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Empirical Study on Poor-Rich Disparities Based on College Campus Consumption Data

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Abstract. With the Chinese society developing rapidly, the poor-rich disparities between different social stratum is becoming more obvious, even in college students. How to understand the poor or rich situation in Chinese college is an important topic worthy of investigation, especially with the help of big data collected by campus information system. This paper analyzes the living situation of college students, based on about 5,000 undergraduates' three years of full cycle consumption records in one university of China, which includes the consumption in campus canteen, shops, water, and electricity, etc. The research not only demonstrates the unbalance of students' consumption levels, by comparing the temporal consumption patterns using statistical analysis, but also further discusses the effect of Government Student Grant in adjusting the unbalance, which is verified to be effective for helping the students in worse economic status in order to improve the social equality and provide more opportunities for those students to obtain college educations. Based on the statistical analysis, it is found that there is certain poor-rich disparities in students' campus living standards, and the aid is given to poor students to improve their living condition effectively. The research provides fundamental understandings on poor-rich disparities of college which is useful for college education.

Keywords: college students, poor-rich disparities, campus information system, government student grant

1 Introduction

The whole Chinese society attaches great importance to education, so most Chinese family try their best to send their young children to receive the high education. As China has gone through a great progress in college education, college education is nearly popularized in the whole society. From the beginning of the college expansion plan in 1999, the college enrollment is increasing rapidly, from 15% in 2002 to 80% in 2022, which means the college education is becoming more and more popular in the whole society. The expansion of colleges results in the popularizing of college education, with 678 new colleges continuously being founded after 2001. Most Chinese universities are public ones, and their only entrance requirement is the students' college entrance examination achievement, so students from different family status have been fairly competing in college entrance, which provides the opportunity for students with different background studying in the same campus. China used to have a free college education, but with the expansion of college education, the colleges have to charge the tuition fees from the students to afford so many students. The tuitions of most Chinese public universities are about 5,000 CNY per school year. Considering the practical yearly income of most Chinese families, some students may have difficulties in paying such tuitions, so the Chinese governments establish the Government Student Grant to support such students.

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As the expansion of college student community, the gaps between different classes in Chinese society also appear in the campus population, among which wealth gap may be the most obvious. As is known, nowadays, China has a rather high Gini coefficient which means serious wealth gap between different classes, so the college students coming from different classes should have the similar situation. Here are the wealth gap and the discussion of the way to balance.

Wealth gap research has been attracting researchers, especially in particular group such as racial wealth gap [1], gender wealth gap [2] and so on. Cristobal Romero et al have introduced the application of data mining techniques in education [3]. Shapiro Thomas et al concentrate on the origin of raising Black and White wealth gap and come up with several reasons as homeownership, employment, inheritance, college education, social and cultural factors [4]. Filmer Deon et al survey the 35 countries to find some effects on education from different household wealth [5].

The wealth gap in students also receive attention from the educational research field. In [6], the poverty level of students are proved to have an negative impact on their academic and social performance. In [7], the authors analyze the complicated factors that the wealth gap influence results in on the poor students by tracking survey on 24 poor students' individual development, and find that the gap can have both positive and negative impact on the poorer students. There are also some research on the mental problems brought especially to young children by poverty issues [8-9].

How to help the poorer students is another heated topic. There are many discussions on the effect of student loans and student aid. The student aid is confirmed to have a great effect on helping students improving their performance [10], but student aids may also lead in increased consumption of higher education and a redistribution of students to smaller institutions [11]. Most research on this field concentrate on increasing the university attending rate and decreasing dropout rate in college [12].

However, most researches on this topic draw conclusions by using a limited population of students, while the one the author undertakes investigates the large and complete student population. The author's motivation is to analyze the practical wealth gap among college students in China, and discuss the effect of the Government Student Grant in helping the students. Therefore, the paper first analyzes the consuming data from campus smart card system to know the basic characteristic of students' consuming in campus [13], then discusses the existence and level of unbalance of students' consumptions, and as for the consumption level, makes a comparison between students with and without Government Student Grant, last, analyzes the consuming level changing before and after receiving the aid.

