Inequality of Opportunity in Health Care in China: Suggestion on the Construction of the Urban-Rural Integrated Medical Insurance System

Chao Ma and Ze Song and Xuhui Sun and Hai Gu

School of Public Health, Southeast University, China, College of Finance and Statistics, Hunan University, China, School of Life & Medical Sciences, University College London, England, Center for Health Management and Care Security Policy Research, Nanjing University, China

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Ma Chao
School of Public Health,
Southeast University, China
machao54.seu@gmail.com

Song Ze
College of Finance and Statistics,
Hunan University, China
benz1985@163.com

Sun Xuhui
School of Life & Medical Sciences,
University College London, England
xuhui.sun@ucl.ac.uk

Gu Hai
Center for Health Management and Care Security Policy Research,
Nanjing University, China
guhai@nju.edu.cn


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High lights

1. This paper combine theory of the EOp (Roemer, 1998) and analytical framework of the reward *principle* and the *compensation principle* (Fleurbaey and Schokkaert, 2009).
2. This paper analyzes inequality health care problems between urban and rural in China.
3. Based on EOp, this paper discusses the urban-rural integrated medical insurance system.
Urban-Rural Inequality of Opportunity in Health Care in China

Abstract: This paper investigates the urban-rural inequality of opportunity in health care in China based on the theory of the EOp of Roemer (1998). Following the compensation principle proposed by Fleurbaey and Schokkaert (2011), this paper decomposes the fairness gap in the urban-rural health care utilization. The results shows that the ratios of the fairness gap to are 1.167 during 1997-2000 and 1.744 during 2004-2006. It implies that the degree of the essential inequity is underestimated. Meanwhile, upgrading the urban-rural reimbursement ratios is probably not sufficient to eliminate the inequality of opportunity in health care utilization between urban and rural residents. Under background of urban-rural dualistic social structure and the widening of urban-rural income gap, the pro-disadvantage policies will be more effective to promote the equality of opportunity in health care.

Key words: Equality of opportunity; Health care; Fairness gap; urban-rural integrated medical insurance system

JEL Classification: D12, D63, I18
1. Introduction

Chinese medical insurance systems is urban-rural dualistic. The Medical Insurance for Urban Residents (MIUR) which is only for urban residents, and the National Cooperative Medical System (NCMS) which is only for rural residents. Owing to deficiency of urban-rural dualistic medical insurance systems, there are larger health and health care inequalities between urban and rural in China. In order to reducing inequalities of health care system, China initiates the Urban-Rural Integrated Medical Insurance System (URIMIS) recently. The URIMIS is still in the stage of exploration. The URIMIS aims to realize equality by unifying the two separate medical insurance systems.

The equality divides to two classes in health care, *outcome equality* and *equality of opportunity* (EOp). The outcome equality means the same reimbursement policy or the same health care utilization between urban and rural residents. Most health care research rely on outcome equality (Lei and Lin, 2009; Wagstaff et al., 2009; Yip and Hsiao, 2009). However, due to large gap in individual and circumstance characteristics between urban and rural residents, it may lead to inefficiency. EOp means the public opportunities should be equally open to all individuals regardless of their races, religions or other factors, which represent the identities (Rawls, 1971). Roemer (1993, 1998, 2002) refine EOp for empirical studies. EOp is of vital importance for both academic researches and policy making (World Bank, 2005).

Refers to equality of opportunity, Daniels (1985, 1996) analyzes health inequality. Zheng (2006) introduces the income-health matrix to measure health opportunity and inequality in health security circumstances and socioeconomic structure. Using data from the UK National Child Development Study, Rosa Dias (2009) finds a significant inequality of opportunity in health. *Circumstances* can affect the self-assessed health level in adulthood directly and indirectly (e.g. through *effort* such as education), such as parental socioeconomic status (SES) and childhood health. Rosa Dias (2010) further improves measurement of inequality of opportunity by combining Roemer’s framework with the Grossman model of human capital and health demand, and discusses the *partial-circumstance problem*. Based on *circumstances* of childhood condition, Jusot et al. (2010) and Trannoy et al. (2010) research on the inequality of opportunity in adulthood health. Balia and Jones (2011) investigate the inequality of opportunity in mortality risk among individuals who and whose parents smoke or ever smoked. Jones et al. (2012) analyze primarily the role of education in the inequality of   

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*we’ve given several examples in Appendix as a simple explanation.*
opportunity in health, and note that there are significant and economically sizable linkages between the quality of education and health in some dimensions.

As mentioned before, there are no relevant topics about China. Based on the theory of the EOp (Roemer, 1993; 1998; 2002) and the compensation principle for the EOp (Fleurbaey and Schokkaert, 2009; 2011), this paper calculates and decomposes the urban-rural health care fairness gaps in China. Using data from the China Health and Nutrition Survey (CHNS), the results show that: (1) during the two periods of 1997-2000 and 2004-2006, the fairness gaps (when we take urban circumstances as the “ideal” reference circumstances) are 1.167 and 1.744 respectively, it indicates that the results is underestimated from the original statistical data; (2) the significance of reimbursement ratio decreases in the fairness gap in the later period, which probably implies that it is less effective to narrow urban-rural gap only by upgrading the reimbursement ratios.

The rest of this paper is organized as follows: Section 2 presents theories and methods. Section 3 outlines data sources and variables. Section 4 calculates and explains the urban-rural fairness gaps in health care by using the CHNS data. Section 5 offers conclusion.

