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Income polarization in the People's Republic of China: Trends and changes

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**Income Polarization in the People's Republic of China:
Trends and Changes**

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Abstract

This paper estimates income polarization in the People's Republic of China (PRC) from 1978 to 2010 and decomposes the estimated polarization by population subgroup. In addition, a framework is proposed to disentangle a change in polarization into a growth and a redistribution component. This framework is then used to quantify the contributions of various income sources to a rise in polarization in the PRC between 2002 and 2007. The analytical results suggest that (1) income polarization exhibited a broadly increasing trend from 1978 to 2010; (2) income polarization was large and rising among rural citizens, while low and declining among urban citizens; polarization of migrants also declined; (3) geographically, income polarization rose in east and particularly central PRC, while west PRC was most polarized with little change over time; and (4) the rise in polarization between 2002 and 2007 was mainly driven by the investment income, followed by transfers. Conversely, business income is polarization-reducing, especially in rural PRC. To a lesser extent, wage is also polarization-reducing, especially among migrants.

JEL Classification: D31, D63, D74, O53

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1. INTRODUCTION

Polarization is an important issue, but it has largely been neglected in “mainstream” economics until recently (Gochoco-Bautista et al. 2013; Fajnzylber, Lederman, and Loayza 2000; Montalvo and Reynal-Querol 2005; D’Ambrosio and Wolff 2006). Polarization describes the degree to which a population is segregated into groups in a society (Gradín 2000: 457). It detects the presence or disappearance of such groups in a distribution (Chakravarty 2009), indicates how individuals and groups feel toward each other (Duclos, Esteban, and Ray 2004), and captures the phenomena of a diminishing middle class or a divided society (Zhang and Kanbur 2001). According to Esteban and Ray (1994: 824), the concept of polarization has three features: a small number of groups, a high degree of homogeneity within each group (the so-called identification ingredient), and significant heterogeneity between groups (the so-called alienation ingredient).

The importance of studying polarization is related to the harm it may generate. First and foremost, polarization is closely linked to revolution, revolt, and other forms of social unrest, which, in general, cannot happen without notions of group identity (Esteban and Ray 1994; Duclos, Esteban, and Ray 2004). Several studies have demonstrated that polarization is intimately connected with social conflict (Chakravarty 2009: Ch 4; Esteban and Ray 1994). As pointed out by Deutsch (1971), when a society breaks up into antagonistic classes, it is characterized by social conflict.

Second, polarization means reduced social mobility. In a highly polarized society, individuals in each cluster feel closer to each other but distant from other groups, causing barriers to identity transformation. For example, the relatively poor face difficulties in moving up the income ladder (Motiram and Sarma 2014). Third, high polarization thwarts growth and growth sustainability because it hinders access to credit markets and opportunities to achieve economies of scale by producers who sell to the middle class. It increases pressure for distortive redistribution, undermines social stability, and threatens the security of property and contract rights due to a higher possibility of drastic changes in government policies (Keefer and Knack 2002).

Last but not least, polarization implies health hazards (Pérez and Ramos 2010). The disadvantaged in a highly polarized society often live under psychosocial stress (Wilkinson 1996, 1997, 1998). Also, conflictive interests between groups on the provision of public goods, such as health and policing, contribute to individual health problems. Needless to say, social conflicts directly lead to injuries, depression, and even deaths.

Conceptually, polarization is closer to the notion of segregation and is thus better correlated with the harms outlined earlier than income inequality (Esteban and Ray 1994). Inequality is concerned with the distance of individual incomes from the population mean, while polarization is concerned with the extent of similarities among members in a group and the distances between groups. The disconnect between inequality and polarization can be best described by a hypothetical example where one individual owns the total income and all others none. In this case, inequality reaches the upper bound, but the society is hardly polarized (Motiram and Sarma 2014).

It can be shown that a decrease in income inequality does not necessarily translate into a fall in polarization. For example, when individual incomes in a group become less dispersed, it means lower total inequality by the well-known subgroup consistency axiom in the inequality literature. However, the clustering of individual incomes within groups means income concentration at the poles, implying higher polarization as demonstrated by the second axiom of Duclos, Esteban,

and Ray (2004). Also, polarization can run counter to the Pigou–Dalton axiom.¹ Therefore, a mean preserving transfer from a richer person to a poorer person within a group causes income in the group to converge, leading to lower inequality but higher identification which, in turn, causes a rise in polarization. Finally, a higher level of between-group inequality implies larger polarization. This extra information is hardly captured by inequality measures unless inequality decomposition is undertaken, which requires additional data. This data is not needed when measuring polarization.

According to Foster and Wolfson (1992, 2010), any measure of polarization should be consistent with so-called “increased spread” and “increased bipolarity.” Polarization increases via increased spread when there is a shift in the population away from the middle. In this case, income inequality also increases as the rich become richer and the poor become poorer. Polarization also increases via increased bipolarity when there are transfers on one side of the middle—i.e., movement of one group away from and another toward the middle. More specifically, increased bipolarity is associated with a pair of progressive transfers, one on each side of the middle. This raises polarization but diminishes inequality. Polarization and inequality move in opposite directions when same-side transfers occur.

Despite its importance and its distinction from inequality, it is only recently that polarization has received research attention. Seshanna and Decornez (2003) examine global polarization using 1960–1999 data from the Penn World Table (PWT 5.6). Applying the Wolfson (1994) polarization measure to the mean real GDP per capita of 112 countries, they find a more polarized world in general, though Organisation for Economic Co-operation and Development (OECD) countries and less developed countries (LDCs) have low polarization relative to other groups of countries. Using almost the same data but different polarization measures, Duro (2005a) finds an inverted-V pattern of global polarization between 1960 and 2000. However, if large countries like the People’s Republic of China (PRC) and India are excluded, a continuously rising polarization is found, and these findings remain valid when PWT 6.1 is used (Duro 2005b).

Ezcurra (2009) applies the polarization measures of Esteban and Ray (1994) and Esteban, Gradín, and Ray (2007) to 1993–2003 data from 61 regions in eight European countries. The results show that polarization varies considerably across countries, and it is negatively associated with regional economic growth. In a case study of Spain, Gradín (2002) observes a declining trend in polarization from 1973 to 1991, possibly driven by the emergence of a welfare state in Spain during this period.

Gasparini et al. (2008) examine polarization in Latin America and the Caribbean over 1989–2004, based on a large set of household survey data. They find high levels of polarization in Latin America, with a mildly increasing trend. Also, conflicts are found to be closely linked with polarization, less with poverty.

For eight Asian countries examined by Gochoco-Bautista et al. (2013), polarization is found to be higher in urban areas than in rural areas. Economic growth, education of the household head, and high employment in manufacturing help contain polarization. Kwack and Lee (2007), focusing on the Republic of Korea, show rising polarization in the early 2000s. Turning to the PRC, Zhang and Kanbur (2001) find substantial polarization between the coast and inland areas, but more aggravated polarization between rural and urban areas. The latter was decreasing, while the former was increasing. Araar (2008) focuses on rural PRC during 1986–2002 and concludes that polarization was increasing and was closely correlated with inequality.

¹ The Pigou–Dalton Transfer Principle (Dalton 1920; Pigou 1912) states that inequality increases (or at least does not decrease) following a mean-preserving transfer from a poorer person to a richer person and vice versa (see Atkinson [1970, 1983], Cowell [1985], Sen [1973]).

Based on the China Health and Nutrition Survey (CHNS) data, Bonnefond and Clément (2012) discover that polarization was stable from 1989 to 1997, but increasing between 1997 and 2006. The rise is more pronounced in urban areas, suggesting a more conspicuous risk of social tensions in cities. They further examine contributions to polarization by income sources. Rural polarization is found to be closely linked to non-agricultural opportunities such as the expansion of township and village enterprises (TVEs) in the 1980s and 1990s. Retirement income is another polarizing component because only a minority of the rural elderly is entitled to pensions (Gao 2008). In contrast, farming income has a depolarizing effect due to a relatively equal land distribution (Wan and Zhou 2005). In urban areas, the dominant polarizing factor income is wage because labor market liberalization has resulted in wage dispersion, while significant unemployment following the restructuring of state enterprises has led to rising wage inequality.

Clearly, the literature on polarization in the PRC is limited, despite a considerable amount of attention being given to inequality in the PRC (Wang, Wan, and Yang 2014). This is regrettable because social tensions have been rising in the PRC. Moreover, these tensions may be driven more by polarization than inequality.

This paper contributes to the existing literature in three aspects. First, using grouped income data from *China Statistical Yearbooks*, we construct the 1978–2010 polarization profiles for the whole of the PRC, and for rural and urban PRC. Such long time series estimates are valuable for future studies to analyze polarization determinants or impacts of polarization. No previous studies have offered such profiles. Bonnefond and Clément (2012) only present polarization estimates for the years 1989, 1991, 1993, 1997, 2000, 2004, and 2006. Second, we propose a decomposition technique, attributing the *change* in polarization into a growth and a redistribution component. This, borrowed from poverty decomposition, has not been attempted before, although Araar (2008) decomposed the level (not the change) of polarization by population groups and income sources for rural PRC during 1986–2002.² Finally, using the 2002 and 2007 China Household Income Project (CHIP) data, we estimate polarization among rural residents, urban residents, and migrants, and quantify the contributions of different income sources to the change in polarization between 2002 and 2007.³ Also, we examine whether income growth and income distribution aggravate or reduce polarization. It is useful to note that no previous attention has been paid to polarization among migrants, now in the order of 270 million. As is known, migrants represent a unique class of citizens in the PRC due to the infamous household registration or *hukou* system.