The paper contribution can be summarized as follows:

(1) After processing the data from the campus smart card system of the college, the author finds interesting temporal characteristics and patterns of the students consumption in campus, such as vacation effect and yearly descending trend.

(2) The wealth gap in the college students is confirmed. The author presents the distribution of students' average sum consumption and per meal prices in canteens and shops through three school years (in Grade 2, 3 and 4), and find the huge consumption level gap among the students.

(3) The effects of Government Student Grant are verified to be effective. The author compares students between those without aid and those with aid from the perspective of the consumption level and compare the consumption level changing of students who receive aid for the first time in Grade 2, 3 and 4, with those who do not, and find that the consumption level of the students with aid firstly increased significantly in Feb of every term, which decreases the consumption gap in canteens.

2 Materials and Methods

In this section, the data set used in this paper is introduced, including the basic information and data cleaning operations [14-15].

2.1 Basic Information

The consumption data set of this paper is from a university in Anhui province, which enrolled 4600 freshmen in 2012. However, there were 71 students who did not have 4-year complete consumption records in the data set

before their graduation in 2016. Then these 71 students are excluded from the analysis because of suspension, dropping out of school or joining the army, etc. Therefore, the final study subjects were 4529 students, including 2697 male students and 1831 female students.

This college owns the complete service system for students and staffs, including multiple canteens, several shops, wash-rooms and other facilities. The data set includes two parts. One is the consuming record produced by students who consume in the campus with their smart cards at all POS, and the other is students' profile, including age, gender, grade, department and etc.

Based on the data of campus one-card, people can find that the consumption data for freshmen is very steady and the consumption disparity is not very big. Therefore, the data analysis begins from sophomore year to senior year, that is, the data set is from 1 September, 2013 to 30 June, 2016. After Data Cleaning and Preprocess, 16,789,770 items are recorded effectively, in which Students' student ID, gender, consumption type, consumption time, consumption amount, POS number and corresponding account number are included. The consumption types in the data set mainly contain dining hall consumption, campus supermarket consumption, electricity fee, Internet fee and water fee, etc.

As to consumption POS, there are totally 609 POS, located in canteen, campus shops, water rooms and etc, belonging to 37 financial consumption accounts.

2.2 Data Cleaning and Preprocess

In the campus one-card consumption system, each consumption is to be stored in the database based on the fixed data format and the abnormal data is cleared through three rules.

The first rule is to clean up the students (a total of 71 students) who did not have complete and continuous consumption records from 2012 to 2016, including all consumption records produced by them.

For a university, strict rules are set up on the opening hours of the school canteen, in order to guarantee college students' regular life and study.

The second rule is that breakfast is provided before 9:00 a.m. and a consumption which exceeds 20 yuan is to be eliminated, so 172 records in total have been eliminated.

The third rule is that lunch starts from 11:00 a.m. and ends at 13:00 p.m., and dinner is from 17:00 a.m. to 20:00 p.m. and a consumption which exceeds 50 YUAN is to be excluded, so a total of 406 records have been excluded.

Based on the data, there are not many cleared records, even if some students adjust their time to consume for some special reasons, or occasionally generate large consumption records with their classmates, but on the whole it doesn't influence the analysis of the disparity between the rich and the poor.

3 Analysis of Statistical Results of Students' Overall Consumption

3.1 Statistical Analysis Items of Students' Overall Consumption

There are 609 POS machines which are placed on the campus to record students' consumption in canteen, supermarket, water fee, electricity fee, Internet fee, and medical treatment, etc. Collect statistics according to 37 financial consumption accounts and show in Fig. 1.