2. Theories and Methods

2.1. Equality of Opportunity

In second principle of justice, Rawls (1971) points out that the public opportunities should open to all individuals equally, regardless of races, religions or other identity. Difference principle (or Rawls maximin principle) means the most disadvantage group should be granted the maximal opportunity. Based on Rawls (1971), Sen (1980, 1999) emphasizes that people have the capabilities to choose the most value lifestyle. Dworkin (1981a, 1981b) introduces the concept of equality of resources. It suggesting that some disadvantages should be compensated, even if they are caused by external. Arneson (1989) and Cohen (1989) modify Dworkin’s theory, and bring two conceptions: equality of opportunity for welfare and equality of access to advantage the. Based on these theories, Roemer (1993, 1998, 2002) proposes an axiomatic approach for EOp empirical studies.

According to EOp, one’s advantage \( (y) \) is determined by two categories, \( i.e. \) circumstances \( (c) \) and effort \( (e) \); the former is beyond one’s control, the latter is not. Circumstances classify into \( J \) types. The function is as follows:

\[ y = f(c, e) \]

\[ f(c, e) = f(c) + f(e) \]

\[ f(c) = \sum_{j=1}^{J} p_j c_j \]

\[ f(e) = \sum_{j=1}^{J} q_j e_j \]

\[ p_j \text{ and } q_j \] are the weights assigned to each type of circumstance and effort.

\[^{\text{footnote}}\] The first principle is about the priority of freedom, namely, it should be prior considered, on the premise that all people have equal freedom, to maximize the freedom that each one can enjoy.
\[ y_i = y(c_i, e_i). \]  

(1)

It will maximize the advantage of those who possess the least advantage\(^\circ\) In a fair society (Roemer, 1998):

\[ \max \min_c y(c, \tilde{e}). \]

(2)

where \( \tilde{e} \) is one’s effort.

Totaling the advantage of all individuals at each level of effort, we obtain:

\[ \max \int_c \min y(c, e) f(e) de, \]

(3)

where \( f(e) \) is the density function of the effort.

Roemer (1998, pp. 5-32) emphasizes repeatedly that part of the effort can be affected by circumstances, which will affect the distribution characteristics of the advantage indirectly. It means that the advantage is with the (absolute) level of effort rather than (relative) degree of effort in one’s own type. However, the individual only take responsibility for degree of effort in his type, not responsible for the distribution characteristics of the effort. Thus, Roemer defines one’s degree of effort using the quantile \( \pi \) in the conditional distribution of his type. Function (3) can be rewritten as (4), which can also be regarded as an explanation of the maximin principle of Roemer:

\[ \max \int_{\pi} \min y(c, \pi) d\pi. \]

(4)

2.2. Empirical Strategy

2.2.1. Reward Principle & Compensation Principle

For the EOp analysis, Fleurbaey and Schokkaert (2009, 2011) propose two principles—the reward principle and the compensation principle under selective egalitarianism.

Reward principle encourages inequalities caused by effort. For this reason, when measuring the EOp, influences from effort should be wiped off firstly. The typical method is to calculate the “corrected” advantage \( \hat{y}_i \) of individual \( i \) by fixing the value of effort \( \tilde{e} \), i.e. \( \hat{y}_i = y(c_i, \tilde{e}) \). In this way, we can obtain the direct unfairness by calculating the inequality in \( \hat{y} \) using traditional methods such as Gini index.

Compensation principle suggests that the inequalities caused by circumstances should be compensated. Whatever the circumstances, each individual should attain the same advantage in the same effort. Meanwhile, compensation should be given to those who attain less advantage. This principle has a close relationship with the horizontal equity, which indicates that the same health care need should receive the

\(^\circ\) It is worth noting that Roemer puts forward a somewhat different proposal from that of Rawls, who cares about how to maximize the minimum level of advantage, however, across all individuals regardless of their types.
same health care regardless of one’s income level, region or race, etc. All of these factors belonging to circumstances. Base on compensation principle, It sets an “ideal” distribution of $c_i(e^*)$, and then we obtain the fair distribution of $y_i(y_i^*)$ via $y_i^* = y(c^*, e)$. The unfair inequality of opportunity (the fairness gap) is $(y_i - y_i^*)$.

Though the two principles and their corresponding methods have something in common, they are in effect only compatible under one situation that $c$ and $e$ are completely independent, i.e. they are additively separable (Fleurbaey and Schokkaert, 2009). Therefore we need to choose between the two for empirical work where in most cases we cannot ignore the correlation of $c$ and $e$.

This paper will base on the compensation principle in view of the following two reasons. First, what we care about is how to reimburse rural residents for their disadvantage of circumstances. This is much closer to the logic of the compensation principle. Second, reward principle is usually used to explain inequalities within a certain group, while compensation principle, between groups. We concern in this paper whether the same health care needs attain the same health care between urban and rural residents. This is more in line with the compensation principle.

2.2.2. When Roemer Meets Oaxaca

We define $c$ as the indicator of household register (hukou). If $c$ equal to 1 means individual is an urban resident, 0 means rural resident. During the analysis, we define all other factors to the vector $e$, which is classified into two components, $e^1$ and $e^2$. The vector $e^1$ is on behalf of factors whose correlation with $c$ will bring about illegitimate urban-rural differences, e.g. income level and medical insurance types, etc. Contrarily, the vector $e^2$ is on behalf of factors which will not bring about illegitimate differences, e.g. health care needs (Fleurbaey and Schokkaert, 2011). In this way, the advantage can be expressed as a function of $c$, $e^1$ and $e^2$:

$$hc_i = \alpha + \beta \varphi(c_i) + \gamma \psi(e^1_i) + \delta \chi(e^2_i) + \epsilon_i,$$

where $hc$ is the health care use, $\beta$, $\gamma$ and $\delta$ are parameters, $\alpha$ is the constant, and $\epsilon_i$ is an error item. In accordance with the definition of $e^1$, it is appropriate to regard $e^1$ as a function of $c$ and $\pi$ (the degree of effort), i.e.

$$e^1_i = \eta(c_i, \pi_i).$$

Thus (5) can be rewritten as

$$hc_i = \alpha + \beta \varphi(c_i) + \gamma \psi \circ \eta(c_i, \pi_i) + \delta \chi(e^2_i) + \epsilon_i.$$

A more general form can be written as

$$hc_i = \alpha + \beta \varphi(c_i) + (\gamma + \mu \epsilon_i) \psi \circ \eta(c_i, \pi_i) + (\delta + \rho \epsilon_i) \chi(e^2_i) + \epsilon_i,$$

where we add $\mu$ and $\rho$ to separately express the coefficient differences of $\psi \circ \eta(c_i, \pi_i)$.
and $\chi(e_i^2)$ between urban and rural groups.

