones. The inter-city component contributed to more than 50 per cent of the intra-provincial regional inequality in Guangdong, Jiangsu and Jilin. Both Guangdong and Jiangsu are in the eastern zone. The inequality between city and county subgroups contributed to about 67 per cent of the intra-provincial regional inequality in Qinghai, which is in the western zone.

Table 10 Changes (%) in the Contributions of Intra-Provincial Components during 1997-2007

			Theil-T change (%)				Theil-L change (%)			
			CU	Co	Ci	Co-Ci	CU	Co	Ci	Co-Ci
Coastal	Eastern	Fujian	-2.63	-0.59	-0.92	-1.12	-0.66	-0.25	-0.10	-0.30
		Guangdong	-3.46	-0.96	-2.04	-0.47	-1.63	-0.53	-0.67	-0.43
		Hainan	-0.15	-0.04	-0.01	-0.11	-0.12	-0.03	0.02	-0.10
		Hebei	3.13	1.41	1.57	0.15	3.24	1.90	1.01	0.33
		Jiangsu	6.78	0.18	4.56	2.04	1.47	0.20	0.38	0.89
		Zhejiang	-1.30	-0.59	-0.08	-0.63	-0.81	-0.44	-0.05	-0.33
Inland	Central	Anhui	-1.38	-0.66	-0.18	-0.54	-0.31	0.07	0.05	-0.43
		Henan	0.49	0.98	0.06	-0.57	0.07	1.00	-0.05	-0.88
		Hunan	0.55	0.22	0.16	0.16	1.76	1.11	0.32	0.32
		Jiangxi	0.80	0.43	0.26	0.11	1.58	1.07	0.32	0.19
	Western	Gansu	-0.10	-0.23	0.06	0.07	-0.57	-0.69	0.03	0.08
		Guangxi	-1.15	-0.79	-0.35	-0.02	-0.88	-0.50	-0.36	-0.02
		Guizhou	0.00	-0.08	0.06	0.01	0.23	-0.02	0.14	0.13
		Inner Mongolia	5.62	5.46	0.43	-0.26	2.64	2.82	0.13	-0.31
		Qinghai	0.32	-0.04	0.03	0.33	0.21	-0.07	0.00	0.28
		Sichuan	-3.09	-1.44	-0.44	-1.20	-3.05	-1.39	-0.37	-1.30
		Xinjiang	-0.30	-0.36	-0.15	0.21	0.44	0.19	-0.09	0.34
		Yunnan	-2.41	-0.83	-0.65	-0.92	-2.94	-1.25	-0.52	-1.17
	North-eastern	Heilongjiang	0.56	-0.08	0.38	0.26	1.70	0.59	0.54	0.57
		Jilin	0.23	0.10	0.23	-0.11	0.12	0.04	0.20	-0.12
		Liaoning	-2.46	-1.01	-0.82	-0.63	-2.18	-1.22	-0.45	-0.51

Source: Authors' own calculation. Note: The coastal region is treated the same as the eastern zone. The inland region includes the central, western, and north-eastern zones. CU: Inter-CU inequality. Co: Inter-county inequality. Ci: Inter-city inequality. Co-Ci: Inequality between city and county subgroups.

Table 11 Decomposition of Changes in Inter-CU Inequality (1997–2007) into Changes in Three Intra-Provincial Components

		Change in component	Theil-T				Theil-L			
			CU	Co	Ci	Co-Ci	CU	Co	Ci	Co-Ci
Coastal	Eastern	Fujian	-0.25	-0.23	0.18	-0.19	0.75	0.06	0.40	0.30
		Guangdong	-1.87	-0.21	-1.15	-0.50	0.08	0.36	0.34	-0.62
		Hainan	-0.08	-0.01	0.02	-0.09	-0.05	0.01	0.06	-0.12
		Hebei	10.00	4.68	3.56	1.76	9.80	5.67	2.47	1.67
		Jiangsu	26.35	1.08	16.91	8.37	10.45	1.19	4.49	4.77
		Zhejiang	1.94	0.86	1.04	0.04	0.54	0.27	0.40	-0.12
Inland	Central	Anhui	-0.73	-0.16	-0.08	-0.50	1.00	1.25	0.22	-0.47
		Henan	6.47	3.72	1.36	1.39	5.85	4.48	0.75	0.61
		Hunan	2.67	1.79	0.51	0.36	5.44	3.84	0.87	0.73
		Jiangxi	2.09	1.31	0.57	0.22	4.15	2.95	0.78	0.43
	Western	Gansu	1.11	0.59	0.16	0.36	1.63	0.95	0.11	0.57
		Guangxi	-0.41	-0.10	-0.30	-0.02	0.14	0.56	-0.39	-0.02
		Guizhou	0.80	0.32	0.15	0.32	2.30	1.07	0.33	0.89
		Inner Mongolia	10.94	10.22	0.99	-0.27	6.60	6.59	0.46	-0.44
		Qinghai	0.86	0.08	0.07	0.71	0.82	0.11	0.02	0.69
		Sichuan	-0.57	0.21	-0.03	-0.75	-0.38	0.73	-0.06	-1.04
		Xinjiang	2.64	0.87	0.88	0.89	3.44	1.86	0.45	1.13
		Yunnan	-0.90	0.12	-0.44	-0.58	-1.11	0.37	-0.46	-1.02
	North-eastern	Heilongjiang	2.06	0.44	0.95	0.67	4.41	1.81	1.27	1.33
		Jilin	0.91	0.35	0.65	-0.09	0.74	0.29	0.61	-0.15
		Liaoning	-0.97	-0.62	-0.15	-0.20	-1.68	-1.21	-0.12	-0.35

