

Measures and underlying mechanisms of inequality of opportunities in China: Evidence from CGSS data

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This paper utilizes the latest CGSS data to quantitatively measure the contribution of inequality of opportunities to the overall income inequality in China. It finds that 27% of total income inequality can be attributed to inequality of opportunities, i.e., the inequality component which is out of control for individuals. This ratio is comparable to that found in most Latin American countries with high income inequality. The heterogeneity analyses show that the inequality of opportunities is even larger for low-educated and low-income groups. Furthermore, the paper empirically verifies three possible channels underlying the measured inequality of opportunities, including labor market discrimination, intergenerational education persistence, and family background effect. Policy suggestions are derived based on the empirical analyses, such as reducing labor market discrimination, balancing education resources among different areas, making it more transparent in state sector recruitment, and lowering inequality by more progressive taxes and transfers.

Keywords: inequality of opportunities, labor market discrimination, intergenerational education persistence, family background

1. Introduction

The past decade has witnessed the income inequality staying at a high level in China. According to the data released by the National Bureau of Statistics, China's Gini coefficient of individuals' annual income has always been above 0.47 since 2003, with the highest level at 0.491 in 2009. Although the Gini coefficient is reduced to 0.469 in 2014, below 0.47 for the first time, it still exceeds 0.4, the well-recognized international alert line. The continued widening income inequality in China has been brought into the spotlight in academia (Yin *et al.*, 2016; Hu and Hu, 2007; Li *et al.*, 2013; Chen and Lin, 2013). However, which factor does contribute to the income inequality in China? Is it the inequality of opportunities confronting us, or the market competition on the premise of equality of opportunities?

Since 1980s, many scholars have noted that it is not necessarily bad to have income inequality for a country. If the income inequality is resulted from different efforts by individuals, it is acceptable, and is able to inspire low-income people to work hard.

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What is unacceptable in our society is the inequality caused by acquired factors beyond the control of individuals (Arneson, 1989; Dworkin, 1981; Sen, 1985). Roemer (1998) applies the above opinion in the model of economics and divided the factors which determined personal income into two kinds. (1)The factor of circumstances, such as family background, gender and birth place, etc. This kind of factor is uncontrolled by acquired efforts, or beyond the scope under our subjective control. (2)The factor of personal efforts. To some degree, it can be controlled by individuals due to their acquired behavior and choice. Roemer calls the first factor of circumstances as the “inequality of opportunities”, and deems it as the social issue of real concern which needs to be solved. The concept of the equality of opportunities is officially proposed in the development report of *Equity and Development* by the World Bank. That is to say, the determinant factor for personal success lies in what efforts a person has made rather than “external factor of circumstances” evidenced by gender, race, family background and birth of place, etc. Zhuang and Ravi (2013), and Zhuang (2010) hold that the equality of opportunities occupies the core position of the idea of inclusive growth.

With the proposal and progress of concepts like the inequality of opportunities, the past ten years have seen a lot of papers which analyzed the issue of inequality of opportunities facing the United States, Europe, Latin America and Arab countries, and put forward a standard approach to measure the degree of a country’s inequality of opportunities (Bourguignon, Ferreira and Menéndez, 2013; Ferreira and Gignoux, 2011; Marrero and Rodriguez, 2012). This study shows that the inequality of opportunities in developed countries is generally low, which is lower than 20% of the total income inequality, while the inequality of opportunities in Latin America is higher, which explains over 30% of the total income inequality. Nevertheless, it is very limited concerning literature studying the degree of the inequality of opportunities in China. This paper tries to fill the gap in such area.

According to the internationally-agreed definition, this paper defines the inequality of opportunities as the inequality caused by factors beyond people’s subjective control. To take a simple example, normally, family background is an uncontrolled factor, like parents’ degree and social relations. So if the income inequality among individuals is completely due to the family background instead of the different efforts made by different people with the same family background, it demonstrates that the degree of the inequality of opportunities is quite high.

There are at least two implications in studying the issue of the inequality of opportunities. Firstly, it is helpful for us to locate the reasons behind the income inequality and formulate tailored policies so as reduce the degree of the inequality. Bai (2006) points out that whether the reason of income inequality is the inequality of opportunities, or the market competition on condition of equality of opportunity, is of paramount importance to interpret the causes and counter-measures of the income inequality in China. Xia (2013) cites the examples in China’s Southern Song Dynasty

and proves the significance of the equality of opportunities. During the period of the Southern Song Dynasty, the disparity problem is quite serious too. But it didn't lead to instability in society. The disparity then, on the contrary, is mainly attributed to the system of official selection in the Southern Song Dynasty when a larger percentage of civilians stood out from the candidates in the imperial examination.

Next, studying the issue of the inequality of opportunities is beneficial for us to set up the positive mechanism of mobility and promote the sustained economic development. The famous economists Ravallion and Lokshin (2000) put forward the Tunnel effect, which indicates that if each poor person can see the hope of turning rich, the social ladder will be built where everyone is encouraged to work hard with full of hope. Those people who are waiting for trains in the tunnel may miss the train this time but believe they will get on the next one. The economists hold view that as long as such social ladder is constructed, the income inequality will no longer be social concern. The inequality of opportunities, as is manifested, will affect social fairness and greatly dampen people's working enthusiasm, thus taking a toll on the economic growth. Shown by the latest research, only the income inequality caused by inequality of opportunities will put a brake on the economic development; while the income inequality led by acquired efforts will stimulate the increase of economy (Marrero and Rodriguez, 2013). Therefore, it is essential to accurately measure the proportion of the income inequality in China which is due to the inequality of opportunities.