Two datasets will be used in this paper. For constructing the polarization profile, we use the grouped income data from more than 20 provinces for 1978–2010, as released by the National Bureau of Statistics (NBS, various years). These grouped data are based on large-scale household surveys that are of good quality. The algorithm of Shorrocks and Wan (2009) will be applied to ungroup the data. The ungrouped data are equivalent to unit-level observations on

² Deutsch, Fusco, and Silber (2013) also decomposed the level of polarization by income source, using 2008 data for Luxembourg.

³ CHIP was initiated by the Chinese Academy of Social Sciences and later transferred to Beijing Normal University. In 1988, the first spell of the PRC income distribution project (later known as the China Household Income Project or CHIP) was conducted. The project covered 10,258 rural and 9,009 urban households. The sampling framework follows that of the National Bureau of Statistics. At present, CHIP provides household data for 1988, 1995, 2002, and 2007. Rural–urban migrants were added to the 2002 and 2007 CHIP. In 2007, the sample sizes increased to 13,000 rural households, 10,000 urban households, and 5,000 rural–urban migrant households. In CHIP, the eastern region comprises Beijing, Shanghai, Tianjin, Hebei, Liaoning, Jiangsu, Zhejiang, Fujian, Shandong, Guangdong, and Hainan; the central region consists of Shanxi, Jilin, Heilongjiang, Anhui, Jiangxi, Henan, Hubei, and Hunan; and the western region includes Inner Mongolia, Guangxi, Chongqing, Sichuan, Guizhou, Yunnan, the Tibet Autonomous Region, Shaanxi, Gansu, Qinghai, Ningxia, and Xinjiang.

individual incomes. The 2002 and 2007 CHIP data will be used for a deeper investigation of polarization and its changes. It should be noted that considerable efforts were made to use CHIP 1988 and 1995, but they do not contain data on migrants and consistent income components cannot be constructed for these years.

The paper is structured as follows. The next section discusses polarization measurement and polarization estimates for the entire PRC, as well as urban and rural PRC. The third section presents the decomposition framework and decomposition results, while the fourth section concludes.

2. POLARIZATION IN THE PEOPLE'S REPUBLIC OF CHINA: 1978–2010

The measurement literature on income polarization can be traced back to Foster and Wolfson (1992, 2010). Focusing on two income groups, they developed a bi-polarization index.⁴ More recent efforts go beyond two groups, leading to the polarization index of Esteban and Ray (1994) and Duclos, Esteban, and Ray (2004).

Esteban and Ray (1994) state that polarization can be characterized by three features: a high degree of homogeneity (identification) within groups; a high degree of heterogeneity (alienation) across groups; and a few groups of significant size, as insignificantly sized groups (e.g., isolated individuals) carry little weight.

Let v_i denote the population share of group i , μ_i the average income, and α a constant with $\alpha \in [0, 1.6]$. Esteban and Ray (1994) define identification as $ID_i = v_i^\alpha$ and alienation as $AL_{ij} = |\mu_i - \mu_j|$. Their polarization index is a weighted sum of ID and AL :

$$\begin{aligned} ER &= K \sum_{i=1}^s \sum_{j=1}^s v_i v_j v_i^\alpha |\mu_i - \mu_j| \\ &= K \sum_{i=1}^s \sum_{j=1}^s v_i^{1+\alpha} v_j |\mu_i - \mu_j|, \end{aligned}$$

where K is included for normalization and α is the sensitivity parameter. ER becomes equivalent to the Gini coefficient when $\alpha = 0$ or when each group contains only one individual.

Based on this index, large polarization can result from high alienation (big gaps between groups) and/or high identification (individuals in each group being close to each other or low within-group inequality). Note that ER is not additively decomposable.

However, ER is based on a discrete, finite set of income groups in a continuous ambient space of possible income values. Thus, it suffers from the conceptual limitation of discontinuity. This leads to the extension by Duclos et al. (2004: 1744):

$$DER(f, \alpha) = \int \int f(x)^{1+\alpha} f(y) |x - y| dx dy$$

⁴ The bi-polarization index can be expressed as $P_{FW} = (G^B - G^W) \frac{\mu}{m}$, where G^B , G^W , μ , and m are between group inequality, within group inequality, the mean, and the median of the income distribution respectively. With the median income as the benchmark to divide data into two groups, this index is just the difference between G^B and G^W , normalized by the median. See, for example, Alesina and Spolaore (1997); Wang and Tsui (2000).

where $\alpha \in [0.25, 1]$, x , and y are the income of two different individuals, and $f(x)$ and $f(y)$ are the density functions. When $\alpha = 0$, DER reduces to the Gini coefficient:

$$G = \int \int f(x)f(y)|x - y|dxdy$$

In this paper, polarization rather than bi-polarization will be estimated, as the latter is limited to two groups only, arbitrarily splitting data based on the sample median. This may lead to inappropriate segregation when low-income individuals just above the median are grouped into the high-income group.

The alienation ingredient of DER is

$$\text{Alienation} = \int \int |x - y|dF(x)dF(y)$$

and the identification ingredient is

$$\text{Identification} = \int f(x)^{1+\alpha}dy$$

Again, DER cannot be decomposed additively into its two ingredients. In this paper, the following index of Duclos et al. (2004: 1750) will be empirically computed:

$$DER = \left(\frac{1}{n}\right) \sum_{i=1}^n \hat{f}(y_i)^\alpha \hat{a}(y_i)$$

where $\hat{a}(y_i) = \hat{\mu} + y_i \left[\left(\frac{1}{n}\right)(2i - 1) - 1 \right] - \left(\frac{1}{n}\right) [2 \sum_{j=1}^{i-1} y_j + y_i]$, $\hat{\mu}$ is the sample mean, n is the sample size, y_i is ordered such that $y_1 \leq y_2 \leq \dots \leq y_n$, $\hat{f}(y_i)^\alpha$ is obtained by non-parametric kernel estimation, and α must be bounded between 0.25 and 1.⁵

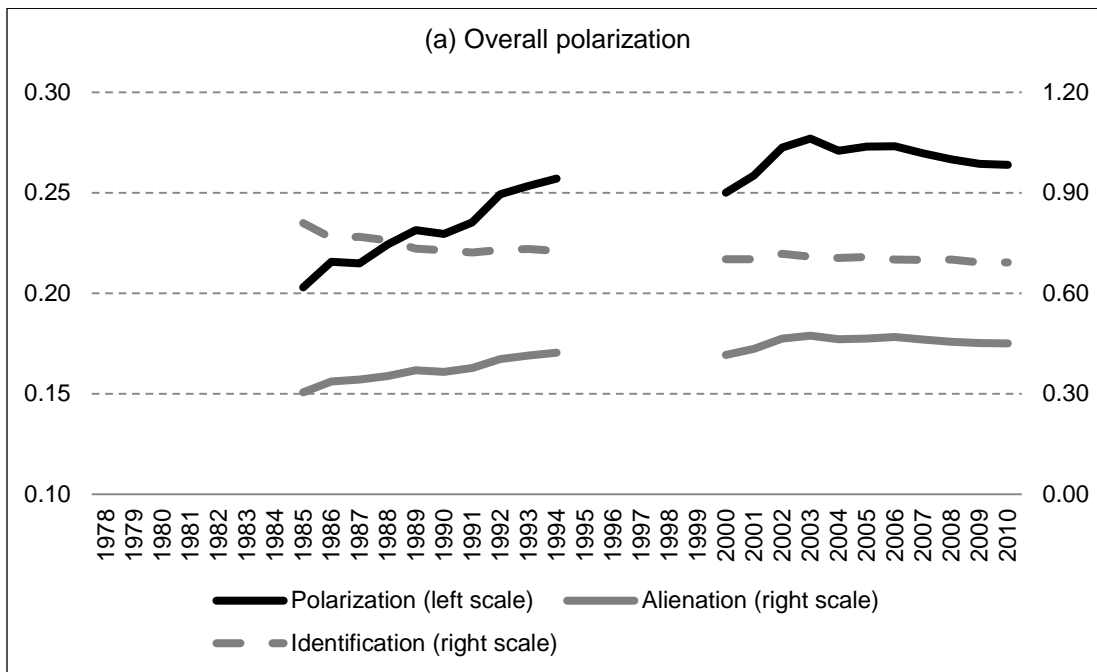
In what follows, DER will be estimated for the whole, rural and urban PRC, as well as east, central, and west PRC. Regional divide is serious in the PRC due to differences in geography, resource endowments, and initial conditions, as well as biased regional development policies. These have resulted in different income levels and distributions across regions. Most importantly, western PRC is home to only 20% of the national population but more than 70% of ethnic minorities. A high polarization in west PRC could mean serious ethnic divisions and civil tensions, as is increasingly evident via reported terror attacks.

⁵ The kernel density estimation fails to converge when negative income observations are present or when the skewedness of the income distribution is larger than 6. In these cases, we assume a log normal distribution and estimate the standard deviation of log incomes by averaging the $m - 1$ estimates of $\sigma_k = \Phi^{-1}(p_k) - \Phi^{-1}(L_k)$, $k = 1, \dots, m - 1$, where p_k denotes the aggregate proportion of the population in income classes 1 to k , while L_k corresponds to the cumulative income share.