Source: Authors' own calculation. Note: The coastal region is treated the same as the eastern zone. The inland region includes the central, western, and north-eastern zones. CU: Inter-CU inequality. Co: Inter-county inequality. Ci: Inter-city inequality. Co-Ci: Inequality between city and county subgroups.

Table 12 Decomposition of Intra-Provincial Inequality in 1997 and 2007

			Theil-T						Theil-L					
			1997			2007			1997			2007		
			Co	Ci	Co-Ci	Co	Ci	Co-Ci	Co	Ci	Co-Ci	Co	Ci	Co-Ci
Coastal	Eastern	Fujian	18.21	41.07	40.72	15.54	45.04	39.42	26.30	29.66	44.03	24.00	32.48	43.52
		Guangdong	35.32	57.47	7.21	43.93	55.96	0.11	42.52	50.23	7.25	46.23	53.65	0.11
		Hainan	34.58	18.61	46.81	43.88	35.63	20.49	39.37	14.63	46.00	47.07	32.35	20.59
		Hebei	48.68	18.99	32.33	47.64	28.25	24.11	56.03	13.86	30.11	56.96	19.78	23.26
		Jiangsu	5.20	61.79	33.02	4.63	62.99	32.37	10.59	49.56	39.85	10.87	47.27	41.86
		Zhejiang	45.07	28.06	26.87	44.90	33.54	21.56	52.98	23.01	24.02	52.66	27.41	19.93
Inland	Central	Anhui	59.74	13.86	26.40	73.34	15.11	11.55	68.08	7.43	24.49	78.92	10.21	10.87
		Henan	35.86	22.24	41.90	44.47	21.78	33.75	43.72	15.13	41.15	52.96	14.51	32.54
		Hunan	81.50	13.86	4.63	74.72	16.39	8.89	83.83	11.59	4.59	77.07	13.81	9.12
		Jiangxi	79.55	15.79	4.66	68.81	22.95	8.24	81.99	13.37	4.64	75.28	16.66	8.06
	Western	Gansu	77.01	3.87	19.12	68.85	7.47	23.68	83.59	1.54	14.87	78.94	2.51	18.56
		Guangxi	80.06	19.05	0.88	90.35	9.36	0.29	82.31	16.89	0.80	90.97	8.73	0.30
		Guizhou	56.34	6.31	37.35	50.57	11.08	38.36	61.46	3.98	34.56	56.67	7.38	35.95
		Inner Mongolia	65.43	20.73	13.84	88.68	11.04	0.29	72.36	14.52	13.12	90.03	9.63	0.33
		Qinghai	50.25	5.57	44.18	25.20	7.39	67.41	61.55	2.15	36.30	40.53	2.26	57.21
		Sichuan	56.78	15.31	27.90	63.73	16.10	20.17	61.26	11.84	26.90	67.86	11.70	20.44
		Xinjiang	47.76	35.59	16.65	42.98	34.83	22.19	57.83	24.26	17.91	56.57	20.47	22.96
		Yunnan	47.80	21.17	31.03	59.64	15.74	24.62	60.24	12.07	27.69	69.47	9.14	21.40
	North-eastern	Heilongjiang	52.47	27.51	20.02	36.23	37.25	26.52	61.15	20.91	17.94	48.70	25.80	25.50
		Jilin	37.17	45.79	17.04	38.05	58.70	3.25	41.28	41.34	17.38	40.30	56.04	3.67
		Liaoning	34.09	38.78	27.13	27.80	43.71	28.49	45.25	29.43	25.31	36.65	36.60	26.75

Source: Authors' own calculation. Note: The coastal region is treated the same as the eastern zone. The inland region includes the central, western, and north-eastern zones. Co: Inter-county inequality. Ci: Inter-city inequality. Co-Ci: Inequality between city and county subgroups.