Defining $\varphi(1)=1$, $\varphi(0)=0$, and taking urban circumstances ($U$) as the “ideal” reference background ($c=1$), then we obtain the fairness gap between urban and rural residents $\hat{\pi}$, as the following:

$$ f.g. = \hat{\beta} + \hat{\rho} \chi(e_i^2 | R) + \hat{\gamma}[\psi \circ \eta(U, \pi_i^1 | R) - \psi \circ \eta(R, \pi_i^1 | R)] + \hat{\mu} \psi \circ \eta(U, \pi_i^1 | R). \quad (9) $$

According to function (9), we can obtain a decomposition form (the right hand of this equation) similar to what proposed by Oaxaca (1973). The constant term can be regarded as a coefficient of the variable $I$, whose value is 1 invariable. Here we consider $I$ as one of the elements of $e_i^2$. The fairness gap between urban and rural residents divides to three parts.

$$ \hat{\beta} + \hat{\rho} \chi(e_i^2 | R) $$
equals to the coefficient effect of $e_i^2$. It indicates that the first part of health care gap, which is from the insufficient health care expenditure of rural residents under urban-rural dualistic.

$$ \hat{\gamma}[\psi \circ \eta(U, \pi_i^1 | R) - \psi \circ \eta(R, \pi_i^1 | R)] $$
equals to the $e_i^1$ environmental characteristic effect. It indicates that the second part of health care gap, which is from the difference circumstances. It equals to difference between the counterfactual characteristics of $e_i^1$ and actual characteristics.

$$ \hat{\mu} \psi \circ \eta(U, \pi_i^1 | R) $$
equals to the $e_i^1$ environmental coefficient effect. It indicates that the third part of health care gap, which is from the implacable urban-rural coefficient differences of $e_i^1$. It means there will be a gap even rural residents in the urban characteristics.

The linear form is:

$$ hc_i = \alpha + \beta c_i + (\gamma + \mu c_i) e_i^1 + (\delta + \rho c_i) e_i^2 + \varepsilon_i \quad (10) $$

for (8), and

$$ e_i^1 = a + bc_i + (d + lc_i) \pi_i^1 + \tau_i \quad (11) $$

for (6), where in (11) $a$ is the constant, $b$, $d$ and $l$ are parameters, and $\tau_i$ is an error item.

The fairness gap is:

$$ f.g. = \hat{\beta} + \hat{\rho} E(e_i^2 | R) + \hat{\gamma}[E(U, \pi_i^1 | R) - E(R, \pi_i^1 | R)] + \hat{\mu} E(U, \pi_i^1 | R). \quad (12) $$

We use the propensity score to get the individual $\pi$ (degree of effort) in his own group. Meanwhile, allowing the error terms of (10) and (11) correlated, we use the

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\* According to Fleurbaey and Schokkaert (2009), the fairness gap should be $y(c_i,e_i) - y(c_i^*,e_i)$. However, in order to obtain positive values of the fairness gap and its components, we use the reverse value here. Since $y(c_i,e_i)$ and $y(c_i^*,e_i)$ are the same for urban residents due to the construction of equation, this fairness gap in effect is the difference between the counterfactual estimate of the rural residents’ health care expenditure in the urban circumstances and the actual health care expenditure of the rural residents.
Geweke-Hajivassiliou-Keane (GHK) simulation (Gates, 2007) to estimate the system.

3. Data

3.1. Data Sources

The sample is from the China Health and Nutrition Survey, which is collected by the Carolina Population Center of the University of North Carolina at Chapel Hill and the National Institute of Nutrition and Food Safety at the Chinese Center for Disease Control and Prevention. It includes nine waves. The URIMIS pilot actions initiate since 2009, the NCMS was established in 2003. Therefore, this paper uses data waves from 1997 to 2006. We set wave 1997 and 2000 as the period 1 group and waves 2004 and 2006 as the group of period 2.

3.2. Variables

As most empirical research, we employ the health care expenditure during the past four weeks as health care utilization. By reference of relative studies on racial/ethical disparities of health and health care (e.g. IOM, 2003; McGuire et al., 2006; Cook et al., 2010; Fleurbaey and Schokkaert, 2011), we define that $e_1$—vector of illegitimate factors—includes variables describing medical insurance policy, region and socioeconomic status (SES), etc., and that $e_2$—vector of legitimate factors—includes variables describing health care needs and individual preferences. Variables in $e_1$ can be classified into three parts: (1) SES variables including family per capita income and education, (2) policy variable, i.e. reimbursement ratio, (3) health care environmental variables, including region, medicines availability and travel time for doctor visits. Variables in $e_2$ are classified into four parts: (1) demographic variables, including age, sex and marital status, (2) general health variables, including self-reported health status and chronic disease history, (3) health variables reflecting situations of illness, i.e. types of illness one had suffered from and the severity of the illness, during the past four weeks, (4) preference variables, including treatment preferences and lifestyle preferences such as whether smoke or drink.