This paper will take advantage of the latest data of China Comprehensive Social Survey 2012 (CGSS) to measure the degree of inequality of opportunities in China and calculate the income inequality caused by opportunity inequality in the proportion of the total income inequality, then explore the fundamental reason of the income inequality in China which is too large and the according solutions. Based on the existing literature, this paper mainly presents four contributions as follows.

First of all, this paper increases the proportion of the environmental factors contained in the opportunity set, and thus can offer a more accurate measurement of the degree of inequality. A few environmental factors are adopted in the existing study measuring the inequality of opportunities, such as parents' education degree and gender. If there are too limited elements in the opportunity set, the degree of inequality of opportunity will be underestimated (Ferreira and Gignoux, 2011). The family background is a factor beyond personal control and has a significant impact on income. Based on the abundant data of family background, the paper incorporates different variables into the factor of environment, like traditional variable of gender and many variables reflecting family background including the family economic status of an individual at the age of 14, parents' respective education level, and their nature of work and job position. Since these variables are indicators of an individual at 14, they will not be very susceptible to the degree of personal efforts. Also, this paper features another innovation that it considers the type of household registration at birth

as part of the family background, and puts this into the opportunity set. As is known to us all, for each and every person, the type of household registration and place at birth are mainly decided by the type of household registration of parents (Fields and Song, 2013), and the household registration exerts great influence on personal income. It is unprecedented in research to include the type of household registration into the opportunity set.

Secondly, this paper will adopt the newest method to measure the inequality of opportunities, that is to say, using Theil index to measure the absolute and relative extent of the inequality of opportunities, an innovation in the research method in this paper. The existing studies mainly use Gini coefficient to calculate the income inequality and the inequality of opportunities (Erisson and Zhang, 2010). However, Gini coefficient is not additively decomposable, thus unable to be adopted to accurately measure the proportion of the inequality of opportunities in the whole income inequality (Shorrocks, 1980). This paper employs the way of decomposing Theil index proposed by Ferreira and Gignoux (2011) to measure the proportion of the inequality of opportunity in the total income inequality. The Theil index, a measurement index which is additively decomposable (Shorrocks, 1984), can calculate the relative degree of the inequality of opportunities in a more accurate manner.

Thirdly, this study not only analyzes the whole extent of the inequality of opportunities in China, but discusses each category of different ages. In particular, this paper tries to figure out how much the income difference is resulted from the opportunity inequality among young people. As the backbone of China's development in the future, young people are faced with issues exemplified by the inequality of opportunities, which worth more social attention. Imagine if uncontrollable factors lead to income inequality among young people, factors of wide opportunity inequality, it will stop young men to harbor hope for the future, and will constrain China's long-term development and social progress.

Finally, this paper will also provide an in-depth analysis of the influence path regarding the income inequality, and then put forward targeted policy suggestions. We can be informed by the result of the empirical analysis what percentage of the income inequality is attributed to uncontrollable factors (the inequality of opportunities) for an individual. Yet, why would such factors contribute to the income inequality?

In this paper, three major ways are offered as follows: labor market discrimination; education persistence; and the influence of family background (namely, the social phenomenon of "fathers' competition"). (1) The labor market discrimination due to gender and household registration makes it impossible for people with different genders and household registrations to access the labor market return on an equal footing. (2) Education persistence refers to that students from low-income families are in a difficult situation to embrace quality education. This results in the differences of education opportunity and quality among individuals with distinct family backgrounds, and such

differences will further lead to the income inequality (Tang, 2011). (3) Good family backgrounds will enable our children to receive quality education, and meanwhile help them to gain better employment opportunity and higher income by virtue of social connections. Li, Meng, Shi, and Wu (2012), based on the analysis of a survey on university graduates' first job, drew a conclusion as follows. After excluding personal and family factors, the children of the cadre family earn 15% higher than the average wage of the first job for children of the non-cadre family, which reflects the income inequality due to the difference in family "relationship". And after measuring the degree of inequality of opportunities in China, this paper will discuss several reasons why inequality of opportunity leads to income disparities and further provide more reliable policy suggestions for China to reduce inequality of opportunity.

The structure of this paper is organized as follows. The second part will review the literature of the inequality opportunities at home and abroad, and compare the inequality of opportunities in different countries. The third part will introduce the methods and models for measuring the inequality of opportunity. The fourth part will provide the data description and obtain the result of the measurement analysis. The fifth part will explore in depth the essential reasons of the inequality of opportunities in China, and verify the following three assumptions respectively: labor market discrimination, educational persistence and family background. Finally, the main conclusions and policy suggestions are presented.

2. Literature review and issues raised

Since the 1980s many scholars have channeled great efforts to the issue of the inequality of opportunities (IO), but most through normative and qualitative rather than quantitative analysis. After the beginning of the 21st century, researches with the quantitative approach, a way deriving from the study on inter-generational income mobility (or how much the parental income influences that of their offspring), starts to emerge despite its rarity in number. Van de Gaer, Schokkaert, and Martinez (2001) propose to measure the inter-generational income mobility by figuring out the inter-generational income elasticity or with the inter-generational income transition matrix. Indicating the relationship between the income of parents and that of the offspring, the inter-generational income elasticity is analogous to the relations in a positive way. What is more, the parental income is far beyond the individuals' controls, thus the higher the inter-generational elasticity, the more probably the inequality of opportunities shows. According to Yao (2006), the inter-generational income elasticity has been as much as 0.7 in China. Chen (2011) fathoms out the same coefficient to be above 0.6 based on a wider time span of from 1988 to 2005 while Guo and Chen (2015) reckon the numbers in such OECD members and developing countries as the USA, Germany, Switzerland and Chile are 0.4, 0.43, 0.28, 0.57, and 0.52 respectively.