First of all, students' consumption is mostly in canteens, accounting for about 70% of the total consumption. The second is what the students spend in supermarkets, accounting for about 18%. Campus supermarkets mainly afford students daily necessities, snacks and school supplies. Moreover, students' living water costs account for about 4% and electricity costs account for about 6%, which proves that the proportion of consumption is not large, mainly because the price is cheap, for example, the electricity charge standard is 0.56 yuan/KWH, drinking water 0.1 yuan/liter, bath water 0.1 yuan/minute, and the water and electricity in public places are free; The last 2% is mainly spent on medical treatment, campus Internet, etc. From the total consumption mentioned above, it can be inferred that a college student's overall consumption in a year on campus is about 6648 yuan.

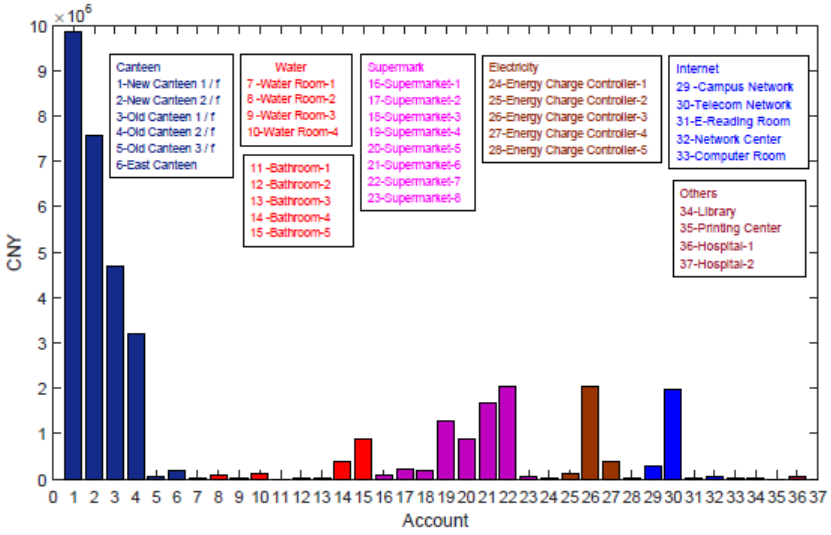


Fig. 1. POS accounts and its total income in the college

3.2 Statistical Analysis of Time Series of Students' Overall Consumption

In college, the students learning state in each year is different, so there are big differences in the students' life state and consumption state as well. As shown in Fig. 2, the X axis is taken as timeline of two terms of each grade, starting from 1 September; Y axis stands for consumption frequency and the number of records, through which the consumption change of the three grades can be observed: First of all, the number of students in grade two and three basically keeps the same, while the number of students in grade four obliviously decreases. However, from the perspective of consumption times in school, the higher the grade, the less the consumption frequency. Second, more juniors and seniors remain in school during the summer vacation, while most of the sophomores choose not to be in school during the vacation.

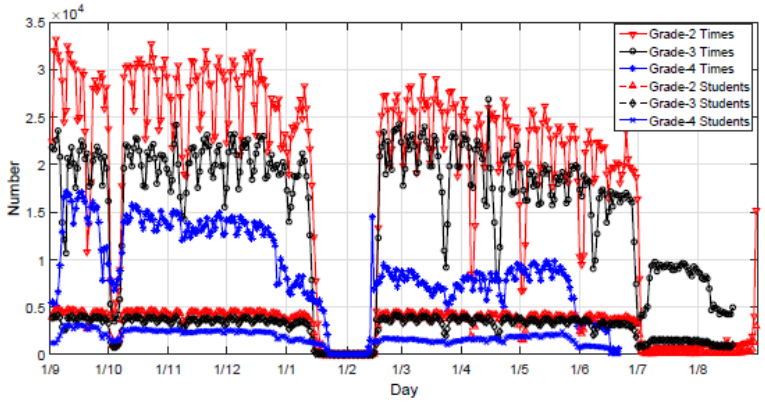


Fig. 2. Change of consumption times and number of students in three school years

Note. (a) Red diamond, black cycle and blue square curves denote grade 2, 3 and 4, respectively. (b) Y axis: Dotted and virtual lines denote the number of consumption times and students who consumed this day, respectively. (c) X axis: 1/9 is the beginning of every school year, and each curve represents an entire year.