Conclusions

Important information can be obtained from the decomposition of inequality based on county-level data. In this chapter we found that intra-provincial regional inequality (that is, inequality amongst the county-level units within the provinces) contributed about 60 per cent of China's overall inequality in 2007, whereas the increase in intra-provincial regional inequality contributed to about 63 per cent of the overall increase in regional inequality during 1997-2007. Thus, intra-provincial regional inequality is the crux of the problem of regional inequality in China. It was also found that the contribution of inter-provincial inequality within all the zones increased significantly while the contributions of other components remained relatively constant or even tended to decline during the period considered. Therefore, more specific government policies should be implemented in order to reduce intra-provincial regional inequality.

The results of our decomposition analysis imply that inequality alleviation may need a local rather than a national approach in the first instance. For example, the results of the Theil-T decomposition of the changes in inequality show that immediate actions are needed at least in three provinces, namely, Jiangsu, Inner Mongolia, and Hebei. These three provinces together contributed to about 47 per cent of the increase in overall inequality in China during 1997-2007.

It is shown that the evolution of regional inequality in each province has its own characteristics and patterns. Thus, it is necessary for the provincial governments to formulate province-specific policies for the county-level units. For instance, the provinces in the central and western zones should focus more on inter-county inequality, while the provinces in the eastern zone should concentrate on both inter-county and inter-city inequalities. The provinces in the north-eastern zone should focus on inter-city inequality. The provinces of Fujian, Jiangsu, Henan, Guizhou, and Qinghai should pay special attention to inequality between city and county subgroups.

Bibliography

Bhalla, A. S., Yao, S. & Zhang, Z. 2003. Causes of Inequalities in China, 1952 to 1999. *Journal of International Development,* 15**,** 939 - 955.

Bourguignon, F. 1979. Decomposable Income Inequality Measures. *Econometrica,* 47**,** 901 - 920.

Brajer, V., Mead, R. & Xiao, F. 2010. Adjusting Chinese Income Inequality for Environmental Equity. *Environment and Development Economics,* 15**,** 341 - 362.

Cai, F., Wang, D. & Du, Y. 2002. Regional Disparity and Economic Growth in China The Impact of Labor Market Distortions. *China Economic Review,* 13**,** 197 - 212.

Chen, Y. P., Liu, M. & Zhang, Q. 2010. Development of Financial Intermediation and the Dynamics of Urban-Rural Disparity in China, 1978-1998. *Regional Studies* 44**,** 1171 - 1187.

Cheng, Y. S. 1996a. A Decomposition Analysis of Income Inequality of Chinese Rural Households. *China Economic Review,* 7**,** 155 - 167.

Cheng, Y. S. 1996b. Peasant Income in China: the Impact of Rural Reforms and Structural Changes. *China Report,* 32**,** 43 - 57.

Cheong, T. S. 2012. Trends, Determinants and Consequences of Regional Inequality in China: New Evidence". Doctoral Dissertation in Economics, Business School, University of Western Australia.

Chow, G. C. 1986. Chinese Statistics. *The American Statistician,* 40**,** 191 - 196.

Cowell, F. A. 2000. Measurement of Inequality. *In:* ATKINSON, A. B. & BOURGUIGNON, F. (eds.) *Handbook of Income Distribution.* Oxford: Elsevier.

Duncan, R. & Tian, X. 1999. China's Inter-Provincial Disparities: An Explanation. *Communist and Post-Communist Studies,* 32**,** 211 - 224.

Fan, C. C. 1995. Of Belts and Ladders: State Policy and Uneven Regional Development in Post-Mao China. *Annals of the Association of American Geographers,* 85**,** 421 - 449.

Fang, H. & Rizzo, J. A. 2011. Income Inequality Dynamics in Rural China from 1991 to 2006: The Role of Alternative Income Sources. *Applied Economics Letters* 18**,** 1307 - 1310.

Fujita, M. & Hu, D. 2001. Regional Disparity in China 1985-1994: The Effects of Globalization and Economic Liberalization. *The Annals of Regional Science,* 35**,** 3 - 37.