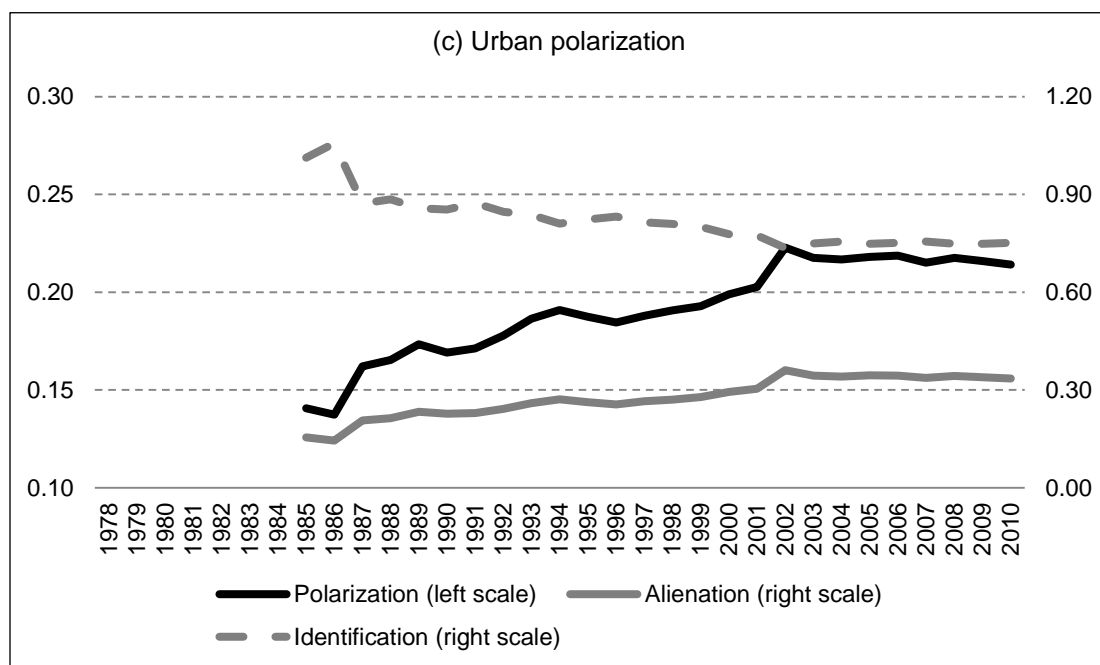
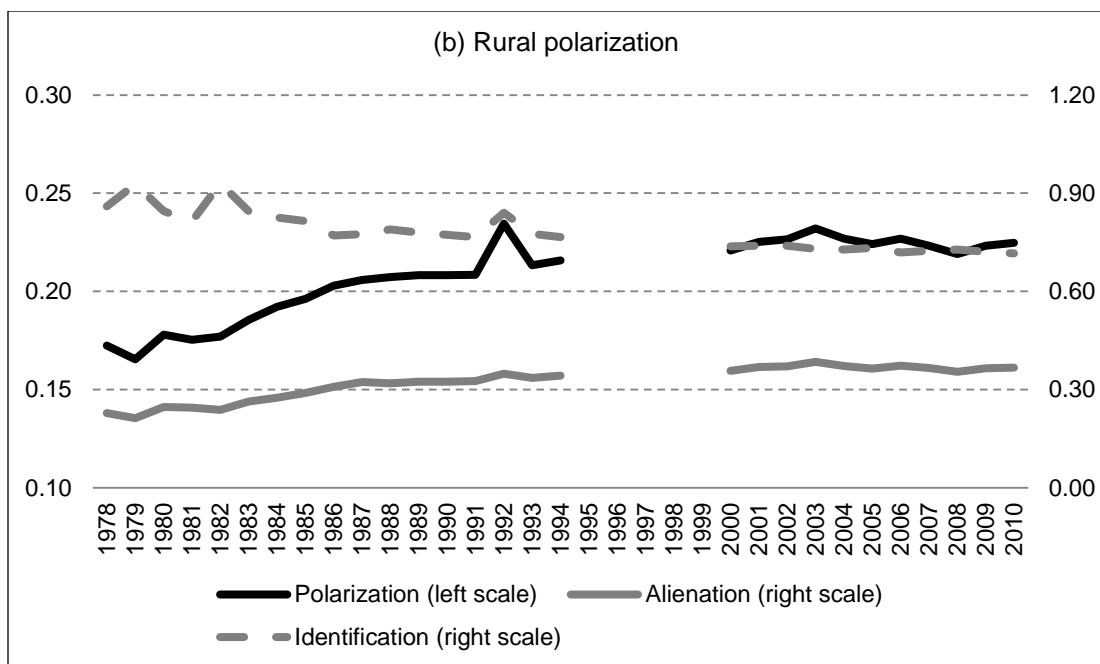
Figure 1a shows a broadly increasing polarization for the whole PRC.⁶ Polarization increased significantly from 1986 to 1994, reaching a peak in 2003. Although polarization decreased after 2003, the level remained high compared to earlier years. This trend correlates with the increasing trend of alienation—i.e., rising income gaps between groups. Polarization would have been much more serious if the identification ingredient of polarization did not decrease. Thus, within-group disparity narrowed over time.

Different from the overall polarization, both rural and urban polarization kept rising from low levels (see Figures 1b and 1c). Increasing alienation, attenuated by decreasing identification, also drove the rising trends, especially in the urban areas. Rural polarization peaked in 1992, driven by increasing identification, while its 2003 peak was caused by rising alienation. Urban polarization peaked in 2002 and culminated entirely from growing alienation.

Figure 1: Polarization, Alienation, and Identification in the People’s Republic of China



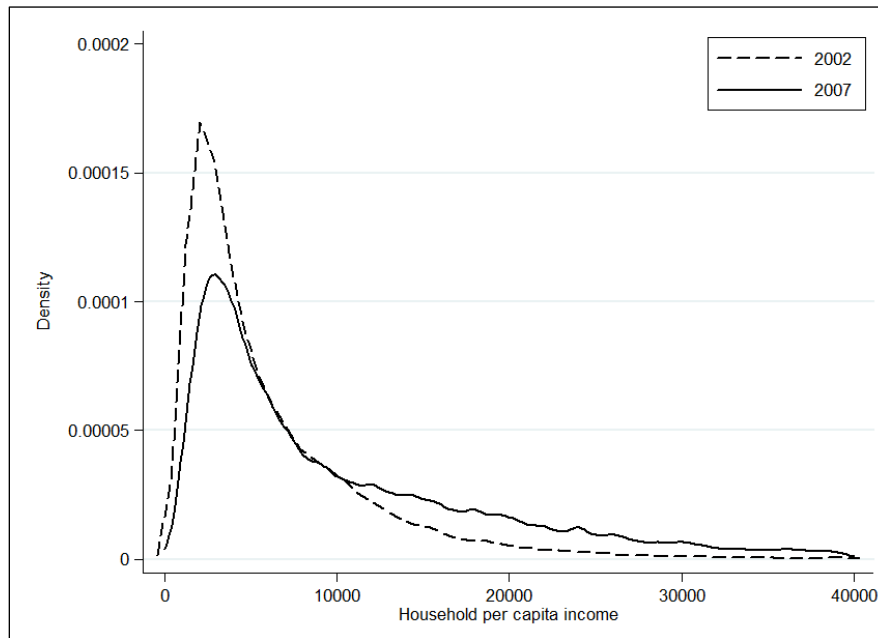
⁶ Due to data limitation, polarization for some years is not estimable: 1978–1984 and 1995–1999 for the whole PRC, 1995–1999 for rural PRC, and 1978–1984 for urban PRC.



Note: Polarization is labeled on the left scale, while alienation and identification are labeled on the right scale. The polarization estimates and their ingredients are significant according to bootstrap standard errors (see more details in Appendix, Table A.1).

Source: Authors' estimations based on NBS data.

To take a deeper look, household data of CHIP 2002 and 2007 can be used. After deflating by a spatial consumer price index, the data is used to obtain kernel densities shown in Figure 2. Figure 2 confirms a possible, although small, rise in income polarization from 2002 to 2007. There was a single pole in the 2002 distribution, with the peak at around CNY2,500. Small multiple poles seem to be present in the 2007 distribution, with peaks around CNY2,500, CNY12,000, CNY18,000, and CNY24,000.

Figure 2: Kernel Densities of Income in the People's Republic of China

Source: Authors' estimations based on CHIP 2002 and 2007.

The possible clustering in the middle and upper distribution in 2007 is explainable. A massive injection of physical capital raised the marginal product of labor under capital-skill complementarity, benefiting skilled labor more than unskilled labor. Numerous studies confirm the rising trend in returns to education in post-reform PRC. This effect is enhanced by continuous technology upgrading, driven by R&D and imports of advanced technologies. This leads to skill-biased technological change, raising the wages of skilled labor relative to the unskilled (Ge and Yang 2014). Conversely, the shrinking of the left tail indicates poverty reduction driven by growth, particularly after the abolition of agricultural taxes in 2003 and the emergence of large-scale migration from the early 1990s.

The CHIP data can also be used to estimate the polarization index by population subgroup (see Figure 3). Five subgroups are considered: rural residents, urban citizens, migrants, rural citizens (rural residents + migrants) and urban residents (urban citizens + migrants).⁷ The migrant group is quite unique in the PRC. Migrants are identified as rural citizens as they have rural *hukou*. But they can also be identified as urban residents (not urban citizens) because they work and live in cities. As shown subsequently, different identifications generate quite different and interesting results. The density curves for these subgroups can be found in the Appendix.