The actual reimbursement ratio (the proportion of health care expenditure paid for by the medical insurance) may be the best indicator to measure the insuring degree.

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As Gates (2007) explains, the GHK simulation has excellent features, and it is widely used in the health economics domain, e.g. Deb and Trivedi (2006), Balia and Jones (2008) and Rosa-Dias (2010), etc. STATA has already developed the corresponding command `cmp`, which is detailedly introduced by Roodman (2009).

In the CHNS questionnaires there are relevant questions which we can use directly for the measurement.
and the health care economic burden. If respondents who did participate in medical insurances but spent zero on health care, we take their self-reported policy reimbursement ratios as replacements. If one’s self-reported policy reimbursement ratio is missing, we replace the missing value with the average value of same characteristic respondents. Meanwhile, the treatment preferences are usually ignored in the health care researches. In this paper we control the treatment preferences to some extent via the answer of “what did you do when you felt ill”. In addition, price level adjusts to the 2009 year.

The final sample includes 4168 individuals. The period 1 includes 1076 sample number, and the period 2 includes 3092. In period 1, 412 respondents are from urban areas. And, there are 1283 urban respondents and 1809 rural respondents in period 2. The description of variables is shown in Table 1, where we see obvious urban-rural differences in the past-four-week health care expenditure. The directly observed differences are 225.096 and 268.149 respectively in period 1 and period 2, with the urban residents expending more in both periods. Urban-rural differences of SES variables, income and education, as well as policy variable, actual reimbursement ratio, are evident, too. Meanwhile, the urban-rural differences expressed by medical environmental variables in $e^1$ seem small, which are somewhat counter-intuitive. Maybe these available variables are not able to reflect the qualities of health care properly or completely, although they do show differences. However, they are still reserved for the fairness gap analysis out of consideration for comprehensiveness and completion.

4. Results

How large are the urban-rural inequalities of opportunity in health care utilization? The results are shown in Table 2.

When the urban circumstances are regarded as the “ideal” reference circumstances of $c$, the total fairness gap is 262.670 yuan in period 1, the urban-rural difference is 225.096 yuan. The ratio of the fairness gap is 1.167 in period 1. The statistics shows that urban residents spend more 100 yuan than rural residents. However, rural residents should spend more 16.7 yuan per capita than urban residents through the equity view. The fairness gap will reach 116.7 yuan. Similarly, the urban-rural difference is 268.149 yuan in period 2, the calculated fairness gap is 467.521 yuan. The ratio of the fairness gap to the average urban-rural difference is

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$^7$ In the CHNS questionnaires the corresponding questions are “What percentage of the fees for outpatient care does your insurance pay (not including registration fee)” and “What percentage of the fees for inpatient care does your insurance pay (not including food expenses)”.
The statistics shows that rural residents spend less 100 yuan per capita than urban residents. Based on the EOp, rural residents should spend 74.4 yuan more per capita. Compared with the outcome inequality, situation of rural residents is much worse. Moreover, the value of the *fairness gap* in period 2 is bigger than period 1. It shows the inequality of opportunity is increasing with time going.

Table 2 also shows that the three parts of the *fairness gap*. The effect of first part is more significant than other two parts. The ratios of $e^2$ coefficient effects are 0.674 in period 1, and 1.173 in period 2. It indicates that the urban-rural gaps accounts for 57.75% of the whole fairness gap in period 1, and 67.25% in period 2. We think that health consciousness and service qualities play a key effect. There is ingrained difference between urban and rural residents in the consciousness of health and health care utilization and health service qualities. Urban residents prefer to more health investment, and usually receive better medicine and techniques first.

The $e^1$ environmental coefficient effect are 8.5% in period 1, and 4.8% in period 2. In addition, the ratios of $e^1$ environmental characteristic effect are 0.408 and 0.522 respectively. It makes up 34.96% of the whole fairness gap in period 1 and 29.93% in period 2.

The effect of reimbursement ratio is 0.236 in period 1, 0.003 in period 2. The effect is much less in period 2. The reason is the NCMS initiate after period 1. the NCMS reduce reimbursement benefit inequality between urban and rural in medical accessibility.

There is index number problem in the Oaxaca decomposition. Based on De Muurger et al. (2007), we re-conduct the fairness gap decomposition, with rural circumstances (R) as the “ideal” reference circumstances. The robustness test supports above result. The details shows in Table 3.

### 5. Conclusion

Based on EOp and compensation principle, This paper analyzes inequality health care utilization between urban and rural in China. We define three components of the fairness gap, the $e^2$ coefficient effect, the $e^1$ environmental characteristic effect, and the $e^1$ environmental coefficient effect. The results indicate that statistical data may underestimate the degree of the essential inequalities. These inequalities are from environmental characteristic. Inequality of opportunity is due to the expansion of income inequality, which is from "hukou" restrictions. Due to the establishment of the NCMS, the effect of reimbursement ratio makes a dramatic change during the two periods. It reduces the inequalities of opportunity between urban and rural.
Due to widening of urban-rural income gap, it is insufficient to narrow the fairness-gap only by unifying the medical insurance policies for both urban and rural residents. Accordance with the *maximin principle* of Roemer, our suggestion is improve the affordability of the rural poor.
References


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Bank, 2005.