That is, from the perspective of the inter-generational income mobility, China suffers from a worse situation pertaining to the inequality of inter-generational income than other observed countries. Being effective in mirroring the inequality, the elasticity coefficient, however, is not capable of telling the exact percentage of the IO-generated inter-generational income inequality since parents' income serves only as one of the circumstances, or the factors which are beyond the individuals' controls. Based on this, there appears scholars proposing the methods to measure the inequality of opportunities directly and to conduct quantitative analysis over data collected from various countries.

According to Roemer (1998), the income inequality is both a result of the inequality of opportunities and the inequality of efforts. Under this frame work many recent researches concerning quantitatively studying the inequality of opportunities have been conducted and among related literature, many scholars, despite their various definitions of opportunity clusters, have described parents' education backgrounds and income, individuals' places of birth and race as uncontrollable or circumstances, and further examined the income inequality caused by "circumstances" in a bid to tell the exact IO percentage (Lin and Yang, 2014).

There are two ways, namely, parametric estimation and non-parametric estimation, to measure opportunity inequality. Based on the regression equation, parameter estimation algorithm treats the factors in opportunity clusters as explanatory variables, harvesting the results of the predicted income which will suggest the proportion of the inequalities of opportunities from circumstances. And in the situation where elements in opportunity clusters are rarely seen, the non-parameter estimation will be in force. If the only observed circumstance factor is gender, then the income difference between the male and the female is absolutely a result of opportunity inequality while the gap between the same gender the result of individual efforts. As the method has been widely used in recent researches to measure the circumstances-caused inequalities of opportunities, this paper follows the same practice.

Wide attention has been poured into the study on the measure of the IO in Europe, Latin America and Arabian countries. Since countries in the Latin America suffers most from the unequal opportunities, Bourguignon's team (2007) associate the inequality of opportunities with five observed circumstances which lie beyond the control of the individuals—father's and mother's education, father's occupation, race, and place of birth in Brazil, concluding that these circumstances account for 23 per cent of the IO. Later, Ferreira and Gignoux (2011) use the same measures to compute for the IO in Latin America, which accounts for around 30 percent of the overall income disparities with Columbia the least 23 per cent and Guatemala the most 34 per cent. Recently Belhaj-Hassine (2012) finds out that the earnings inequality in Egypt caused by unequal opportunities has been lowered from 22 percent in 1988 to 15 percent in 2006.

Besides, after conducting research on 9 OECD countries in the inequality of

opportunities, Lefranc, Pistolesi, and Trannoy (2008) find that the ratio in these countries lasts 10 percent around and that a considerable income in certain countries does not necessarily bring out the equality of opportunities and vice versa. A case to point is Belgium, where a relatively modest income is corresponded with a considerably high inequality of opportunities. Taking advantage of the data collected by the EU, Marrero and Rodriguez (2012) examine the inequality of opportunities in 23 European countries where the opportunity inequality ratio ranges from 3 percent (Finland) to 15 percent (Ireland).

Pitifully, however, among the existing researches there are only two papers analyzing the unequal opportunities in China. On the basis of the data from the China Health and Nutrition Survey (or CHNS), Zhang and Eriksson (2010) calculate the inequality of opportunities in China with the Gini coefficient, claiming that income inequality caused by unequal opportunities in 2006 explains nearly 60 percent of China's total earnings disparity, a number which is far higher than that in its counterparts. The opportunity clusters (or circumstances beyond individual's control) include parental income, parental education and individuals' gender. Chen and Huang (2015) also use the CHNS data to analyze the same issue during 1989 to 2009 and the conclusion bears much similarities.

Both papers mentioned above utilizes the Gini coefficient to measure the income inequality, but there is a mortal flaw in this choice on the ground that this coefficient is not additively decomposable and does not help work out the exact proportion of IO-generated income inequality to the total earnings (Shorrocks, 1980). Thus, this paper will follow the practice of Ferreira and Gignoux (2011) to choose the Theil index because it is more helpful in figuring out the inequality of opportunities based on the fact that the index is additively decomposable. Besides, this paper also defines circumstances in a much broader context to make itself more comprehensive and reliable. Turning now to the choice of the data base, the papers on China's inequality of opportunities are mainly constructed on the CHNS data from before 2006 which has received doubts for its uncertainty of measurements and missing value. The doubt has been backed up by Gong (2008), who points out that the educational return based on the CHNS data is far less than the return calculated on the basis of other data. In contrast, the Chinese General Social Survey (CGSS) data, has been acknowledged for its reliable data collection and widely adopted in studying issues concerning China.

For this reason this paper uses the CGSS data gathered in 2012 (the CGSS 2012 data) to measure the proportion of IO-generated income inequality to the overall earnings. What is more, various age groups will also be analyzed and great attention be given to the inequality of opportunities among the young. The paper also delves into several approaches to the income inequality caused by unequal opportunities, providing effective policy complications to build up a fair and equal income distribution system and bring in more equal opportunities.

3. Empirical strategies

To ensure that the outcome of this paper is compatible with the researches on the inequality of opportunities in other countries, this paper follows the universally accepted parameter estimation algorithm like Bourguignon (2007), Ferreira and Gignoux (2011), and Marrero and Rodriguez (2012). That is, we closely follow Roemer's (1998) practice to divide earnings determinants into two categories: circumstances and efforts. Thus the two factors will be denoted by C and E respectively. Here the individual's income function can be established as:

$$w = f [C, E(C, v), u] \quad (1)$$

where W is the individual's income; u and v are those determinants of earnings that can be affected by variables such as luck.¹ Here C for circumstances are factors exogenous to the individual and E for efforts endogenous.