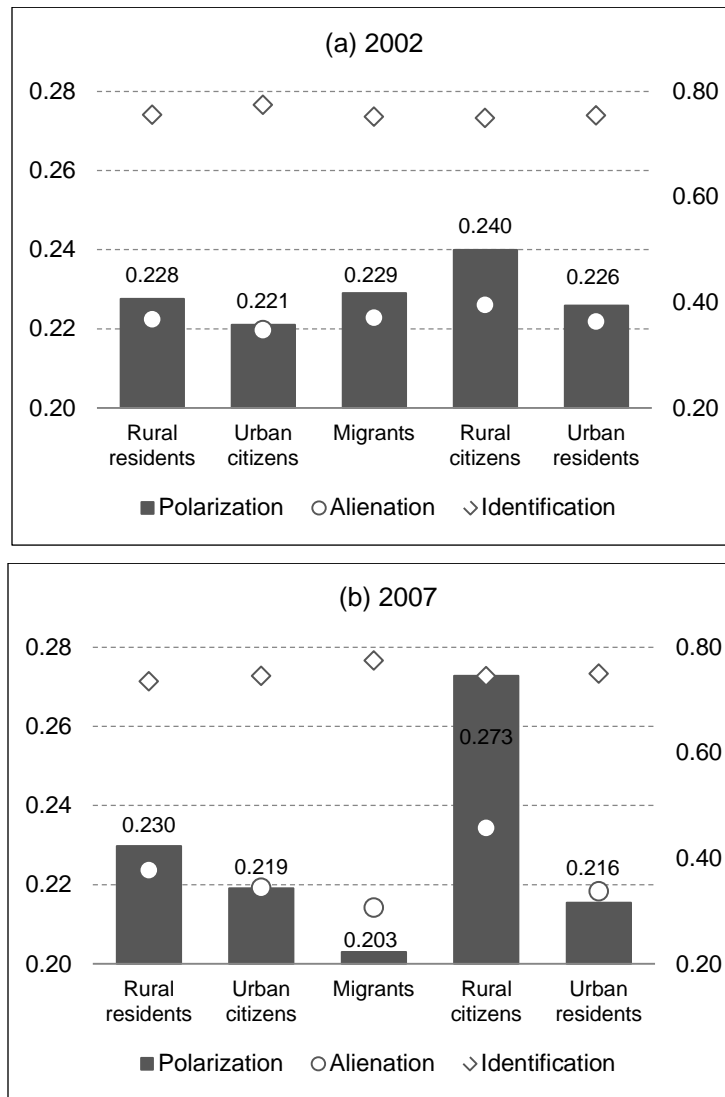
Focusing on polarization in 2002, the highest polarization was found among rural citizens, which can be attributed to their large alienation ingredient (the largest in Figure 3a), reflecting significant heterogeneity between rural residents and migrants. Their identification ingredient is among the smallest, indicating moderate clustering in this population subgroup. On the contrary, urban citizens are least polarized, despite having the highest identification. Clearly, the low urban polarization is due to the low level of alienation, which can be attributed to two major factors. The urban (not rural) sector was under an egalitarian system in pre-reform PRC, the impacts of which are still present. Additionally, the public sector is largely located in cities and towns and remains largely homogeneous.

⁷ Citizens are defined according to their *hukou* status.

From 2002 to 2007, polarization increased the most for rural citizens and decreased the most for migrants. The other groups experienced little change. The rise is mainly accounted for by increasing alienation, probably caused by the significant rightward shift in the income distribution of migrant workers relative to rural residents, following the well-publicized emergence of labor shortages in coastal cities after 2003. These shortages have pushed up wages for migrant workers of all categories, which also explains the big decrease in the alienation element of polarization among migrants as well as among urban residents. These changes imply that migrants were becoming more homogeneous with urban citizens.

The improved homogeneity between urban citizens and migrants can also be explained by the changing composition of migrants. As time passes, many middle-aged migrants return home and thus the migrant population becomes increasingly dominated by the young with better education. The latter have high expectations for jobs and are better able to adapt to urban work and life.

Figure 3: Polarization in the People’s Republic of China by Population Subgroup



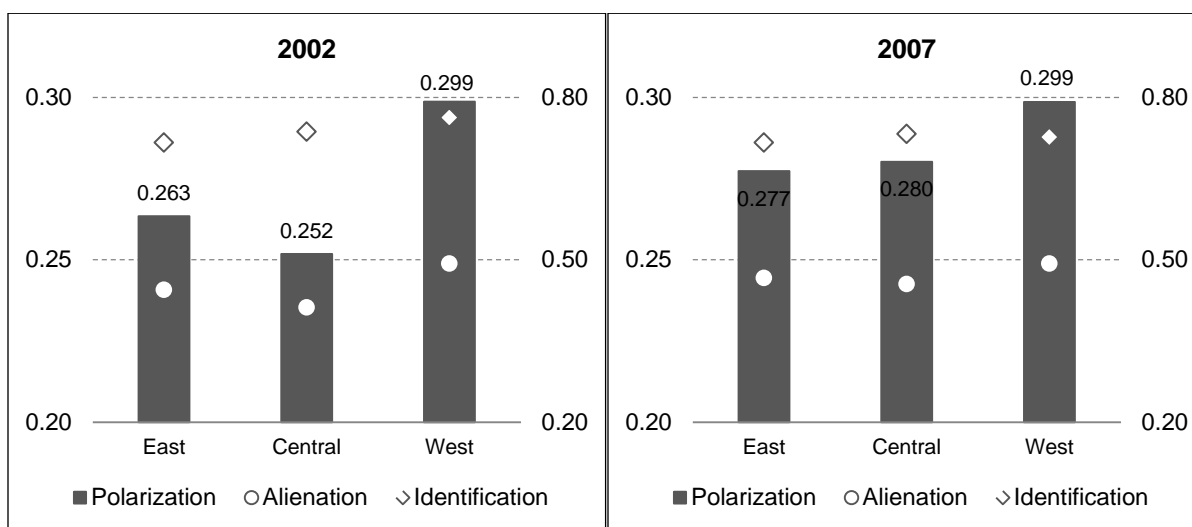
Note: Polarization is labeled on the left scale, while alienation and identification are labeled on the right scale.

Source: Authors’ estimations based on CHIP 2002 and 2007.

Polarization by region is shown in Figure 4. In both 2002 and 2007, the west is much more polarized than other regions. One possible reason is that the share of agriculture is relatively large in the west, meaning high segregation between rural and urban residents. This is supported by the higher alienation as well as the higher identification ingredients in the west. The east is a little more polarized than central PRC, mainly due to its larger alienation ingredient.

From 2002 to 2007, polarization in the west remained unchanged, while it increased notably in eastern and particularly central PRC. This increase is caused by the rise in the alienation ingredient, possibly related to industrial transfers from the coast to central PRC. As is known, heterogeneity is the largest between rural residents and urban citizens and second largest between rural residents and migrants. When the migrant group emerges or grows as in central PRC, it is likely to lead to increased polarization.

Figure 4: Polarization in East, Central, and West People’s Republic of China



Note: Polarization is labeled on the left scale, while alienation and identification are labeled on the right scale.

Source: Authors’ estimations based on CHIP 2002 and 2007.

3. DECOMPOSITION OF CHANGES IN POLARIZATION BY INCOME SOURCE

Based on the CHIP data, polarization rose from 0.277 in 2002 to 0.292 in 2007 (Table 1). This increase came mainly from rising alienation, offset by a drop in the identification ingredient. In other words, income gaps between groups shrunk, while income gaps between individuals within groups expanded. As discussed earlier, labor shortages that began in 2003 pushed up wages for migrants in general, bridging the gap between urban citizens and migrants. Meanwhile, the abolition of agricultural taxes and increased assistance to poor farmers narrowed the gaps between rural residents and urban residents (both migrants and urban citizens).

Table 1: Polarization in the People's Republic of China, 2002 and 2007

Year	Polarization	Alienation	Identification
2002	0.277	0.467	0.727
2007	0.292	0.492	0.715

Source: Authors' estimations based on CHIP 2002 and 2007.

Which income source is more important in accounting for the polarization change? To address this question, a decomposition framework is proposed and then applied to the CHIP data. Suppose there are only two income sources x and y . Let $p(x, y)$ denote the polarization indexed by time t . A change in polarization can be expressed as:

$$\begin{aligned}
\Delta p &= p(x_{t+1}, y_{t+1}) - p(x_t, y_t) \\
&= \frac{1}{2}p(x_{t+1}, y_{t+1}) + \frac{1}{2}p(x_{t+1}, y_{t+1}) - \frac{1}{2}p(x_t, y_t) - \frac{1}{2}p(x_t, y_t) \\
&\quad + \frac{1}{2}p(x_{t+1}, y_t) - \frac{1}{2}p(x_{t+1}, y_t) + \frac{1}{2}p(x_t, y_{t+1}) - \frac{1}{2}p(x_t, y_{t+1}) \\
&= \frac{1}{2}[p(x_{t+1}, y_{t+1}) - p(x_t, y_{t+1})] + \frac{1}{2}[p(x_{t+1}, y_t) - p(x_t, y_t)] \\
&\quad + \frac{1}{2}[p(x_{t+1}, y_{t+1}) - p(x_{t+1}, y_t)] + \frac{1}{2}[p(x_t, y_{t+1}) - p(x_t, y_t)] \\
&= \Delta p(x) + \Delta p(y)
\end{aligned}$$

$$\text{where } \Delta p(x) = \frac{1}{2}[p(x_{t+1}, y_{t+1}) - p(x_t, y_{t+1})] + \frac{1}{2}[p(x_{t+1}, y_t) - p(x_t, y_t)]$$

$$\Delta p(y) = \frac{1}{2}[p(x_{t+1}, y_{t+1}) - p(x_{t+1}, y_t)] + \frac{1}{2}[p(x_t, y_{t+1}) - p(x_t, y_t)]$$

The derivation can be extended to the case with multiple income sources. It turns out that this approach is equivalent to the allocation of a change in a dependent variable among its determinants based on cooperative game theory (for more details, see Shapley 1953). Called Shapley decomposition, this approach has been used to decompose poverty and inequality or their changes (Shorrocks 2013; Wan 2008). It is worth reiterating that both Araar (2008) and Deutsch, Fusco, and Silber (2013) decomposed the level (not the change) of polarization by population group and income source.