The results in Fig. 2 reflect the different characteristics of college students in different stages in the training procedure: First of all, the purpose of the university training is to cultivate four-year application-type college students with engineering application ability, so since the second half of the third year, more and more students participate in the internship. Especially in grade 4 of the university, all seniors have to undertake the enterprise internship, and graduation design is to be finished by the way of cooperation between colleges and enterprises. Secondly, the higher the students' grade, the more social activities the students have and their activities is not confined in the campus, so, senior college students' consumption shifts from the campus to the off-campus. Moreover, it is found that the consumption of different grades during the summer vacation is various as well, for example, in grade 2 and grade 4, the amount of student consumption and the number of students at school in summer vacation decrease, while in grade 3, the number of student consumption and the number of students in summer vacation increase significantly. According to the survey, many students of grade 3 prefer to stay in school in summer vacation for the postgraduate entrance examination, practical projects, professional competitions and short-term courses.

In order to understand the consumption gap between rich and poor students, the average consumption amount and daily consumption amount of each student are collected from the database, as well as the total consumption amount of all students every day, as shown in Fig. 3.

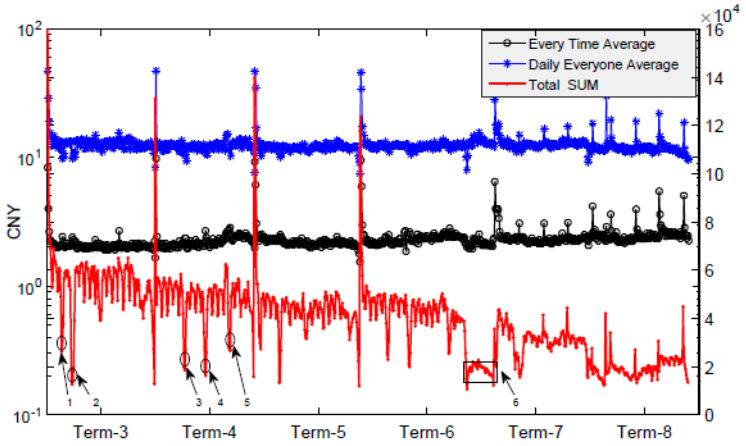


Fig. 3. The average consumption amount of each student and the total consumption amount of all students every day in three school years

Note. (a) Left Y axis: Black and blue curve denote the consumption amount of each consumption record and the daily consumption amount of each student, respectively. (b) Right Y axis: Red curve denotes the daily sum of consumption amounts of all students. (c) X axis: 0 denotes 2013.09.01, and include all six terms and a short term in Grade 3 summer vacation in three school years. (d) 1-Mid-autumn Festival (off for 3 days, usually in the middle of September), 2-Chinese National Day (7 days off from 10.1-10.7), 3-Tomb-sweeping Festival (off for 3 days, around the beginning of April), 4-International Labor Day (3 days off from 5.1-5.3), 5-Dragon Boat Festival (off for 3 days, around the beginning of Jun), 6-The short term.

Several patterns could be gotten from the data set and Fig. 3.

(1) Back-to-school effect. On the first day of each semester, the total consumption amount increase significantly, mainly because students buy daily necessities, network charge, electricity charge, etc.

(2) Holiday effect. In winter and summer vacations or some other holidays, students' leaving school, going back home and travelling lead to the decrease the campus consumption abruptly. Therefore, the consumption on campus drops sharply, and the total consumption is only one third of the usual.

(3) Change in consumption patterns. The average daily consumption of each student kept basically unchanged in the three school years, but the peak of daily consumption occurs at the beginning of the second and third semester, while there are several minor peaks in the fourth year, which is consistent with Fig. 2 and the fluctuating consumption is due to the seniors' high mobility.

(4) Price increase. The price of consumption increases slightly every year. As can be seen from the black line in Fig. 3, the average trend of each consumption is increasing, and the annual increase is about 6.6% from the three-year data.