Goh, C.-C., Luo, X. & Zhu, N. 2009. Income Growth, Inequality and Poverty Reduction: A Case Study of Eight Provinces in China. *China Economic Review,* 20**,** 485 - 496.

Gries, T. & Redlin, M. 2009. China's Provincial Disparities and the Determinants of Provincial Inequality. *Journal of Chinese Economic and Business* 7**,** 259 - 281.

Gustafsson, B. & Li, S. 2001. The Effects of Transition on the Distribution of Income in China: A Study Decomposing the GINI Coefficient for 1988 and 1995. *Economics of Transition,* 9**,** 593 - 617.

Gustafsson, B. & Li, S. 2002. Income Inequality within and across Counties in Rural China 1988 and 1995. *Journal of Development Economics,* 69**,** 179 - 204.

Hao, R. & Wei, Z. 2010. Fundamental Causes of Inland-Coastal Income Inequality in Post-Reform China. *The Annals of Regional Science,* 45**,** 181 - 206.

Herrmann-Pillath, C., Kirchert, D. & Pan, J. 2002. Disparities in Chinese Economic Development: Approaches on Different Levels of Aggregation. *Economic Systems,* 26**,** 31 - 54.

Hertel, T. & Zhai, F. 2006. Labor Market Distortions, Rural-Urban Inequality and the Opening of China's Economy. *Economic Modelling,* 23**,** 76 - 109.

Holz, C. A. 2006. Why China's New GDP Data Matters. *Far Eastern Economic Review,* 169**,** 54 - 57.

Huang, J.-T., Kuo, C.-C. & Kao, A.-P. 2003. The Inequality of Regional Economic Development in China between 1991 and 2001. *Journal of Chinese Economic and Business Studies,* 1**,** 273 - 285.

Jian, T., Sachs, J. D. & Warner, A. M. 1996. Trends in Regional Inequality in China. *China Economic Review,* 7**,** 1 - 21.

JONES, D. C., OWEN, A. L. & LI, C. 2003. Growth and Regional Inequality in China During the Reform Era. *China Economic Review,* 14**,** 186 - 200.

Kanbur, R. & Zhang, X. 1999. Which Regional Inequality? The Evolution of Rural-Urban and Inland-Coastal Inequality in China from 1983 to 1995. *Journal of Comparative Economics,* 27**,** 686 - 701.

Kanbur, R. & Zhang, X. 2005. Fifty Years of Regional Inequality in China: a Journey Through Central Planning, Reform, and Openness. *Review of Development Economics,* 9**,** 87 - 106.

Khan, A. R., Griffin, K., Riskin, C. & Zhao, R. 1993. Sources of Income Inequality in Post-Reform China. *China Economic Review,* 4**,** 19 - 35.

Khan, A. R. & Riskin, C. 1998. Income and Inequality in China: Composition, Distribution and Growth of