The CHIP data contains observations on six income sources: wages, net business income, investment income, rental value of owner-occupied housing, transfer income, and taxes and fees. Since the last source is missing for more than half of the surveyed households, only the first five sources will be added to obtain household gross per capita income (see more details in Appendix, Table A.2). The decomposition results are presented in Figure 5, where a positive value means a polarization-increasing source income and vice versa. All income sources contributed to increasing polarization, with the only exception of business income. Investment income is the dominant polarization-increasing source. This is likely to be related to its large and growing disparity among households. Also, the fast declining labor share in national income implies the rising importance of investment income in driving polarization and segregation between investors and laborers. Needless to say, investors are usually in the rich segment of a society and benefit more as financial markets develop, as in the PRC, making the country more polarized.

The increase in the polarization of rural citizens was contributed by all income components, again dominated by investment income, followed by business income and transfers. Transfers

brought about higher polarization because social programs better cover migrants in cities who already have higher incomes.

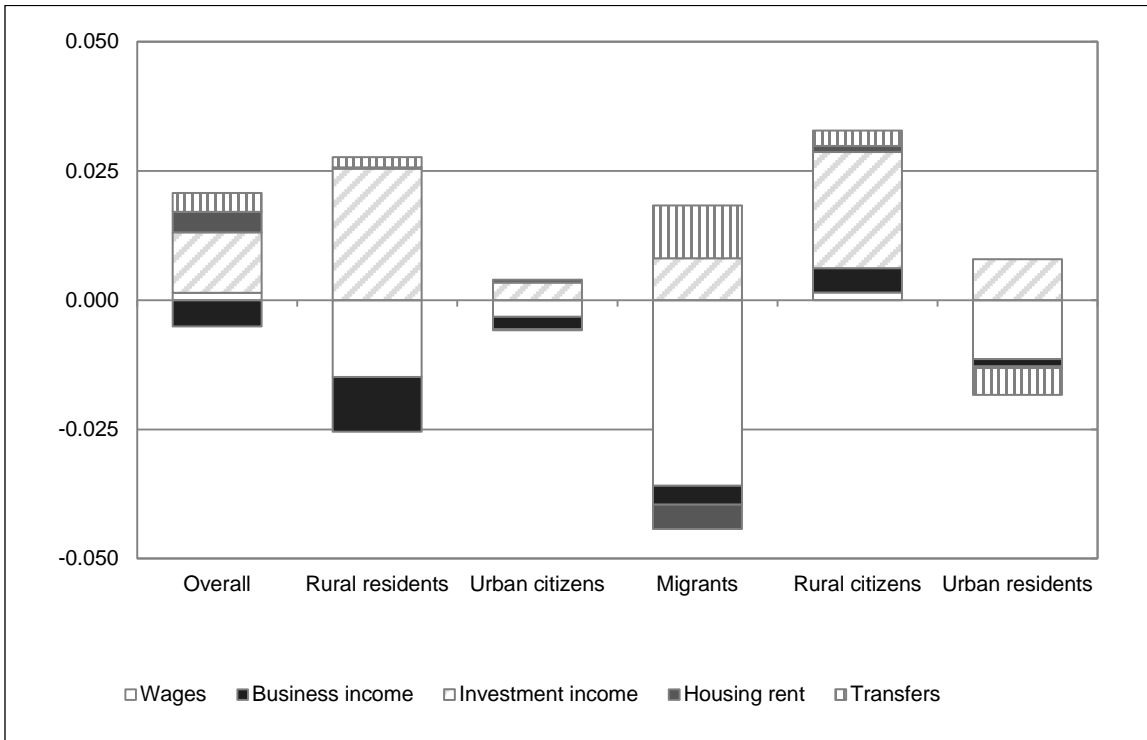
There was only a negligible increase in the polarization of rural residents, once again mainly attributable to investment income. The rise was offset by polarization-decreasing wage and business income. This finding corroborates well with the fact that agriculture tax was fully eliminated in 2006, leading to higher business income for poor farmers.

The significant decrease in the polarization of migrants mainly came from wages, followed by housing rent and business income. The decrease was moderated by the polarization-increasing effect of transfers and investment income. Here, the effect of transfers is related to the status of migrants. Those working full-time and in formal enterprises already receive a higher income, and they are more likely to have access to health care, insurance, and pensions, while others have little or no access to social programs.

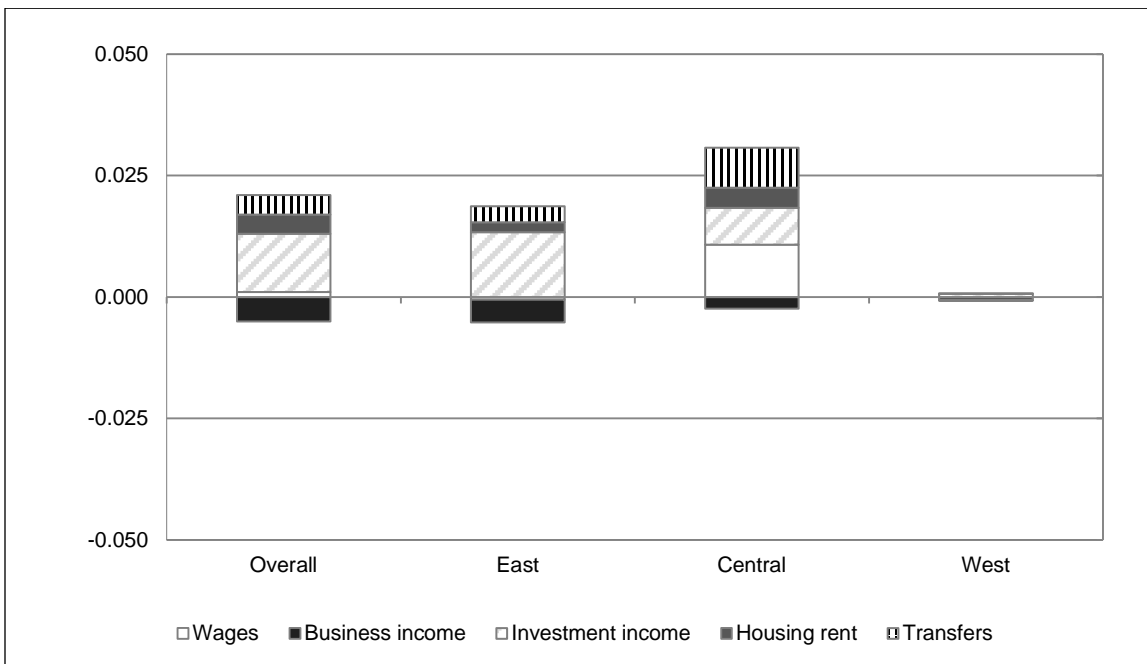
The moderate decrease in polarization of urban residents was mainly driven by the income components of wages and transfers. This is in line with the observation of growing wages for migrants. And in recent years, more and more migrants have gained access to social benefits (usually employment-based) (Gao, Yang, and Li 2012; 2013). The moderate decrease can also be attributed to the slight decrease in polarization of urban citizens. The latter, in turn, is attributable to wages and business income. The polarization-decreasing effect of business income was possibly caused by growing government support provided for business start-ups. For example, graduates can obtain substantial seed funding from the government for setting up enterprises. Promotion of services sector development, especially the e-commerce boom, also helps nurture the creation and growth of business owners.

By region, the changes in polarization were similar to that in the total population. Figure 5b shows that business income is the dominant polarization-reducing source, while investment income is the largest polarization-increasing source. Although wage income exerts a negligible effect, it helped raise polarization in central PRC, perhaps due to the industrial transfers discussed earlier. Finally, as Figure 4 shows, the change in polarization was negligible for the west.

Figure 5: Source Income Contribution to Changes in Polarization, 2002–2007
 (a) By population subgroup



(b) By region



Source: Authors' calculations based on CHIP 2002 and 2007.

4. DECOMPOSITION OF CHANGES IN POLARIZATION INTO GROWTH AND REDISTRIBUTION EFFECTS

The contribution of each income source can be further decomposed into a growth effect and a redistributive effect, following studies on poverty and income inequality (Kakwani and Subbarao 1990; Jain and Tendulkar 1990; Datt and Ravallion 1992; Baye 2006; Zhang and Wan 2006; Wan 2008). Our extension permits examination of how polarization will change if only the mean income μ_x changes or if only the income dispersion changes.