Special emphasis needs to be given to the fact that circumstances can also exert an influence on efforts, and education performs as the case in point. In the known literature concerning the inequality of opportunities education has been considered as one of the efforts, but in China circumstances affect education in a larger context which is supported by the fact that Chinese children from affluent regions enjoys more accesses to quality education (Song, 2012). Education is both influenced by efforts and by circumstances in China.

Since this paper aims not to the causation of certain variables but to the inequality of opportunities, thus the reduced form of the OLS estimation (1) shall be employed as:

$$\ln w = C\varphi + \varepsilon \quad (2)$$

The paper will get the needed measures in three procedures. Firstly, we use the OLS estimation equation to get the individual's predicted income $\hat{w}$. As mentioned above, circumstances here include gender, household size, household income in the individual's fourteens, employers of parents, and parental education and occupations.

Then we will work out how much "circumstances" contribute to inequality of opportunities, or the Theil index $\hat{w}$. The most prominent advantage of this measurement is that the index is additively decomposable, thus being helpful to tell how much the unequal opportunities contribute to the overall income inequality (Shorrocks, 1984). The Theil index, or the mean log deviation, is a special case of the generalized entropy measures being zero. The index of predicted income is denoted by $T(\hat{w})$.

¹ A most recent paper shows that luck is closely related with personal income and the inequality (Lefranc, 2009).

Finally, we will fathom out how much the inequality of opportunities can explain the overall income inequality, and we will have the equation:

$$IO = \frac{T(\hat{w})}{T(w)} \quad (3)$$

We call the individual income $T(w)$, and the IO is the measures we use in this paper.¹

In spite of covering almost all possible circumstances (C), this paper is still not able to encompass all efforts for the limited number of variables in data. That is to say, the IO we get is the lower bound of that number in reality and is not dependable on whether the linear functions are correct or not. But still the paper covers all the possible circumstances and thus can best mirror China's reality.

With the procedures above, we are able to further calculate how much each of the circumstances contributes to the overall income inequality. For example, we can exclude the variable gender when we adopt the OLS estimation equation (2) to measure the gender-generated IO. Then a new predicted income $\hat{w}$ (no gender) is on the table and we have the Theil index of the predicted income $T(\hat{w} \text{ (no gender)})$. Consequently the gender-generated IO is $[T(\hat{w}) - T(\hat{w} \text{ (no gender)})]$. We will utilize the equation to measure each of the circumstances' contribution to the inequality of opportunities.²

4. Results of statistical and empirical analyses

Taking advantage of the CGSS data, this paper goes deep into China's inequality of opportunities and its operating mechanism. The Chinese General Social Survey (CGSS), launched in 2003, is the earliest national representative continuous survey project run by the Department of Sociology of the Renmin University of China. CGSS is aimed to systematically monitor the changing relationship between social structure and quality of life in both urban and rural China. Social structure refers to dimensions of social group and organization as well as networks of social relationships. Quality of life is the objective and subjective aspects of the people well-being both at the individual and aggregate levels. The institution committed 5 annual surveys in 2003, 2004, 2005, 2006, and 2008 nationwide. From 2003 to 2008, this phase is Cycle I of the CGSS. Since 2010, the CGSS has been committed by National Survey Research Center at Renmin University of China (NSRC). As planned NSRC will commit fieldwork for the

¹ Also the ex-ante measurement which will only analyze how much circumstances affect the income rather than efforts.

² According to Ferreira and Gignous' (2011) mathematical justification, the whole inequality of opportunities does not rely on whether the function is correct or not, but the circumstances-produced inequality of opportunities measured this way is conducted on the prerequisite of the fact that the function is correct. So we need to be cautious while applying the equation to figure out how much each of the circumstances contribute to the unequal opportunities.

CGSS from 2010 to 2019 every two years, and this phase is Cycle II of the CGSS. By now, the CGSS has finished 2010, 2011, 2012, and 2013 fieldwork for Cycle II.

The most recent CGSS data covering individual's annual income, and gender, place of birth, and family background among other circumstances were released in 2012, thus being enough to support this research.

4.1. Descriptive statistics

Descriptive statistics are given in Table 1. To analyze the income inequality, we have 5523 valid observations on the offspring who have steady annual income of 27499.05 RMB on average in 2011. The average age of them is 41 years in which males account for 58 per cent and the offspring observations' years of education is an average of 9.43 years, a time span which is longer than the period required by China's nine-year compulsory education policy. The linear order of 1 to 5 represents the health levels of the observations from the worst body condition to the best constitution. On average, the samples are healthy since the coefficient is as much as 3.8 out of 5 and their households' social status is 3.14 out of 10, thus indicating a quite normal level. Besides, 39 per cent of the observations are from the eastern provinces; 29 percent the western area and 32 per cent the middle area. From the perspective of the household registration, 69 per cent of the observations are registered in rural areas with a 41 per cent of the household registrations, saying that there is a large proportion of the migrant workers.¹

Table 1
Descriptive statistics

Variable	Samples	Means	Standard deviation	Minimum	Maximum
Age	5523	40.94	10.51	17	60
Gender	5523	0.42	0.49	0	1
Income in 2011	5523	27499.05	38676.62	200	1000000
Years of education	5523	9.43	4.59	0	20
Health status	5523	3.80	0.99	1	5
Household status	5523	3.14	1.84	1	10
Migrant workers	5523	0.69	0.46	0	1
Rural household Registration	5523	0.41	0.49	0	1
Western area	5523	0.39	0.49	0	1
Middle area	5523	0.32	0.47	0	1

¹ We regard the parental household as one of the circumstances in the following practices, but as a matter of fact, since nearly no samples change their household registration, the parental household remains the same.