Table 1
Description of Variables

<p>| Variables | Period 1 | | | Period 2 | | |
|-----------|----------|----------|----------|----------|----------|
|           | Urban | Rural | Urban | Rural | Urban | Rural |
| y         | Mean | Sd. | Mean | Sd. | Mean | Sd. |
| Health care expenditure during the past 4 weeks | 779.758 | 2201.553 | 554.663 | 2189.791 | 709.827 | 5039.766 | 441.677 | 2351.327 |
| e1        |         |         |         |         |         |         |
| Family per capita income (yuan/year) | 6943.783 | 7030.383 | 4569.000 | 5328.661 | 10729.150 | 10548.700 | 5796.847 | 8870.297 |
| Region (1= the east region, 0= others) | 0.383 | 0.487 | 0.325 | 0.469 | 0.486 | 0.500 | 0.411 | 0.492 |
| Medicines availability(1=yes, 0=no) | 0.951 | 0.215 | 0.967 | 0.179 | 0.988 | 0.111 | 0.985 | 0.121 |
| e2        |         |         |         |         |         |         |
| Basic Demographic Information |         |         |         |         |         |         |
| Age (years) | 53.008 | 16.252 | 52.322 | 15.692 | 54.145 | 15.897 | 55.435 | 14.686 |
| Sex (1=male, 0=female) | 0.422 | 0.495 | 0.438 | 0.497 | 0.434 | 0.496 | 0.423 | 0.494 |
| Marital status (1= married, 0= others) | 0.801 | 0.400 | 0.797 | 0.403 | 0.796 | 0.403 | 0.811 | 0.392 |
| General Health Information |         |         |         |         |         |         |
| Self-reported health status | 2.138 | 0.750 | 2.056 | 0.819 | 2.228 | 0.797 | 2.061 | 0.785 |
| (4=excellent, 3=good, 2=fair, 1=poor) |         |         |         |         |         |         |
| Ever diagnosed High blood pressure (1=yes, 0=no) | 0.182 | 0.386 | 0.148 | 0.355 | 0.246 | 0.431 | 0.170 | 0.376 |
| Diabetes (1=yes, 0=no) | 0.158 | 0.365 | 0.123 | 0.329 | 0.194 | 0.396 | 0.132 | 0.339 |</p>
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<tbody>
<tr>
<td>Myocardial infarction (1=yes, 0=no)</td>
<td>0.015</td>
<td>0.120</td>
<td>0.014</td>
<td>0.116</td>
<td>0.014</td>
<td>0.118</td>
<td>0.009</td>
<td>0.094</td>
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<tr>
<td>Apoplexy (1=yes, 0=no)</td>
<td>0.039</td>
<td>0.193</td>
<td>0.027</td>
<td>0.163</td>
<td>0.034</td>
<td>0.180</td>
<td>0.025</td>
<td>0.156</td>
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**Illness During the Past 4 Weeks**

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<tbody>
<tr>
<td>Suffered from chronic or acute diseases (1=yes, 0=no)</td>
<td>0.874</td>
<td>0.332</td>
<td>0.883</td>
<td>0.322</td>
<td>0.634</td>
<td>0.482</td>
<td>0.669</td>
<td>0.471</td>
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<tr>
<td>Got fever, sore throat or cough (1=yes, 0=no)</td>
<td>0.359</td>
<td>0.480</td>
<td>0.357</td>
<td>0.479</td>
<td>0.373</td>
<td>0.484</td>
<td>0.362</td>
<td>0.481</td>
<td></td>
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<tr>
<td>Got diarrhea or stomachache (1=yes, 0=no)</td>
<td>0.126</td>
<td>0.332</td>
<td>0.131</td>
<td>0.338</td>
<td>0.156</td>
<td>0.363</td>
<td>0.153</td>
<td>0.360</td>
<td></td>
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<tr>
<td>Got headache or dizziness (1=yes, 0=no)</td>
<td>0.306</td>
<td>0.461</td>
<td>0.283</td>
<td>0.451</td>
<td>0.253</td>
<td>0.435</td>
<td>0.265</td>
<td>0.441</td>
<td></td>
</tr>
<tr>
<td>Got joint pain or muscle pain (1=yes, 0=no)</td>
<td>0.165</td>
<td>0.372</td>
<td>0.181</td>
<td>0.385</td>
<td>0.260</td>
<td>0.439</td>
<td>0.281</td>
<td>0.450</td>
<td></td>
</tr>
<tr>
<td>Got rash or dermatitis (1=yes, 0=no)</td>
<td>0.032</td>
<td>0.175</td>
<td>0.024</td>
<td>0.153</td>
<td>0.036</td>
<td>0.186</td>
<td>0.024</td>
<td>0.152</td>
<td></td>
</tr>
<tr>
<td>Got eye/ear disease (1=yes, 0=no)</td>
<td>0.034</td>
<td>0.181</td>
<td>0.026</td>
<td>0.158</td>
<td>0.062</td>
<td>0.240</td>
<td>0.050</td>
<td>0.217</td>
<td></td>
</tr>
<tr>
<td>Got heart disease/heart pain (1=yes, 0=no)</td>
<td>0.102</td>
<td>0.303</td>
<td>0.069</td>
<td>0.254</td>
<td>0.112</td>
<td>0.316</td>
<td>0.082</td>
<td>0.274</td>
<td></td>
</tr>
<tr>
<td>Got other infectious disease (1=yes, 0=no)</td>
<td>0.032</td>
<td>0.175</td>
<td>0.032</td>
<td>0.175</td>
<td>0.047</td>
<td>0.211</td>
<td>0.050</td>
<td>0.217</td>
<td></td>
</tr>
<tr>
<td>Got noncommunicable disease (1=yes, 0=no)</td>
<td>0.158</td>
<td>0.365</td>
<td>0.149</td>
<td>0.356</td>
<td>0.244</td>
<td>0.430</td>
<td>0.187</td>
<td>0.390</td>
<td></td>
</tr>
<tr>
<td>Severity of the illness (3=quite severe, 2=somewhat severe, 1=not severe)</td>
<td>1.740</td>
<td>0.689</td>
<td>1.640</td>
<td>0.674</td>
<td>1.687</td>
<td>0.657</td>
<td>1.702</td>
<td>0.665</td>
<td></td>
</tr>
<tr>
<td>Inpatient visits (1=yes, 0=no)</td>
<td>0.092</td>
<td>0.290</td>
<td>0.074</td>
<td>0.262</td>
<td>0.031</td>
<td>0.174</td>
<td>0.030</td>
<td>0.170</td>
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</tbody>
</table>