Household Income, 1988 to 1995. *The China Quarterly,* 154**,** 221 - 253.
Lee, J. 2000. Changes in the Source of China's Regional Inequality. *China Economic Review,* 11**,** 232 - 245.
Li, S. & Xu, Z. 2008. The Trend of Regional Income Disparity in the People's Republic of China. *ADBI Discussion Paper 85.* Tokyo: Asian Development Bank Institute.
Lin, T., ZHUANG, J., YARCIA, D. & LIN, F. 2008. Income Inequality in the People's Republic of China and Its Decomposition: 1990-2004. *Asian Development Review,* 25**,** 119 - 136.
Liu, H. 2006. Changing Regional Rural Inequality in China 1980-2002. *Area,* 38**,** 377 - 389.
Liu, X. 2010. Decomposition of China's Income Inequality, 1995-2006. *Chinese Economy,* 43**,** 49 - 72.
Liu, X. & Sicular, T. 2009. Nonagricultural Employment Determinants and Income Inequality Decomposition. *Chinese Economy,* 42**,** 29 - 43.
Lu, D. 2002. Rural-Urban Income Disparity: Impact of Growth, Allocative Efficiency, and Local Growth Welfare. *China Economic Review,* 13**,** 419 - 429.
Lu, M. & Chen, Z. 2006. Urbanization, Urban-Biased Policies, and Urban-Rural Inequality in China, 1987 - 2001. *The Chinese Economy,* 39**,** 42 - 63.
Lu, M. & Wang, E. 2002. Forging Ahead and Falling Behind: Changing Regional Inequalities in Post-Reform China. *Growth and Change,* 33**,** 42 - 71.
Rawski, T. G. 2001. What is Happening to China's GDP Statistics? *China Economic Review,* 12**,** 347 - 354.
Rozelle, S. 1994. Rural Industrialization and Increasing Inequality: Emerging Patterns in China's Reforming Economy. *Journal of Comparative Economics,* 19**,** 362 - 391.
Sakamoto, H. & Fan, J. 2010. Distribution Dynamics and Convergence among 75 Cities and Counties in Yangtze River Delta in China: 1990-2005. *Review of Urban and Regional Development Studies,* 22**,** 39 - 54.
Shen, L. 2009. The Urban-Rural Disparity: A Demand Side Analysis. *Journal of Developing Areas* 43**,** 87 - 107.
Shorrocks, A. F. 1980. The Class of Additively Decomposable Inequality Measures. *Econometrica,* 3**,** 613 - 625.
Shorrocks, A. F. 1984. Inequality Decomposition by Population Subgroups. *Econometrica,* 52**,** 1369 - 1385.
Sicular, T., Yue, X., Gustafsson, B. & Li, S. 2007. The Urban-Rural Income Gap and Inequality in China. *Review of Income and Wealth,* 53**,** 93 - 126.
Song, S., Chu, G. S.-F. & Cao, R. 2000. Intercity Regional Disparity in China. *China Economic Review,* 11**,** 246 - 261.
State Statistical Bureau 1998 - 2008a. *Provincial Statistical Yearbook,* Beijing, China Statistics Press.
State Statistical Bureau 1998 - 2008b. *Provincial Yearbook,* Beijing, China Statistics Press.
State Statistical Bureau 2003. *County Data of 2000 Census,* Beijing, China Statistics Press.
State Statistical Bureau 2004 - 2008. *China Statistical Yearbook for Regional Economy,* Beijing, China Statistics Press.
State Statistical Bureau 2006. *China Statistical Yearbook,* Beijing, China Statistics Press.
Sutherland, D. & Yao, S. 2011. Income Inequality in China over 30 Years of Reforms. *Cambridge Journal of Regions, Economy and Society,* 4**,** 91 - 105.
Theil, H. 1967. *Economics and Information Theory,* Amsterdam, North Holland Publishing Company.
Theil, H. 1972. *Statistical Decomposition Analysis,* Amsterdam, North Holland Publishing Company.
Tsui, K.-Y. 1993. Decomposition of China's Regional Inequalities. *Journal of Comparative Economics,* 17**,** 600 - 627.
Tsui, K.-Y. 2007. Forces Shaping China's Interprovincial Inequality. *Review of Income and Wealth,* 53**,** 60 - 92.
Veeck, G. & Pannell, C. W. 1989. Rural Economic Restructuring and Farm Household Income in Jiangsu, People's Republic of China. *Annals of the Association of American Geographers,* 79**,** 275 - 292.
Villaverde, J., Maza, A. & Ramasamy, B. 2010. Provincial Disparities in Post-reform China. *China and World Economy,* 18**,** 73 - 95.
Wan, G. 2007. Understanding Regional Poverty and Inequality Trends in China: Methodological Issues and Empirical Findings. *Review of Income and Wealth,* 53**,** 25 - 34.
Wan, G. 2008. Poverty Reduction in China: Is High Growth Enough? *Policy Brief.* United Nations University.
Wei, Y. D. & Kim, S. 2002. Widening Inter-County Inequality in Jiangsu Province, China, 1950-95. *The Journal of Development Studies,* 38**,** 142 - 164.
Whalley, J. & Yue, X. 2009. Rural Income Volatility and Inequality in China. *CESifo Economic Studies,* 55**,** 648 - 668.