Let L_x denote the Lorenz curve of income x and index time period t . These two effects can be disentangled as follows:

$$\begin{aligned} \Delta p(x) &= p(x_{t+1}) - p(x_t) \\ &= p(\mu_{x_{t+1}}, L_{x_{t+1}}) - p(\mu_{x_t}, L_{x_t}) \\ &= \frac{1}{2}p(\mu_{x_{t+1}}, L_{x_{t+1}}) + \frac{1}{2}p(\mu_{x_{t+1}}, L_{x_{t+1}}) - \frac{1}{2}p(\mu_{x_t}, L_{x_t}) - \frac{1}{2}p(\mu_{x_t}, L_{x_t}) \\ &\quad + \frac{1}{2}p(\mu_{x_{t+1}}, L_{x_t}) - \frac{1}{2}p(\mu_{x_{t+1}}, L_{x_t}) + \frac{1}{2}p(\mu_{x_t}, L_{x_{t+1}}) - \frac{1}{2}p(\mu_{x_t}, L_{x_{t+1}}) \\ &= \frac{1}{2}\{[p(\mu_{x_{t+1}}, L_{x_t}) - p(\mu_{x_t}, L_{x_t})] + [p(\mu_{x_{t+1}}, L_{x_{t+1}}) - p(\mu_{x_t}, L_{x_{t+1}})]\} \\ &\quad + \frac{1}{2}\{[p(\mu_{x_{t+1}}, L_{x_{t+1}}) - p(\mu_{x_{t+1}}, L_{x_t})] + [p(\mu_{x_t}, L_{x_{t+1}}) - p(\mu_{x_t}, L_{x_t})]\} \end{aligned}$$

$$\text{The growth effect} = \frac{1}{2}\{[p(\mu_{x_{t+1}}, L_{x_t}) - p(\mu_{x_t}, L_{x_t})] + [p(\mu_{x_{t+1}}, L_{x_{t+1}}) - p(\mu_{x_t}, L_{x_{t+1}})]\}$$

$$\text{The redistribution effect} = \frac{1}{2}\{[p(\mu_{x_{t+1}}, L_{x_{t+1}}) - p(\mu_{x_{t+1}}, L_{x_t})] + [p(\mu_{x_t}, L_{x_{t+1}}) - p(\mu_{x_t}, L_{x_t})]\}$$

To estimate these effects, two counterfactual income distributions are constructed: income distributions of x with only its mean or its dispersion changed. The former can be expressed as $Y_x(\mu_{x_{t+1}}, L_{x_t}) = Y_x\left(\mu_{x_t} * \frac{\mu_{x_{t+1}}}{\mu_{x_t}}, L_{x_t}\right)$, from which the polarization index of $p(\mu_{x_{t+1}}, L_{x_t})$ can be estimated. The difference between $p(\mu_{x_{t+1}}, L_{x_t})$ and $p(\mu_{x_t}, L_{x_t})$ is the growth effect. By the same token, the difference between $p(\mu_{x_{t+1}}, L_{x_{t+1}})$ and $p(\mu_{x_{t+1}}, L_{x_t})$ is the redistribution effect. Further, letting the starting point be $t + 1$ rather than t permits one to obtain $Y_x(\mu_{x_t}, L_{x_{t+1}}) = Y_x\left(\mu_{x_{t+1}} * \frac{\mu_{x_t}}{\mu_{x_{t+1}}}, L_{x_{t+1}}\right)$. And the corresponding growth and redistribution effects can be estimated. These two alternative estimates of the same effect are then averaged to arrive at the final estimate.

Figure 6 shows the growth and redistributive effects by income component. For the PRC as a whole (Figure 6a), for east and central PRC, as well as for rural citizens (Figures 6e, 6g, and 6h), the total growth and total redistributive effects (see bottom bars) are both polarization-increasing. On the contrary, they are both polarization-decreasing for urban citizens and migrants (Figures 6c and 6d). For urban residents (Figure 6f), the total redistribution effect is polarization-attenuating, and more than offsets the polarization-increasing effect of growth. For rural residents, the total growth effect is polarization-increasing, while the total redistribution effect is polarization-decreasing.

Figure 6a shows that both effects of investment income are polarization-increasing, with the growth effect larger than the redistribution effect. Housing rent exhibited a similar pattern as investment income but on a smaller scale. The other three income sources had these two effects offsetting each other. This was particularly obvious for business income: polarization became lower due to its growth, but higher due to its worsening distribution.

Among rural residents, although polarization increased slightly, the changes brought by growth and redistribution were substantial. Income growth led to higher polarization, especially from the growth of investment income. This was offset largely by the redistributive effects of wages and business income.

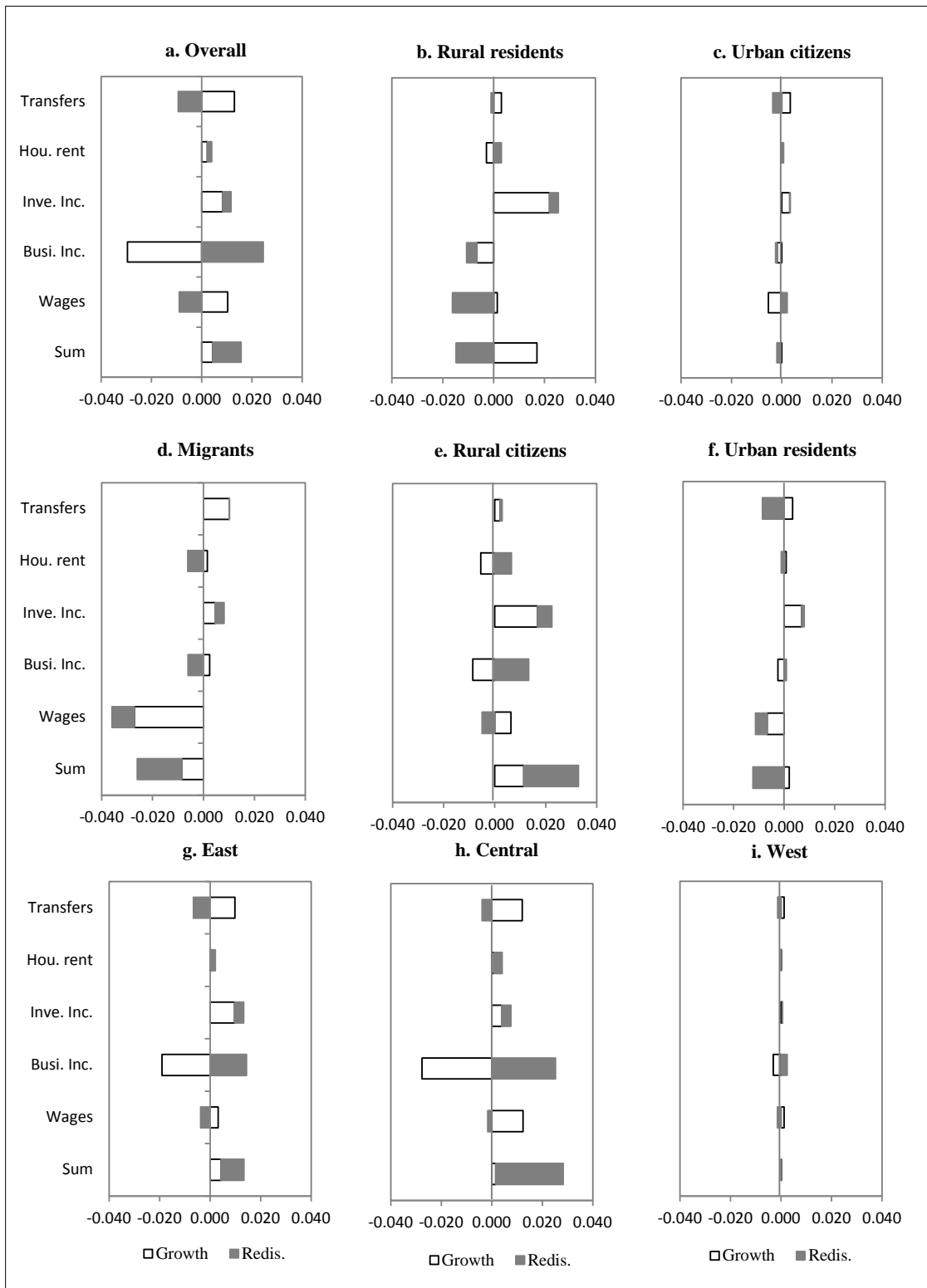
For rural citizens, the increase in polarization came from both growth and redistributive effects. Except for wages, all other income sources contributed to higher polarization due to their worsening distributions. This was probably caused by the income of migrants becoming more distant from that of rural residents, confirming Figure 3, which shows a higher alienation ingredient for this group.

Among urban residents (Figure 6b), wage and transfer redistribution contributed to the decreasing polarization. Transfers lower polarization, especially as more migrants join social insurance programs, such as for work injury insurance, medical insurance, unemployment insurance, and pensions (Gao et al. 2012). Additionally, wage growth led to a decrease in polarization, but growth in investment income led to a rise in polarization.

Turning to urban citizens (Figure 6c), all growth and redistributive effects were limited. Nevertheless, the redistribution effect of transfers and the growth of wages helped reduce polarization. For migrants, the decrease in polarization came from both income growth and improved distribution. Wage growth contributed significantly to the decrease, while the growth of transfers and investment income counterbalanced other polarization-reducing effects. The redistribution effects of rent and business income were polarization-reducing among migrants.

By region (Figures 6g, 6h, and 6i), the increases in polarization predominantly came from the redistribution effects, except in west PRC. In central PRC, the dominant polarization-increasing force came from the redistribution effect of business income and, to a lesser extent, of rent and investment income. This was offset slightly by the redistribution of transfers. The growth effect of transfers and wages pushed up polarization, but this was entirely counterbalanced by the growth of business income. With respect to east PRC, the pattern is similar to central PRC. Overall change in polarization in west PRC was negligible. Only business income yielded a noticeable contribution, with its two effects offsetting each other.

Figure 6: Changes in Polarization: Growth and Redistributive Effects, 2002–2007



Source: Authors' calculations based on CHIP 2002 and 2007.