**Preferences**

<p>| | | | | | | | | | |</p>
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<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>What to do when felt ill (4=none, 3=saw a doctor, 2=saw the local health worker, 1=self care)</td>
<td>2.522</td>
<td>0.908</td>
<td>2.706</td>
<td>0.751</td>
<td>2.074</td>
<td>1.168</td>
<td>2.472</td>
<td>1.048</td>
<td></td>
</tr>
<tr>
<td>Ever smoked (1=yes, 0=no)</td>
<td>0.250</td>
<td>0.434</td>
<td>0.304</td>
<td>0.460</td>
<td>0.313</td>
<td>0.464</td>
<td>0.307</td>
<td>0.462</td>
<td></td>
</tr>
<tr>
<td>Drink alcohol last year (1=yes, 0=no)</td>
<td>0.316</td>
<td>0.465</td>
<td>0.280</td>
<td>0.449</td>
<td>0.341</td>
<td>0.474</td>
<td>0.280</td>
<td>0.449</td>
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</tr>
</tbody>
</table>

**Number of sub-sample**

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>412</td>
<td>664</td>
<td>1283</td>
<td>1809</td>
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</table>
Table 2
Decomposition of the Fairness Gaps Using CHNS Data

<table>
<thead>
<tr>
<th></th>
<th>Period 1</th>
<th></th>
<th>Period 2</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Directly observed average differences</td>
<td>Fairness Gap</td>
<td>Ratio</td>
<td>Fairness Gap</td>
</tr>
<tr>
<td>Age</td>
<td>387.248</td>
<td>1.720</td>
<td>-801.470</td>
<td>-2.989</td>
</tr>
<tr>
<td>Male</td>
<td>76.158</td>
<td>0.338</td>
<td>251.163</td>
<td>0.937</td>
</tr>
<tr>
<td>Married</td>
<td>-123.302</td>
<td>-0.548</td>
<td>-105.519</td>
<td>-0.394</td>
</tr>
<tr>
<td>Self-reported health: fair</td>
<td>166.831</td>
<td>0.741</td>
<td>-593.614</td>
<td>-2.214</td>
</tr>
<tr>
<td>Self-reported health: good</td>
<td>56.920</td>
<td>0.253</td>
<td>-305.803</td>
<td>-1.140</td>
</tr>
<tr>
<td>Self-reported health: excellent</td>
<td>18.001</td>
<td>0.080</td>
<td>-29.494</td>
<td>-0.110</td>
</tr>
<tr>
<td>High blood pressure</td>
<td>54.396</td>
<td>0.242</td>
<td>0.897</td>
<td>0.003</td>
</tr>
<tr>
<td>Diabetes</td>
<td>-79.090</td>
<td>-0.351</td>
<td>51.664</td>
<td>0.193</td>
</tr>
<tr>
<td>Myocardial infarction</td>
<td>6.067</td>
<td>0.027</td>
<td>-4.507</td>
<td>-0.017</td>
</tr>
<tr>
<td>Apoplexy</td>
<td>7.781</td>
<td>0.035</td>
<td>-3.898</td>
<td>-0.015</td>
</tr>
<tr>
<td>Suffered from chronic or acute diseases</td>
<td>667.391</td>
<td>2.965</td>
<td>-165.665</td>
<td>-0.618</td>
</tr>
<tr>
<td>Got fever, sore throat or cough</td>
<td>-136.195</td>
<td>-0.605</td>
<td>90.036</td>
<td>0.336</td>
</tr>
<tr>
<td>Got diarrhea or stomachache</td>
<td>-28.023</td>
<td>-0.124</td>
<td>-44.276</td>
<td>-0.165</td>
</tr>
<tr>
<td>Got headache or dizziness</td>
<td>78.907</td>
<td>0.351</td>
<td>-48.257</td>
<td>-0.180</td>
</tr>
<tr>
<td>Got joint pain or muscle pain</td>
<td>-1.126</td>
<td>-0.005</td>
<td>41.766</td>
<td>0.156</td>
</tr>
<tr>
<td>Got rash or dermatitis</td>
<td>4.013</td>
<td>0.018</td>
<td>40.411</td>
<td>0.151</td>
</tr>
<tr>
<td>Got eye/ear disease</td>
<td>-42.756</td>
<td>-0.190</td>
<td>24.671</td>
<td>0.092</td>
</tr>
<tr>
<td>Got heart disease/cHEST pain</td>
<td>34.711</td>
<td>0.154</td>
<td>63.017</td>
<td>0.235</td>
</tr>
<tr>
<td>Got other infectious disease</td>
<td>39.230</td>
<td>0.174</td>
<td>17.924</td>
<td>0.067</td>
</tr>
<tr>
<td>Got noncommunicable disease</td>
<td>-64.060</td>
<td>-0.285</td>
<td>46.340</td>
<td>0.173</td>
</tr>
<tr>
<td>Severity of the illness: somewhat severe</td>
<td>111.614</td>
<td>0.496</td>
<td>-4.149</td>
<td>-0.015</td>
</tr>
<tr>
<td>Severity of the illness: quite severe</td>
<td>82.171</td>
<td>0.365</td>
<td>133.673</td>
<td>0.499</td>
</tr>
<tr>
<td>Inpatient</td>
<td>-8.388</td>
<td>-0.037</td>
<td>43.000</td>
<td>0.160</td>
</tr>
<tr>
<td>To see local health worker when felt ill</td>
<td>0.692</td>
<td>0.003</td>
<td>-20.647</td>
<td>-0.077</td>
</tr>
<tr>
<td>To see a doctor when felt ill</td>
<td>163.488</td>
<td>0.726</td>
<td>189.518</td>
<td>0.707</td>
</tr>
<tr>
<td>To do nothing when felt ill</td>
<td>31.194</td>
<td>0.139</td>
<td>55.693</td>
<td>0.208</td>
</tr>
<tr>
<td>Smoke</td>
<td>-3.613</td>
<td>-0.016</td>
<td>-54.234</td>
<td>-0.202</td>
</tr>
<tr>
<td>Drink</td>
<td>-165.846</td>
<td>-0.737</td>
<td>-103.918</td>
<td>-0.388</td>
</tr>
<tr>
<td>Wave</td>
<td>-27.906</td>
<td>-0.124</td>
<td>-99.114</td>
<td>-0.370</td>
</tr>
<tr>
<td>Intercept</td>
<td>-1154.844</td>
<td>-5.130</td>
<td>1649.307</td>
<td>6.151</td>
</tr>
<tr>
<td></td>
<td>151.663</td>
<td>0.674</td>
<td>314.513</td>
<td>1.173</td>
</tr>
</tbody>
</table>