Wu, H. X. 1997. Measuring China's GDP. *Briefing Paper Series No. 8.* Canberra: East Asia Analytical Unit.
Wu, X. & Perloff, J. M. 2005. China's Income Distribution, 1985-2001. *Review of Economics and Statistics,* 87**,** 763 - 775.
Wu, Y. & Zhu, J. 2011. Corruption, Anti-Corruption, and Inter-County Income Disparity in China. *The Social Science Journal*.
Yang, D. T. 1999. Urban-Biased Policies and Rising Income Inequality in China. *The American Economic Review,* 89**,** 306 - 310.
Yao, S. 1997. Decomposition of Gini Coefficients by Income Factors: A New Approach and Application. *Applied Economics Letters,* 1997**,** 27 - 31.
Yao, S. 1999. On the Decomposition of Gini Coefficients by Population Class and Income Source: a Spreadsheet Approach and Application. *Applied Economics,* 31**,** 1249 - 1264.
Yao, S. & Liu, J. 1998. Economic Reforms and Regional Segmentation in Rural China. *Regional Studies,* 32**,** 735 - 746.
Yao, S. & Zhang, Z. 2001. On Regional Inequality and Diverging Clubs: A Case Study of Contemporary China. *Journal of Comparative Economics,* 29**,** 466 - 484.
Yao, S., Zhang, Z. & Feng, G. 2005. Rural-Urban and Regional Inequality in Output, Income and Consumption in China under Economic Reforms. *Journal of Economic Studies,* 32**,** 4 - 24.
Ying, L. G. 1999. China's Changing Regional Disparities during the Reform Period. *Economic Geography,* 75**,** 59 - 70.
Yu, L., Luo, R. & Zhang, L. 2007. Decomposing Income Inequality and Policy Implications in Rural China. *China & World Economy,* 15**,** 44 - 58.
Zhou, H. & Zou, W. 2010. Income Distribution Dynamics of Urban Residents: The case of China (1995-2004). *Frontiers of Economics in China,* 5**,** 114 - 134.
Zhou, Y. 2009. The Factors That Impact Income Inequality of Rural Residents in China: Decomposing the Gini Coefficient from Income Components. *Frontiers of Economics in China,* 4**,** 617 - 632.

ECONOMICS DISCUSSION PAPERS 2010		
DP NUMBER	**AUTHORS**	**TITLE**
10.01	Hendry, D.F.	RESEARCH AND THE ACADEMIC: A TALE OF TWO CULTURES
10.02	McLure, M., Turkington, D. and Weber, E.J.	A CONVERSATION WITH ARNOLD ZELLNER
10.03	Butler, D.J., Burbank, V.K. and Chisholm, J.S.	THE FRAMES BEHIND THE GAMES: PLAYER'S PERCEPTIONS OF PRISONER'S DILEMMA, CHICKEN, DICTATOR, AND ULTIMATUM GAMES
10.04	Harris, R.G., Robertson, P.E. and Xu, J.Y.	THE INTERNATIONAL EFFECTS OF CHINA'S GROWTH, TRADE AND EDUCATION BOOMS
10.05	Clements, K.W., Mongey, S. and Si, J.	THE DYNAMICS OF NEW RESOURCE PROJECTS A PROGRESS REPORT
10.06	Costello, G., Fraser, P. and Groenewold, N.	HOUSE PRICES, NON-FUNDAMENTAL COMPONENTS AND INTERSTATE SPILLOVERS: THE AUSTRALIAN EXPERIENCE
10.07	Clements, K.	REPORT OF THE 2009 PHD CONFERENCE IN ECONOMICS AND BUSINESS
10.08	Robertson, P.E.	INVESTMENT LED GROWTH IN INDIA: HINDU FACT OR MYTHOLOGY?
10.09	Fu, D., Wu, Y. and Tang, Y.	THE EFFECTS OF OWNERSHIP STRUCTURE AND INDUSTRY CHARACTERISTICS ON EXPORT PERFORMANCE
10.10	Wu, Y.	INNOVATION AND ECONOMIC GROWTH IN CHINA
10.11	Stephens, B.J.	THE DETERMINANTS OF LABOUR FORCE STATUS AMONG INDIGENOUS AUSTRALIANS
10.12	Davies, M.	FINANCING THE BURRA BURRA MINES, SOUTH AUSTRALIA: LIQUIDITY PROBLEMS AND RESOLUTIONS
10.13	Tyers, R. and Zhang, Y.	APPRECIATING THE RENMINBI
10.14	Clements, K.W., Lan, Y. and Seah, S.P.	THE BIG MAC INDEX TWO DECADES ON AN EVALUATION OF BURGERNOMICS
10.15	Robertson, P.E. and Xu, J.Y.	IN CHINA'S WAKE: HAS ASIA GAINED FROM CHINA'S GROWTH?
10.16	Clements, K.W. and Izan, H.Y.	THE PAY PARITY MATRIX: A TOOL FOR ANALYSING THE STRUCTURE OF PAY
10.17	Gao, G.	WORLD FOOD DEMAND
10.18	Wu, Y.	INDIGENOUS INNOVATION IN CHINA: IMPLICATIONS FOR SUSTAINABLE GROWTH
10.19	Robertson, P.E.	DECIPHERING THE HINDU GROWTH EPIC