4.2. Contributions of inequality of opportunities (IO) to China's overall income disparity

Using the equation above, Table 2 showcases the core achievements of the study, reasoning that China is still confronted with a high level of inequality of opportunities which leads to 27 per cent of the income inequality. The ratio is similar to that in Latin America and far higher than that in OECD members (Ferreira and Gignoux, 2001; Lefranc, 2008).

Table 2
Empirical outcomes of China's inequality of opportunities (IO)

Variable	Theil index value	Proportion to overall income
Overall income inequality	0.661	100
Overall IO	0.182	27
Gender	0.034	5.14
Parental household	0.020	3.02
Family status	0.005	0.74
Father	0.010	1.48
Mother	0.025	3.72

According to Table 2, the first thing worth noting is that, different from the outcome that gender only accounted for 1.7 per cent of IO in 1989-2006 (Zhang and Eriksson, 2010), variables which contributes most to inequality of opportunities are gender and parental household, and the former factor of gender is the most influential. The parental household, in comparison, does not matter as much as it used to be with a 0.74 per cent contribution to the income inequality while the parental education, types of employment and occupation accounts for more than 5 per cent. We will go deep into the working mechanism of each factor in Part 5.

4.3. Analysis on the heterogeneity of China's inequality of opportunities (IO)

We group the samples based on the observations' age and education background and analyze the heterogeneity of these groups in a bid to tell the differences in inequality of opportunities among various individuals as follow.

Table 3
Analyses of inequality of opportunities among different groups

Group	Overall Theil index	IO value	Proportion in IO
Aged 16-35	0.632	0.083	13
Aged 35-60	0.646	0.237	37
High school and below	0.490	0.167	34
College and above	0.623	0.027	4

The Table implies that the young are facing less inequality of opportunities with a proportion of 13 per cent. That is to say the huge income inequality among the young is not completely a result of gender and family background as expected, but primarily of individual efforts, mirroring that the marketization of China's labor forces has lessened the IO. In contrast individuals aged 35 and above are suffering from incredible IO which is as much as 37 per cent.

From the dimension of education, individuals without college years explains 34 per cent of the IO to the overall number, demonstrating the fact that the income inequality for these observations is a consequence of such circumstances as gender and family background while for those with college and above education a result of efforts. This finding emphasizes two implications: one, college education help individuals define their future by enabling them to shorten the income inequality through efforts on account of the common practice that circumstances are not the only determinants of personal earnings; two, depression among the individuals without college education is what policy makers should take into consideration while addressing the issue of unequal opportunities owing to these individuals' encountering of helplessness and despair in working for a better life.

4.4. Trend analyses of China's inequality of opportunities (IO) in terms of time

As an effort to comprehend the changing trend of China's IO in the past years, we have also calculated the inequality of opportunities on the basis of the CGSS data. Since the CGSS 2003 data only cover the urban area, and the CGSS 2006 data exclude the factor of parental education, the CGSS 2008, the CGSS 2010, and the CGSS 2012 are the data we construct our study on to figure out the IO as Table 4. As we can see, China experiences an increase after a decrease in its IO, a change which is analogous to the trend of the country's income inequality, spelling out the fact that China is faced with a worsening landscape of the IO.

Table 4
The trend of Change of the opportunity inequality

Year	Indicator	Theil Index	Percentage
CGSS 2008	Total income inequality	0.606	100
	Degree of the inequality of opportunities	0.170	28
CGSS 2010	Total income inequality	0.589	100
	Degree of the inequality of opportunities	0.104	18
CGSS 2012	Total income inequality	0.661	100
	Degree of the inequality of opportunities	0.182	27

5. In-depth analysis and discussion of the IO

We've discerned out that a package of external factors, like gender, household registration, family economic status, parents' education and working background, play a significant role in the income inequality for individuals in the analysis above. Most of the existing literature have conducted qualitative analysis on the influence mechanism of the IO and illustrated that the above factors do have an impact on the degree of opportunity inequality in income inequality. However, papers presenting further analysis in this aspect are rarely seen (Chen *et al.*, 2009; Chen and Cao, 2013). To be specific, by which channel can such factors as gender, household registration and family background influence individual income? This part will bring out the quantitative analysis on the mechanism of the IO, so as to gain a more accurate understanding toward the issue of China's unequal opportunity. Three influence channels proposed in this paper, labor market discrimination, educational persistence and family background, will be verified in the following part.

5.1. Labor market discrimination

Table 2 unveils the result that the income difference has been heavily influenced by factors as gender and household. What are the root causes of the influence? According to the theory of discrimination in the labor market, the income gap of different groups may be caused by their productivity differences, or by discrimination in the labor market under the same conditions of productivity. In order to verify the causes of income gap between different sexes and household groups, Oaxaca-Blinder's decomposition technique is used in this paper, a common technique to study the labor market discrimination (Demurger, Li and Yang, 2012). The decomposition technique by Oaxaca-Blinder cuts the average salary of two groups into two parts: (1) the explanatory part due to the differences of individual characteristic (ie, endowment); (2) the inexplicable part due to the differences of return of individual characteristic (ie, coefficient). Oaxaca (2007) attributes the inexplicable part to the discrimination.