$e^1$ coefficient effect:

Family per capita income | -15.542 | -0.069 | 147.014 | 0.548 |
Education                 | 70.475  | 0.313  | 13.324  | 0.050 |
Reimbursement ratio       | 53.126  | 0.236  | 0.793   | 0.003 |
East China                | -8.402  | -0.037 | -20.763 | -0.077 |
Travel time to health facility | -9.245   | -0.041 | -0.729  | -0.003 |
Medicines available       | 1.352   | 0.006  | 0.373   | 0.001 |

$e^1$ environmental characteristic effect:
<table>
<thead>
<tr>
<th>Environmental coefficient effect:</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Family per capita income</td>
<td>-28.221</td>
<td>-0.125</td>
<td>87.714</td>
<td>0.327</td>
</tr>
<tr>
<td>Education</td>
<td>129.135</td>
<td>0.574</td>
<td>16.578</td>
<td>0.062</td>
</tr>
<tr>
<td>Reimbursement ratio</td>
<td>16.633</td>
<td>0.074</td>
<td>10.050</td>
<td>0.037</td>
</tr>
<tr>
<td>East China</td>
<td>-34.839</td>
<td>-0.155</td>
<td>-64.626</td>
<td>-0.241</td>
</tr>
<tr>
<td>Travel time to health facility</td>
<td>-68.028</td>
<td>-0.302</td>
<td>21.779</td>
<td>0.081</td>
</tr>
<tr>
<td>Medicines available</td>
<td>4.564</td>
<td>0.020</td>
<td>-58.499</td>
<td>-0.218</td>
</tr>
<tr>
<td>Total</td>
<td>19.244</td>
<td>0.085</td>
<td>12.997</td>
<td>0.048</td>
</tr>
<tr>
<td>Number of sub-sample</td>
<td>262.670</td>
<td>1.167</td>
<td>467.521</td>
<td>1.744</td>
</tr>
</tbody>
</table>

Note: “Ratio” in the 3rd and 5th column denotes the ratio of the decomposed fairness gap as well as the total fairness gap, i.e. each cell in the 2nd and 4th column, to the directly observed average difference in the corresponding period.
Table 3
Robustness Test of Table 2: Rural as the Reference Circumstances