5. CONCLUSIONS AND IMPLICATIONS

This paper analyzes polarization in the PRC from 1978 to 2010, for the country as a whole and for different population subgroups and regions. A change in polarization is then attributed to different income sources, and further into the growth and redistribution components of these income sources.

From 1978 to 2010, income polarization generally exhibited rising trends for the country as a whole and for rural and urban PRC, largely due to worsening alienation. Thus, isolation between individuals or households became more pronounced over time. However, the rising polarization was moderated somehow by declining identification—that is, the clustering of individuals within income groups weakened over time.

By population subgroup, polarization among rural citizens was the highest, while polarization among urban citizens was the lowest. The former also increased significantly from 2002 to 2007 mainly because of rising alienation. Meanwhile, polarization among migrants and urban residents decreased, perhaps because migrants became more integrated in cities. By region, west PRC is the most polarized, with little change over time. Polarization increased in east and particularly central PRC.

The increase in polarization between 2002 and 2007 was mainly caused by investment income. This was so for all population subgroups. The growth and redistribution effects of investment income reinforce each other. Housing rent exhibited a similar pattern as investment income but on a much smaller scale. Transfers were also polarization-increasing. As for polarization-reducing factors, business income was the dominant component, especially among rural residents. Wages also helped, particularly among migrants.

In order to contain polarization, several policy recommendations can be considered. First, the household registration or *hukou* system needs to be reformed. Since the 1950s, the *hukou* has been like a quasi-passport, separating urban citizens from rural citizens. In other words, the PRC has been a country divided into two worlds: the privileged life for urban citizens on one hand, and backward living for rural citizens on the other. This is the most serious and unjust form of segregation. The *hukou* system has been undergoing gradual reform, particularly in small and most mid-sized cities. However, in large cities such as Beijing and Shanghai, it remains almost impossible for migrants to obtain urban citizenship. Second, there is a need to treat migrants and urban citizens equally in terms of political, economic, and social rights, particularly in accessing public services such as education, health, and services. Third, agribusiness needs to be promoted in rural PRC to help alleviate polarization, as business income is found to reduce polarization, especially among rural citizens. More attention should be paid to ecological agriculture and rural tourism. Lastly, taxing investment income progressively could be helpful as it is the most important polarization-increasing income source.

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* The Asian Development Bank refers to China by the name People's Republic of China.

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APPENDIX

To gauge the statistical significance of polarization estimates and its alienation and identification ingredients, the bootstrap technique (30 times for each estimate) is applied to obtain the standard errors and confidence intervals. The results show that our estimates are all significant.

Table A.1: Bootstrap Standard Errors and Confidential Intervals for Estimates in Figure 1

(a) Overall People's Republic of China

Year	P	BSSE_P	LOW_P	UP_P	I	BSSE_I	LOW_I	UP_I	A	BSSE_A	LOW_A	UP_A
1985	0.203	0.000	0.202	0.203	0.809	0.000	0.808	0.810	0.304	0.001	0.303	0.306
1986	0.216	0.000	0.215	0.216	0.765	0.000	0.765	0.767	0.337	0.001	0.336	0.338
1987	0.215	0.000	0.214	0.215	0.768	0.001	0.767	0.770	0.342	0.001	0.341	0.344
1988	0.224	0.000	0.224	0.225	0.757	0.000	0.758	0.757	0.353	0.000	0.352	0.354
1989	0.231	0.000	0.231	0.232	0.733	0.000	0.732	0.734	0.369	0.000	0.368	0.370
1990	0.229	0.000	0.229	0.230	0.728	0.000	0.727	0.728	0.365	0.000	0.364	0.366
1991	0.235	0.000	0.235	0.236	0.722	0.000	0.721	0.722	0.377	0.000	0.376	0.378
1992	0.249	0.000	0.249	0.250	0.729	0.000	0.728	0.730	0.404	0.001	0.403	0.405
1993	0.253	0.000	0.253	0.254	0.732	0.000	0.732	0.733	0.414	0.001	0.413	0.415
1994	0.257	0.000	0.257	0.257	0.726	0.000	0.726	0.727	0.422	0.000	0.422	0.423
1995	-	-	-	-	-	-	-	-	-	-	-	-
1996	-	-	-	-	-	-	-	-	-	-	-	-
1997	-	-	-	-	-	-	-	-	-	-	-	-
1998	-	-	-	-	-	-	-	-	-	-	-	-
1999	-	-	-	-	-	-	-	-	-	-	-	-
2000	0.250	0.000	0.250	0.250	0.701	0.000	0.701	0.701	0.416	0.000	0.415	0.417
2001	0.259	0.000	0.258	0.259	0.702	0.000	0.701	0.702	0.434	0.000	0.433	0.435
2002	0.273	0.000	0.272	0.273	0.718	0.000	0.717	0.719	0.464	0.000	0.463	0.465
2003	0.277	0.000	0.277	0.277	0.709	0.000	0.709	0.710	0.473	0.001	0.472	0.474
2004	0.271	0.000	0.271	0.271	0.705	0.000	0.705	0.705	0.462	0.000	0.462	0.463
2005	0.273	0.000	0.273	0.274	0.708	0.000	0.708	0.708	0.464	0.000	0.463	0.465
2006	0.273	0.000	0.273	0.274	0.700	0.000	0.700	0.701	0.469	0.000	0.468	0.470
2007	0.270	0.000	0.269	0.270	0.699	0.000	0.699	0.700	0.461	0.000	0.460	0.462
2008	0.267	0.000	0.266	0.267	0.701	0.000	0.700	0.701	0.455	0.000	0.454	0.456
2009	0.264	0.000	0.264	0.265	0.692	0.000	0.691	0.692	0.451	0.000	0.450	0.452
2010	0.264	0.000	0.264	0.264	0.692	0.000	0.691	0.692	0.451	0.000	0.450	0.452

Note: P, I, and A stand for polarization, identification, and alienation, respectively. BSSE_P, LOW_P, and UP_P represent the bootstrapped standard error, the lower bound, and the upper bound of the polarization estimates, respectively. Similar abbreviations apply for the identification and alienation estimates.

Source: Authors' estimations based on NBS data from 1978 to 2010.

(b) Rural People's Republic of China

Year	P	BSSE_P	LOW_P	UP_P	I	BSSE_I	LOW_I	UP_I	A	BSSE_A	LOW_A	UP_A
1978	0.172	0.000	0.172	0.174	0.860	0.002	0.857	0.863	0.228	0.001	0.226	0.230
1979	0.165	0.001	0.164	0.168	0.927	0.003	0.923	0.934	0.213	0.002	0.208	0.217
1980	0.178	0.000	0.178	0.179	0.845	0.001	0.845	0.847	0.248	0.001	0.246	0.249
1981	0.175	0.001	0.174	0.177	0.814	0.002	0.812	0.818	0.245	0.002	0.242	0.249
1982	0.177	0.001	0.176	0.179	0.930	0.003	0.925	0.935	0.238	0.002	0.234	0.242
1983	0.185	0.001	0.184	0.187	0.845	0.001	0.843	0.848	0.264	0.002	0.261	0.267
1984	0.192	0.000	0.192	0.193	0.826	0.001	0.825	0.828	0.276	0.001	0.274	0.277
1985	0.196	0.000	0.196	0.197	0.815	0.001	0.814	0.816	0.290	0.001	0.289	0.291
1986	0.203	0.000	0.203	0.204	0.771	0.001	0.770	0.772	0.309	0.001	0.308	0.311
1987	0.206	0.000	0.206	0.206	0.775	0.001	0.773	0.776	0.323	0.001	0.322	0.325
1988	0.207	0.000	0.207	0.208	0.790	0.000	0.789	0.791	0.320	0.001	0.319	0.321
1989	0.208	0.000	0.208	0.209	0.780	0.000	0.779	0.781	0.324	0.001	0.323	0.326
1990	0.208	0.000	0.208	0.209	0.773	0.000	0.772	0.774	0.324	0.001	0.323	0.325
1991	0.208	0.000	0.208	0.209	0.766	0.000	0.765	0.767	0.326	0.001	0.325	0.327
1992	0.234	0.008	0.218	0.235	0.841	0.028	0.784	0.844	0.349	0.001	0.347	0.351
1993	0.213	0.000	0.213	0.214	0.776	0.001	0.774	0.777	0.336	0.001	0.334	0.338
1994	0.216	0.000	0.215	0.216	0.767	0.000	0.766	0.767	0.342	0.001	0.341	0.344
1995	-	-	-	-	-	-	-	-	-	-	-	-
1996	-	-	-	-	-	-	-	-	-	-	-	-
1997	-	-	-	-	-	-	-	-	-	-	-	-
1998	-	-	-	-	-	-	-	-	-	-	-	-
1999	-	-	-	-	-	-	-	-	-	-	-	-
2000	0.221	0.000	0.220	0.221	0.737	0.000	0.737	0.738	0.358	0.001	0.356	0.359
2001	0.225	0.000	0.225	0.226	0.740	0.000	0.739	0.741	0.369	0.001	0.367	0.371
2002	0.227	0.000	0.226	0.227	0.740	0.000	0.739	0.741	0.371	0.001	0.370	0.373
2003	0.232	0.000	0.232	0.233	0.730	0.000	0.730	0.731	0.385	0.001	0.384	0.387
2004	0.227	0.000	0.227	0.227	0.728	0.000	0.728	0.729	0.372	0.001	0.371	0.373
2005	0.224	0.000	0.224	0.225	0.733	0.000	0.732	0.733	0.364	0.001	0.363	0.365
2006	0.227	0.000	0.227	0.228	0.719	0.000	0.719	0.720	0.374	0.001	0.372	0.375
2007	0.223	0.000	0.223	0.224	0.724	0.000	0.723	0.724	0.366	0.001	0.365	0.368
2008	0.219	0.000	0.219	0.220	0.728	0.000	0.727	0.729	0.355	0.001	0.354	0.357
2009	0.223	0.000	0.223	0.224	0.721	0.000	0.720	0.722	0.365	0.001	0.363	0.367
2010	0.225	0.000	0.224	0.225	0.716	0.000	0.716	0.717	0.368	0.001	0.366	0.369

Note: P, I, and A stand for polarization, identification, and alienation, respectively. BSSE_P, LOW_P, and UP_P represent the bootstrapped standard error, the lower bound, and the upper bound of the polarization estimates, respectively. Similar abbreviations apply for the identification and alienation estimates.