The specific steps of the method go as follows. If we mark the equilibrium salaries of group H and L in the labor market as W_H and W_L , respectively, the two groups the matrixes of individual characteristics (individual endowments) of the sub-samples, X_H and X_L , and according regression coefficient vectors (also called pay structure) as β_H and β_L , the semi-log estimating equations of such two groups (normally based on the Mincer salary-determining equation) are $\ln w_H = X_H \beta_H + u_H$ and $\ln w_L = X_L \beta_L + u_L$. Then we mark the average values of individual feature vectors for sub-samples of these two groups as $\bar{X}_H$ and $\bar{X}_L$ separately. So, according to the nature of OLS (orthogonal least-squares) that the residual error is zero on average, the average income gap for such two groups can

be expressed as:¹

$$\ln \bar{w}_H - \ln \bar{w}_L = \bar{X}_H \beta_H - \bar{X}_L \beta_L \quad (4)$$

Based on the feature of the above equation, Oaxaca decomposes the right part of the equation into the following form, which considers the actual income structure of group H as the pay structure in the labor market under the condition of non-discrimination:

$$\ln \bar{w}_H - \ln \bar{w}_L = (\bar{X}_H - \bar{X}_L) \beta_H + \bar{X}_L (\beta_H - \beta_L) \quad (5)$$

The first item on the right side of the equation shows the income gap between group H and L even without discrimination, namely the income gap due to the differences of individual characteristics of group H and L. The second item is the salary difference caused by pay structure gap for the two groups, that is to say the difference due to different returns on the same characteristics under the unified condition of individual characteristics.

By employing this decomposition method, Table 5 and Table 6 respectively show the empirical results of gender discrimination and household registration discrimination in the labor market. Table 5 indicates that the income gap between men and women in China is caused by gender discrimination in the labor market, and the gap generated by human capital is even negative. In other words, the human capital and productivity of female workers is even higher than that of men. While their income is below that of men under the same conditions, mirroring that the discrimination is very serious, which is the rooted cause explaining the IO arising from gender differences.

Table 5
Gender discrimination in the labor market

Indicator	Decomposition result (Oaxaca-Blinder)	Percentage
Average income gap	0.292 (0.028)	100
Explicable income gap	-0.063 (0.017)	-21
Discrimination-led income gap	0.355 (0.025)	121%

Notes: The result of the second column is the absolute difference in the logarithm of the income, and the third column is the percentage indicator. The explanatory variables in the return of salary include not only the previous chance variables but also other variables that affect income, such as education level, years of working experience and its squared value, health condition, vocational variable, industry variable, and regional variable.

¹ X here is the matrix of $n \times k$, and $\bar{X}$ the row vector; β is actually the estimated value $\hat{\beta}$. For the continuity and simplicity of expression, we delete the “^” (hat mark) in the estimated parameter of related regression equations.

The discrimination on the household registration is less serious than gender discrimination. Implied from the results in Table 5, most of the income disparities between urban and rural households can be explained by differences in regard to productivity, only 13% have roots in discriminative factors. Of course, it is worth our attention here that we are not saying the income gap resulted from non-discriminatory factors is of little amount. If there remains differences of accessing education opportunities for laborers with different gender and household registration, which leads to unequal treatment towards them before entering into the labor market owing to their characteristics, then such treatment directly influences their income after they find their ways into the labor market, and we call it as the “pre-labor market discrimination” (Song, 2014).

Table 6

Household registration discrimination in the labor market

Indicator	Decomposition result (Oaxaca-Blinder)	Percentage
Average income gap	0.326 (0.028)	100
Explicable income gap	0.283 (0.027)	86.8
Discrimination-led income gap	0.043 (0.033)	13.2

Notes: The decomposition result of the second column is the absolute difference in the logarithm of the income, and the third column is the percentage indicator. The explanatory variables in the return of salary include not only the previous chance variables but also other variables that affect income, such as education level, years of working experience and its squared value, health condition, vocational variable, industry variable, and regional variable.

5.2. Intergenerational education persistence

From Table 2 we can find that the parents' education background is an important factor affecting children's income. Meanwhile, uncontrolled by children, parents' education level will lead to income inequality, which is part of the IO. So, what is the reason for the fact that parents' educational background will affect children's income? Two approaches are proposed in this paper and will be verified respectively. First of all, possibly, parents' education level would affect children's education level, which is called as the intergenerational persistence of education (Ma, 2014). This part will examine if the intergenerational persistence of education contributes to the IO in China. The next part will analyze another approach, the impact of family background on other aspects beyond education.

Normally, intergenerational education persistence can be ascribed to two reasons. (1) High-level education always enable us to gain higher income, and higher-income families can provide their children with better nutrition and education, which enables

their children to access more education on the basis of decent material conditions. (2) Parents' education is a reflection of their capability. Probably saying, those parents who can acquire advanced degree are positioned to have higher intelligence and stronger learning ability which can be passed on to their children through genetic channel. Such two channels jointly decide on parents influence on their children's education. Despite both of the above two reasons contributing to the inequality of opportunities, the first one can be avoided by government via formulating more equitable educational policies, while the differences among genetic factors cannot be averted. Therefore, this paper tries to strip such two factors then to solve the endogenous problem of parents' education, which requires the method of adopting instrumental variables.

To this end, we introduce the method by Meng and Gregory (2002) and take it as the instrumental variable regarding the interrupted periods of education caused by the "cultural revolution". Please find Table 7 where you can see the specific assignment. The "cultural revolution" (1966-1976) is an educational destruction nationwide due government policies, especially in urban areas. Thus, the higher education was interrupted, so is the primary, middle and high school education at various degrees. But, for those who were forced to stop receiving education by the "cultural revolution", their children had generally completed education. So, on this occasion, the "cultural revolution" can be seen as an exogenous variable and also the instrumental variable in terms of parents' education, highly related to parents' education level while irrelevant to that of their children. This paper will adopt the "cultural revolution" as the instrumental variable to do accurate calculation of the transfer coefficient of parents' education.