<table>
<thead>
<tr>
<th></th>
<th>Period 1</th>
<th>Period 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Directly observed average differences</td>
<td>225,096</td>
<td>268,149</td>
</tr>
<tr>
<td></td>
<td>Fairness Gap</td>
<td>Ratio</td>
</tr>
<tr>
<td><strong>(e^2) coefficient effect:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>392.324</td>
<td>1.743</td>
</tr>
<tr>
<td>Male</td>
<td>73.391</td>
<td>0.326</td>
</tr>
<tr>
<td>Married</td>
<td>-123.965</td>
<td>-0.551</td>
</tr>
<tr>
<td>Self-reported health: fair</td>
<td>192.867</td>
<td>0.857</td>
</tr>
<tr>
<td>Self-reported health: good</td>
<td>61.505</td>
<td>0.273</td>
</tr>
<tr>
<td>Self-reported health: excellent</td>
<td>13.187</td>
<td>0.059</td>
</tr>
<tr>
<td>High blood pressure</td>
<td>67.092</td>
<td>0.298</td>
</tr>
<tr>
<td>Diabetes</td>
<td>-101.040</td>
<td>-0.449</td>
</tr>
<tr>
<td>Myocardial infarction</td>
<td>6.518</td>
<td>0.029</td>
</tr>
<tr>
<td>Apoplexy</td>
<td>11.146</td>
<td>0.050</td>
</tr>
<tr>
<td>Suffered from chronic or acute diseases</td>
<td>660.779</td>
<td>2.936</td>
</tr>
<tr>
<td>Got fever, sore throat or cough</td>
<td>-137.071</td>
<td>-0.609</td>
</tr>
<tr>
<td>Got diarrhea or stomachache</td>
<td>-26.994</td>
<td>-0.120</td>
</tr>
<tr>
<td>Got headache or dizziness</td>
<td>85.231</td>
<td>0.379</td>
</tr>
<tr>
<td>Got joint pain or muscle pain</td>
<td>-1.028</td>
<td>-0.005</td>
</tr>
<tr>
<td>Got rash or dermatitis</td>
<td>5.254</td>
<td>0.023</td>
</tr>
<tr>
<td>Got eye/ear disease</td>
<td>-56.747</td>
<td>-0.252</td>
</tr>
<tr>
<td>Got heart disease/ chest pain</td>
<td>51.078</td>
<td>0.227</td>
</tr>
<tr>
<td>Got other infectious disease</td>
<td>39.139</td>
<td>0.174</td>
</tr>
<tr>
<td>Got noncommunicable disease</td>
<td>-67.785</td>
<td>-0.301</td>
</tr>
<tr>
<td>Severity of the illness: somewhat severe</td>
<td>122.736</td>
<td>0.545</td>
</tr>
<tr>
<td>Severity of the illness: quite severe</td>
<td>103.797</td>
<td>0.461</td>
</tr>
<tr>
<td>Inpatient</td>
<td>-10.483</td>
<td>-0.047</td>
</tr>
<tr>
<td>To see local health worker when felt ill</td>
<td>0.367</td>
<td>0.002</td>
</tr>
<tr>
<td>To see a doctor when felt ill</td>
<td>151.617</td>
<td>0.674</td>
</tr>
<tr>
<td>To do nothing when felt ill</td>
<td>26.976</td>
<td>0.120</td>
</tr>
<tr>
<td>Smoke</td>
<td>-2.969</td>
<td>-0.013</td>
</tr>
<tr>
<td>Drink</td>
<td>-186.812</td>
<td>-0.830</td>
</tr>
<tr>
<td>Wave</td>
<td>-24.483</td>
<td>-0.109</td>
</tr>
<tr>
<td>Intercept</td>
<td>-1154.844</td>
<td>-5.130</td>
</tr>
<tr>
<td></td>
<td>170.783</td>
<td>0.759</td>
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<tr>
<td><strong>(e^1) environmental characteristic effect:</strong></td>
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</tr>
<tr>
<td>Family per capita income</td>
<td>-0.874</td>
<td>-0.004</td>
</tr>
<tr>
<td>Education</td>
<td>18.030</td>
<td>0.080</td>
</tr>
<tr>
<td>Reimbursement ratio</td>
<td>16.448</td>
<td>0.073</td>
</tr>
<tr>
<td>East China</td>
<td>-2.170</td>
<td>-0.010</td>
</tr>
<tr>
<td>Travel time to health facility</td>
<td>-4.561</td>
<td>-0.020</td>
</tr>
<tr>
<td>Medicines available</td>
<td>2.793</td>
<td>0.012</td>
</tr>
<tr>
<td>Factor</td>
<td>29.667</td>
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</tr>
<tr>
<td>------------------------------</td>
<td>--------</td>
<td>-------</td>
</tr>
<tr>
<td><strong>Environmental Coefficient Effect:</strong></td>
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</tr>
<tr>
<td>Family per capita income</td>
<td>-42.889</td>
<td>-0.191</td>
</tr>
<tr>
<td>Education</td>
<td>181.580</td>
<td>0.807</td>
</tr>
<tr>
<td>Reimbursement ratio</td>
<td>53.310</td>
<td>0.237</td>
</tr>
<tr>
<td>East China</td>
<td>-41.072</td>
<td>-0.182</td>
</tr>
<tr>
<td>Travel time to health facility</td>
<td>2.187</td>
<td>0.010</td>
</tr>
<tr>
<td>Medicines available</td>
<td>-72.712</td>
<td>-0.323</td>
</tr>
<tr>
<td></td>
<td>80.404</td>
<td>0.357</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>280.854</strong></td>
<td><strong>1.248</strong></td>
</tr>
</tbody>
</table>

**Note:** “Ratio” in the 3rd and 5th column denotes the ratio of the decomposed fairness gap as well as the total fairness gap, i.e. each cell in the 2nd and 4th column, to the directly observed average difference in the corresponding period.
Appendix

Examples of the Misleading Aspects of the *Outcome Equality* in the Health Care Analysis

In the introduction of this paper, we endorse the idea that we should focus on the essential equity, *i.e.* the *equality of opportunity* (EOp), rather than the *outcome equality* or the *reimbursement equality* of health care. Here we give three examples as a simple explanation. Example A and B explain the misleading use of the *outcome equality*, and Example C, the *reimbursement equality*.

Example A: Suppose the aging proportion is higher among urban residents, who involuntarily have more health need, and thus more health care expenditure, than the rural residents. Such urban-rural differences due to demographic characteristics are indeed reasonable and desirable, reflecting the effective allocation of health resources. Under such situation, policies need no interfere, while purchasing the *outcome equality* may result in inefficiency.

Example B: Suppose there are two residents belonging respectively to the urban and rural areas. The health care expenditure of the rural resident should have been 1000 yuan because of his serious illness. However, as lack of money or effective medical security, his actual expenditure is only 500 yuan. Meanwhile, the urban resident, who enjoys a more generous medical insurance, spends the same 500 yuan for a health problem, such as flu, which could have been cured with the expense of only 100 yuan. There seems no inequality from straightforward the aspect of actual expenditure on health care. However, the essential inequality was concealed.

Example C: Suppose there are two residents belonging respectively to the urban and rural areas and enjoying the same reimbursement of 50%. One day, they both are attacked by a same disease, such as flu. However, the rural resident decides not to see a doctor because of lack of money, but the urban resident does. Then, the premium paid by the rural resident in effect is used to reimburse the urban resident, resulting in the phenomenon of *the rural help the urban* or *the poor help the rich*, although we are reluctant to face it. Thus when we judge basing on the reimbursement equality, such as unifying the reimbursement policies for both urban and rural residents, there may also be essential inequities.