Source: Authors' estimations based on NBS data from 1978 to 2010.

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Year	P	BSSE_P	LOW_P	UP_P	I	BSSE_I	LOW_I	UP_I	A	BSSE_A	LOW_A	UP_A
1985	0.141	0.001	0.140	0.142	1.012	0.004	1.005	1.019	0.155	0.001	0.152	0.157
1986	0.137	0.001	0.137	0.139	1.057	0.005	1.048	1.068	0.144	0.001	0.142	0.147
1987	0.162	0.001	0.161	0.164	0.872	0.003	0.868	0.878	0.207	0.001	0.204	0.209
1988	0.165	0.000	0.165	0.166	0.885	0.001	0.884	0.887	0.214	0.001	0.213	0.215
1989	0.173	0.000	0.173	0.174	0.857	0.001	0.856	0.859	0.233	0.001	0.232	0.234
1990	0.169	0.000	0.169	0.170	0.854	0.001	0.852	0.856	0.227	0.001	0.226	0.228
1991	0.171	0.000	0.171	0.172	0.873	0.001	0.871	0.875	0.229	0.001	0.228	0.230
1992	0.178	0.000	0.178	0.178	0.847	0.001	0.846	0.848	0.242	0.001	0.241	0.243
1993	0.187	0.000	0.186	0.187	0.837	0.001	0.836	0.839	0.260	0.001	0.259	0.261
1994	0.191	0.000	0.191	0.192	0.810	0.001	0.809	0.812	0.272	0.001	0.271	0.273
1995	0.188	0.000	0.187	0.188	0.823	0.001	0.822	0.825	0.263	0.001	0.262	0.264
1996	0.184	0.000	0.184	0.185	0.831	0.000	0.831	0.832	0.256	0.000	0.255	0.257
1997	0.188	0.000	0.188	0.188	0.815	0.001	0.814	0.816	0.265	0.000	0.264	0.266
1998	0.191	0.000	0.190	0.191	0.810	0.001	0.808	0.811	0.271	0.001	0.270	0.272
1999	0.193	0.000	0.193	0.193	0.800	0.000	0.800	0.801	0.278	0.000	0.277	0.279
2000	0.199	0.000	0.199	0.200	0.778	0.001	0.777	0.779	0.294	0.001	0.293	0.295
2001	0.203	0.000	0.202	0.203	0.774	0.000	0.774	0.775	0.304	0.000	0.303	0.305
2002	0.223	0.000	0.223	0.223	0.735	0.001	0.734	0.736	0.361	0.001	0.360	0.362
2003	0.218	0.000	0.217	0.218	0.750	0.000	0.749	0.751	0.344	0.001	0.343	0.345
2004	0.217	0.000	0.216	0.217	0.756	0.000	0.755	0.757	0.341	0.001	0.339	0.342
2005	0.218	0.000	0.218	0.219	0.748	0.000	0.748	0.749	0.345	0.001	0.344	0.346
2006	0.219	0.000	0.218	0.219	0.751	0.000	0.751	0.752	0.344	0.000	0.344	0.345
2007	0.215	0.000	0.215	0.216	0.755	0.000	0.755	0.756	0.337	0.001	0.336	0.338
2008	0.217	0.000	0.217	0.218	0.748	0.000	0.748	0.749	0.343	0.001	0.342	0.344
2009	0.216	0.000	0.216	0.216	0.749	0.000	0.748	0.749	0.339	0.000	0.338	0.340
2010	0.214	0.000	0.214	0.215	0.752	0.000	0.751	0.753	0.335	0.001	0.334	0.337

Note: P, I, and A stand for polarization, identification, and alienation, respectively. BSSE_P, LOW_P, and UP_P represent the bootstrapped standard error, the lower bound, and the upper bound of the polarization estimates, respectively. Similar abbreviations apply for the identification and alienation estimates.

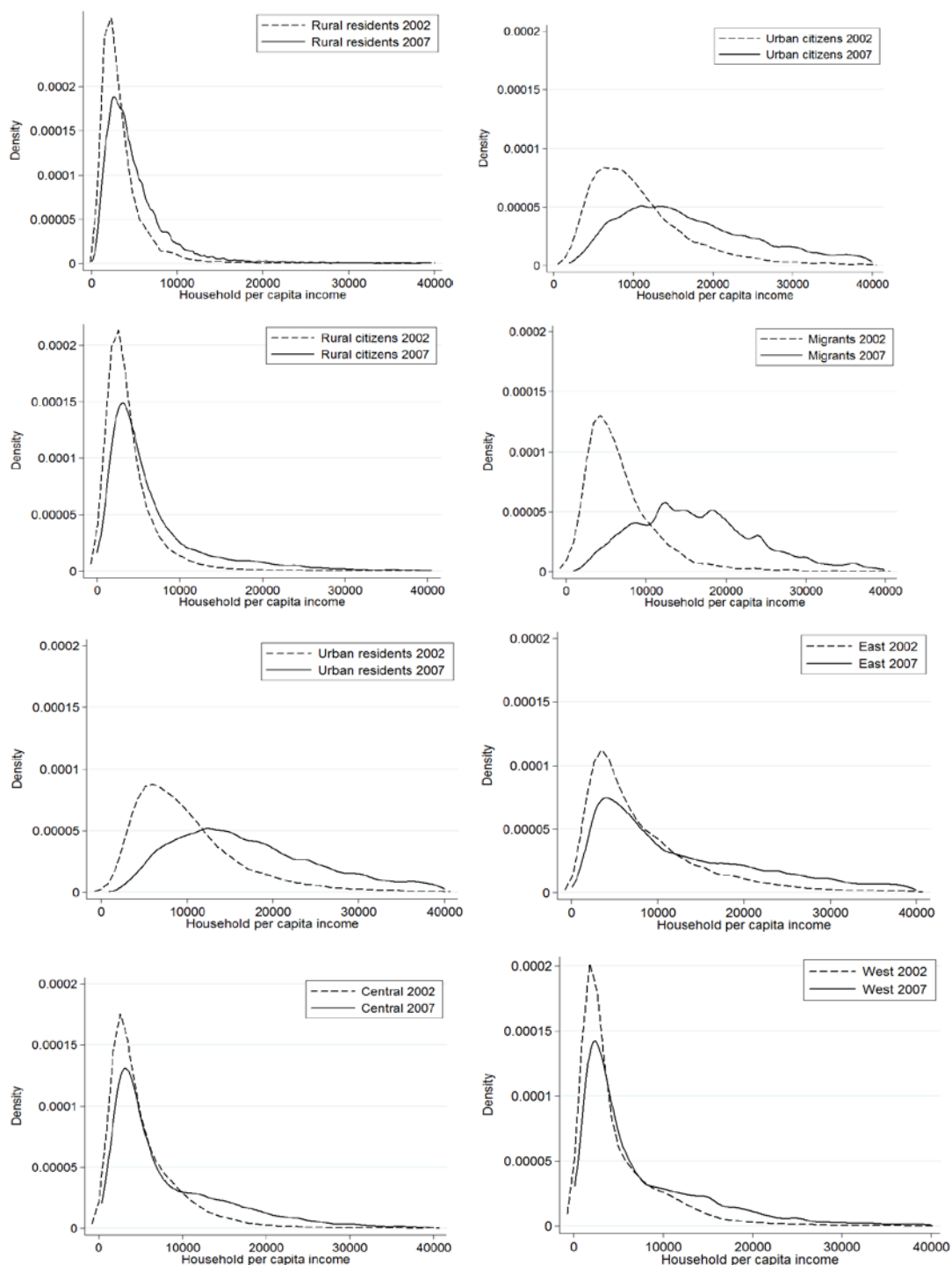
Source: Authors' estimations based on NBS data from 1978 to 2010.

Table A.2: Correspondence between the Five Income Categories and the CHIP Income Categories

Rural Areas	Wages	Income from wages, pensions, and other compensation received by individual members of the household
		Household income from township, village, collective, and other types of enterprises
	Business income	Cash income from farming and industrial and subsidiary activities
		Gross value of self-consumption of farm products
	Investment income	Income from property
	Income from housing rent	Rental value of housing
Transfer income	Net transfer from/to collective and state entities	
	Miscellaneous income (including private transfers)	
Urban Areas	Wages	Cash income of working members
	Business income	Income from private/individuals
	Investment income	Income from property
	Income from housing rent	Rental value of owner occupied housing
	Transfer income	Income of retired members
		Miscellaneous income (including private transfer and special income)
Subsidies less taxes (except housing subsidy and ration coupon subsidy) and income in kind		
Housing subsidy		

Source: CHIP dataset.

Figure A.1: Income Kernel Density Functions



Source: Authors' construction based on CHIP 2002 and 2007.