Table 7

Historical situation of the cultural revolution's impact on education in urban areas

Year of birth	The first year of entering primary school	The first year of entering middle school	The first year of entering high school	Delayed years for entrance	Interrupted years in primary school	Interrupted years in middle school	Interrupted years of high school	Total interrupted years
1948	1955	1961	1964				1	1
1949	1956	1962	1965				2	2
1950	1957	1963	1971				3	3
1951	1958	1964	1971			1	3	4
1952	1959	1965	1971			2	3	5
1953	1960	1968	1971			3	3	6
1954	1961	1968	1971		1	3	3	7
1955	1962	1968	1971		2	3	3	8
1956	1963	1969	1971		3	3	1	7
1957	1964	1970	1972		3	2	1	6
1958	1965	1971	1973		3	1	1	5
1959	1968	1973	1976	2	1			3
1960	1968	1973	1976	1	1			2
1961	1968	1973	1976		1			1

Note: it is rectified based on Meng and Gregory(2002), Chen (2010), Meng and Zhao(2013).

As introduced by Meng and Gregory (2002), when we use the “cultural revolution” as the instrumental variable of the education level, we should limit the study group to those whose education were affected by the “cultural revolution”, and were born between 1948 and 1961. Chen (2010), Meng and Zhao (2013) hold that the proper control groups of ages are those born between 1942 and 1947, and between 1962 and 1966, when we evaluate the impact of the “cultural revolution” on education. So we limit the sample to the group who were born between 1942 and 1966 when using the instrumental variables. After that, given that CGSS2012 data provides too limited sample containing the information of two generations, and it only involves the data of parents’ education level without any specific years of education, we adopt the latest CHIP 2013 (China Household Income Project) database to make up for such weakness.¹ We can, based on CHIP2013, select out samples where parents were born between 1942 and 1966 and their children had completed education. And 1052 samples from urban areas are acquired after the deletion of abnormal and missing values. Table 8 offers the result after the analysis on the instrumental variables, with the dependent variable as the education level of children.

Table 8

Intergenerational educational persistence

2SLS	(1) Father’s impact	(2) Mother’s impact
Father’s education	0.612*** (0.218)	
Mother’s education		0.0286 (0.227)
Male	-0.465** (0.201)	-0.768*** (0.191)
Ethnic Minorities	0.818** (0.380)	0.512 (0.390)
dummy variable of different provinces	yes	yes
Sample size	1,052	1,052
R2	0.201	0.139

Notes: The dependent variable is the education level of children. *** indicates it is evident on the level of 1%; the standard errors are contained in the brackets. 2SLS adopts samples from urban areas and take the “cultural revolution” as the instrumental variable. The assignment of specific instrumental variables can be found in Table7.

Source: CHIP2013.

Table 8 manifests that even if we exclude the genetic factor and adopts the “cultural revolution” as the instrumental variable of parents’ education, the effect of intergenerational education solidification is still apparent. For each increase of one

¹ Please find specific introductions of CHIP data from Gao, Yang and Li (2013).

year for fathers receiving education, their children's education will increase 0.612 year on average. This illustrates that parents with high education level tend to reap more money in income, and offer better nutritious and educational condition for their children, which does favor to their children's access to better material basis and more education. Therefore, clearly, the reform of educational resource equalization can lower the income inequality triggered by intergenerational solidification.

In fact, historical event such as the “cultural revolution” is completely beyond personal control, so historical event is also a kind of chance variable. The following table shows the analysis result in the first phase of instrumental variables, and demonstrates that those people deeply influenced by cultural revolution is lower in their education level. It thus attaches importance to “the bad time of birth”.¹

Table 9
The impact of the “cultural revolution” on education

	Father's education	Mother's education
The interruption of father's education due to the “cultural revolution”	-0.182*** (0.0364)	
The interruption of mother's education due to the “cultural revolution”		-0.146*** (0.0398)
Sample size	920	844
R2	0.027	0.016

Notes: Dependent variable is the actual years of parents' education, and independent variable is the interrupted years of education due to the “cultural revolution”. Please see Table 7 which presents the specific assignment of instrumental variables. *** indicates it is obvious at the level of 1%; the standard error is shown in the bracket.

Source: CHIP2013.

5.3. The impact of family background on income

Apart from the parents' background which directly affects their children's education and further influence their income, what else influence channels do we have? That is to say, even for individuals with the same education level, better family background may help them enter high-income organizations through “relationship” and gain higher salary. In order to verify this assumption, we analyzed the impact of parents' education level on income after controlling the individual education level. We can find the result below.

¹ The “cultural revolution” not only affects education, but further influence income when the “cultural revolution” is seen as the element of the opportunity set. But the majority of people who were worst affected by the “cultural revolution” have been retired, and we did not measure the impact on the inequality of opportunities brought by the “cultural revolution”.

Table 10
The impact of family background on personal income

	Coefficient	Standard deviation
Education	0.072***	0.003
Years of working	0.028***	0.003
Squared years of working	-0.001***	0.000
Agricultural or non-agriculture household	0.235***	0.028
Gender	0.439***	0.023
Healthy condition	0.101***	0.012
East part	0.595***	0.029
Middle part	0.158***	0.028
Father's education	0.031***	0.007
Mother's education	0.019**	0.008
Sample size	5523	
R2	0.4732	

Notes: income is the dependent variable, ***, ** and * is respectively obvious at the level of 1%, 5% and 10%.
Source: CGSS2012.