10.20	Stevens, G.	RESERVE BANK OF AUSTRALIA-THE ROLE OF FINANCE
10.21	Widmer, P.K., Zweifel, P. and Farsi, M.	ACCOUNTING FOR HETEROGENEITY IN THE MEASUREMENT OF HOSPITAL PERFORMANCE
10.22	McLure, M.	ASSESSMENTS OF A. C. PIGOU'S FELLOWSHIP THESES
10.23	Poon, A.R.	THE ECONOMICS OF NONLINEAR PRICING: EVIDENCE FROM AIRFARES AND GROCERY PRICES
10.24	Halperin, D.	FORECASTING METALS RETURNS: A BAYESIAN DECISION THEORETIC APPROACH
10.25	Clements, K.W. and Si. J.	THE INVESTMENT PROJECT PIPELINE: COST ESCALATION, LEAD-TIME, SUCCESS, FAILURE AND SPEED
10.26	Chen, A., Groenewold, N. and Hagger, A.J.	THE REGIONAL ECONOMIC EFFECTS OF A REDUCTION IN CARBON EMISSIONS
10.27	Siddique, A., Selvanathan, E.A. and Selvanathan, S.	REMITTANCES AND ECONOMIC GROWTH: EMPIRICAL EVIDENCE FROM BANGLADESH, INDIA AND SRI LANKA

ECONOMICS DISCUSSION PAPERS 2011		
DP NUMBER	**AUTHORS**	**TITLE**
11.01	Robertson, P.E.	DEEP IMPACT: CHINA AND THE WORLD ECONOMY
11.02	Kang, C. and Lee, S.H.	BEING KNOWLEDGEABLE OR SOCIABLE? DIFFERENCES IN RELATIVE IMPORTANCE OF COGNITIVE AND NON-COGNITIVE SKILLS
11.03	Turkington, D.	DIFFERENT CONCEPTS OF MATRIX CALCULUS
11.04	Golley, J. and Tyers, R.	CONTRASTING GIANTS: DEMOGRAPHIC CHANGE AND ECONOMIC PERFORMANCE IN CHINA AND INDIA
11.05	Collins, J., Baer, B. and Weber, E.J.	ECONOMIC GROWTH AND EVOLUTION: PARENTAL PREFERENCE FOR QUALITY AND QUANTITY OF OFFSPRING
11.06	Turkington, D.	ON THE DIFFERENTIATION OF THE LOG LIKELIHOOD FUNCTION USING MATRIX CALCULUS
11.07	Groenewold, N. and Paterson, J.E.H.	STOCK PRICES AND EXCHANGE RATES IN AUSTRALIA: ARE COMMODITY PRICES THE MISSING LINK?
11.08	Chen, A. and Groenewold, N.	REDUCING REGIONAL DISPARITIES IN CHINA: IS INVESTMENT ALLOCATION POLICY EFFECTIVE?
11.09	Williams, A., Birch, E. and Hancock, P.	THE IMPACT OF ON-LINE LECTURE RECORDINGS ON STUDENT PERFORMANCE
11.10	Pawley, J. and Weber, E.J.	INVESTMENT AND TECHNICAL PROGRESS IN THE G7 COUNTRIES AND AUSTRALIA
11.11	Tyers, R.	AN ELEMENTAL MACROECONOMIC MODEL FOR APPLIED ANALYSIS AT UNDERGRADUATE LEVEL
11.12	Clements, K.W. and Gao, G.	QUALITY, QUANTITY, SPENDING AND PRICES
11.13	Tyers, R. and Zhang, Y.	JAPAN'S ECONOMIC RECOVERY: INSIGHTS FROM MULTI-REGION DYNAMICS
11.14	McLure, M.	A. C. PIGOU'S REJECTION OF PARETO'S LAW
11.15	Kristoffersen, I.	THE SUBJECTIVE WELLBEING SCALE: HOW REASONABLE IS THE CARDINALITY ASSUMPTION?
11.16	Clements, K.W., Izan, H.Y. and Lan, Y.	VOLATILITY AND STOCK PRICE INDEXES
11.17	Parkinson, M.	SHANN MEMORIAL LECTURE 2011: SUSTAINABLE WELLBEING – AN ECONOMIC FUTURE FOR AUSTRALIA
11.18	Chen, A. and Groenewold, N.	THE NATIONAL AND REGIONAL EFFECTS OF FISCAL DECENTRALISATION IN CHINA
11.19	Tyers, R. and Corbett, J.	JAPAN'S ECONOMIC SLOWDOWN AND ITS GLOBAL IMPLICATIONS: A REVIEW OF THE ECONOMIC MODELLING
11.20	Wu, Y.	GAS MARKET INTEGRATION: GLOBAL TRENDS AND IMPLICATIONS FOR THE EAS REGION
11.21	Fu, D., Wu, Y. and Tang, Y.	DOES INNOVATION MATTER FOR CHINESE HIGH-TECH EXPORTS? A FIRM-LEVEL ANALYSIS