Table 10 illustrates that one of the important mechanisms of the IO—the impact of parents' education background on individual's income includes the influence on personal education and others. Even we control the factors like personal education, years of working, and household registration, parental education level still have direct impact on personal income. It shows that many high-income organizations do have non-transparent and unreasonable ways of implementing employment and income mechanism, with “relationship” playing a significant role in this situation.

6. Conclusions and policy implication

6.1. The main conclusions

This paper adopts quantitative analysis on the degree of IO in China using the latest CGSS data. The analysis shows that over 27% of the total income inequality is due to the inequality of opportunity. This proportion, similar to that of the most unequal countries in Latin America, overtakes that of the overwhelming majority of OECD countries. It reflects that a large percentage of the continued high income inequality in China is irrational, which can and should be improved by our government through mixed measures of reform.¹

Also, this paper conducts heterogeneity analysis targeted at different groups of people. Positive results have been discovered, along with some issues worth

¹ Lefranc *et al.* (2008) analyzed the degrees of IO in nine OECD countries, and most of them are around 10%. Ferreira and Gignoux (2011) calculated the degree of inequality of opportunities for Latin American countries, and such inequality explains about 30% of the total income inequality, with Colombia accounting for the lowest 23% and the highest in Guatemala, 34%.

our attention. On the one hand, in China, the degree of IO among young people under 35 is on the decline, less than that among people above 35, indicating that an overwhelming majority young people can achieve higher income and living-standards through their own effort. Moreover, fates are in their own hands to a larger extent once they gain the degree from university. The income inequality from person to person is mainly attributed to the degree of paid efforts, much less related to the external elements. All this is performance achieved through sustained market reform in China, which enables the market to play a bigger role in the distribution of resources. On the other hand, far from satisfactory are such aspects as the community with low education are to a larger extent unable to control their own fate whose income level is decided by external factors like family background. And these people will be clouded by a sense of further imbalance, incapable to harbor hope. Moreover, the degree of the inequality of opportunities represents a tendency of rebound, which captures our attention.

On the basis of quantitatively measuring the inequality of opportunity in China, this paper makes an in-depth analysis on the mechanism of IO in China, and uses the method of empirical analysis to verify the three hypotheses: labor market discrimination, educational persistence and the impact of family background. The empirical results show that these three channels are the source of the inequality of opportunities in China. Firstly, gender discrimination is very serious, which is the main reason for the current income inequality between men and women. Secondly, the intergenerational education persistence is obvious. Even if the tool variable method is used to exclude the influence of genetic factors, the phenomenon of educational transmission is still significant, indicating that there are differences between the educational opportunities and the quality of education for people from different family backgrounds. The inequality of such educational opportunities results in the income inequality. Finally, a good family background can not only enable children to receive quality education, but also help their children get better job opportunities and higher income through social relations.

6.2. The Policy suggestion of the inequality of opportunities

The reform of the IO has a bearing on both fairness and efficiency. It is, therefore, essential to a country and even more crucial to China which is experiencing economic “new normal” and comprehensively deepening reform. According to the existing papers, generally speaking, two main kinds of the opportunity equality policies are included as follows. (1) To interfere in the formation of income acquiring ability, mainly by the redistribution of public resources and offer more human resources to individuals disadvantaged in environmental variables. (2) To redistribute the current income format mainly through ways as taxation and payment transfer to easing the income inequality brought by environmental differences. The paper, based on the

above empirical result, suggests that China adopts the following tougher and targeted equality policies in order to reduce the degree of the IO and bridge the income inequality.

Firstly, we should regulate labor market behavior through legislation, eliminate labor market discrimination as far as possible, including gender discrimination and household registration discrimination, so as to guarantee the equal treatment enjoyed by workers with the same productivity in the labor market. From the reality of China and the empirical results in this paper, the problem of gender discrimination is the most prominent, and women in the labor market are in the disadvantageous position. In recent years, the implementation of the “full two children” policy to some extent may further push women into the disadvantageous position in the job market. Thus, it needs to strengthen regulation and penalty as regards employment discrimination and to narrow the income gap between man and woman.

Secondly, we should promote the equalization of public education resources, reduce the phenomenon of intergenerational education, so as to provide more human resources for individuals disadvantageous regarding environmental variables. The inequality of education is an important factor causing the intergenerational persistence of income inequality in China. Education can provide uptrend opportunities for low-income groups, whereas unfair education reduces the mobility of intergenerational income. Viewed from the results of this study, the current education intergenerational persistence is not only the consequence of genetic factors, more importantly, it is due to uneven distribution of educational resources. So, this requires the government to raise the education subsidies for low-income families, to strengthen investment in poverty-stricken areas, and to improve the degree of equalization of education.

Thirdly, through anti-corruption and other means, we should further standardize the high-income sector, especially the employment mechanism of state sector, in a bid to reduce the role of “relationship” in resource allocation in labor market. In doing so, we can truly recruit people based on morality and minimize the impact of family background, the uncontrollable factor, on income.

Finally, by means of tax and payment transfer, we should eliminate the income inequality led by environmental differences. It should be noted that some environmental differences are not only beyond the control of the individual, but also beyond the control of a society. As for the factor of family background, theoretically, the society can make it possible for families differing in backgrounds to access the same educational and job opportunities, and further reduce the income inequality caused by inequality of opportunities. However, because parents can influence each person's IQ, personality, etc. and these differences cannot be removed, it is needed to adopt redistribution policy to reduce the income inequality in the final income distribution due to environmental factors.

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