11.22	Fu, D. and Wu, Y.	EXPORT WAGE PREMIUM IN CHINA'S MANUFACTURING SECTOR: A FIRM LEVEL ANALYSIS
11.23	Li, B. and Zhang, J.	SUBSIDIES IN AN ECONOMY WITH ENDOGENOUS CYCLES OVER NEOCLASSICAL INVESTMENT AND NEO-SCHUMPETERIAN INNOVATION REGIMES
11.24	Krey, B., Widmer, P.K. and Zweifel, P.	EFFICIENT PROVISION OF ELECTRICITY FOR THE UNITED STATES AND SWITZERLAND
11.25	Wu, Y.	ENERGY INTENSITY AND ITS DETERMINANTS IN CHINA'S REGIONAL ECONOMIES

ECONOMICS DISCUSSION PAPERS 2012		
DP NUMBER	**AUTHORS**	**TITLE**
12.01	Clements, K.W., Gao, G., and Simpson, T.	DISPARITIES IN INCOMES AND PRICES INTERNATIONALLY
12.02	Tyers, R.	THE RISE AND ROBUSTNESS OF ECONOMIC FREEDOM IN CHINA
12.03	Golley, J. and Tyers, R.	DEMOGRAPHIC DIVIDENDS, DEPENDENCIES AND ECONOMIC GROWTH IN CHINA AND INDIA
12.04	Tyers, R.	LOOKING INWARD FOR GROWTH
12.05	Knight, K. and McLure, M.	THE ELUSIVE ARTHUR PIGOU
12.06	McLure, M.	ONE HUNDRED YEARS FROM TODAY: A. C. PIGOU'S WEALTH AND WELFARE
12.07	Khuu, A. and Weber, E.J.	HOW AUSTRALIAN FARMERS DEAL WITH RISK
12.08	Chen, M. and Clements, K.W.	PATTERNS IN WORLD METALS PRICES
12.09	Clements, K.W.	UWA ECONOMICS HONOURS
12.10	Golley, J. and Tyers, R.	CHINA'S GENDER IMBALANCE AND ITS ECONOMIC PERFORMANCE
12.11	Weber, E.J.	AUSTRALIAN FISCAL POLICY IN THE AFTERMATH OF THE GLOBAL FINANCIAL CRISIS
12.12	Hartley, P.R. and Medlock III, K.B.	CHANGES IN THE OPERATIONAL EFFICIENCY OF NATIONAL OIL COMPANIES
12.13	Li, L.	HOW MUCH ARE RESOURCE PROJECTS WORTH? A CAPITAL MARKET PERSPECTIVE
12.14	Chen, A. and Groenewold, N.	THE REGIONAL ECONOMIC EFFECTS OF A REDUCTION IN CARBON EMISSIONS AND AN EVALUATION OF OFFSETTING POLICIES IN CHINA
12.15	Collins, J., Baer, B. and Weber, E.J.	SEXUAL SELECTION, CONSPICUOUS CONSUMPTION AND ECONOMIC GROWTH
12.16	Wu, Y.	TRENDS AND PROSPECTS IN CHINA'S R&D SECTOR
12.17	Cheong, T.S. and Wu, Y.	INTRA-PROVINCIAL INEQUALITY IN CHINA: AN ANALYSIS OF COUNTY-LEVEL DATA
12.18	Cheong, T.S.	THE PATTERNS OF REGIONAL INEQUALITY IN CHINA
12.19	Wu, Y.	ELECTRICITY MARKET INTEGRATION: GLOBAL TRENDS AND IMPLICATIONS FOR THE EAS REGION
12.20	Knight, K.	EXEGESIS OF DIGITAL TEXT FROM THE HISTORY OF ECONOMIC THOUGHT: A COMPARATIVE EXPLORATORY TEST
12.21	Chatterjee, I.	COSTLY REPORTING, EX-POST MONITORING, AND COMMERCIAL PIRACY: A GAME THEORETIC ANALYSIS
12.22	Pen, S.E.	QUALITY-CONSTANT ILLICIT DRUG PRICES
12.23	Cheong, T.S. and Wu, Y.	REGIONAL DISPARITY, TRANSITIONAL DYNAMICS AND CONVERGENCE IN CHINA