4 Poor and Rich Differentiation of Students' Overall Consumption with No Aid

Along with the definition of breakfast, lunch and dinner, the author investigates the each student's average price in the canteens for the three meals, together with the average price for each student's payment in the campus shops. The author intends to check the consumption differences between poor and rich students according to the basic consumption data generated by them. Of course, without the aid.

4.1 The Difference in Total Consumption of Students with No Aid

Fig. 4 shows the probability density function of consumption amount in canteens, shops and their sum of each student in three school years. (Grade 2 to Grade 4). No matter in canteen consumption, shop consumption or the sum consumption together, the expenditure differs greatly among massive students. Take the canteen consumption as the example, the expenditure in the range of 2,000CNY and 10,000CNY stands for the majority of students, among which some students spend five times more money than other students. So, it is reasonable to infer that the consumption level in the student's group may differ greatly, which reflects their wealth gaps.

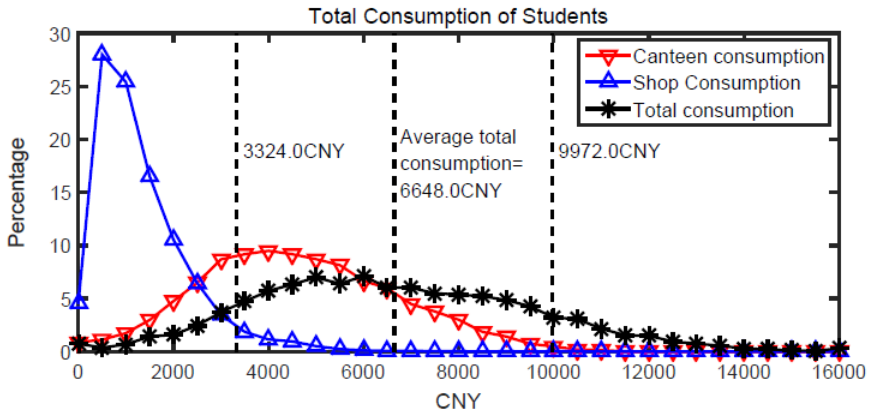


Fig. 4. The statistical date function of each student's consumption amount in canteens, shops in three school years

4.2 The Difference in Timely Consumption of Students with No Aid

Some students have spent more money in canteens than others possibly because they have consumed more frequently, instead of just because of their buying much more expensive food items each time. So the author turns to the average price of each breakfast, lunch or dinner. Thus, Fig. 5 shows the statistical date function of the average amount of each meal in canteens or students' each consumption in shops in three school years. The average shop consumption needs 4.646 CNY and the average meal in canteens needs 5.415 CNY.

It can be found just the food consumption and other consumption at a time also differ greatly in the student's population. Especially considering the meal expenditure, about 5% students spend 4 CNY while nearly 10% students spend 5.415 CNY, even nearly other 5% students can enjoy the 7 CNY for a meal each time in three school year. So it can be inferred that the financial unbalance does exist in the campus [16].

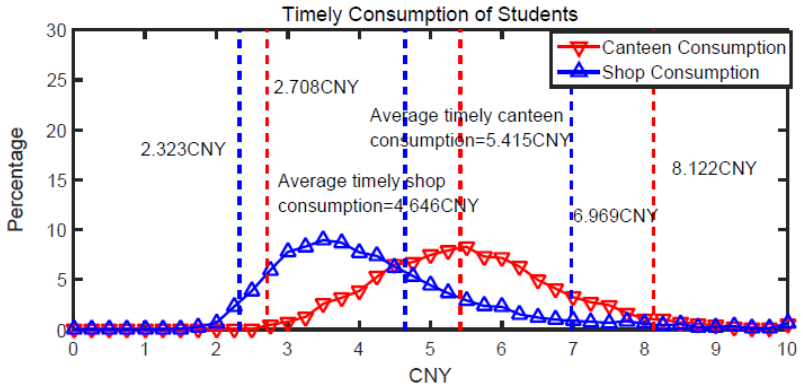


Fig. 5. The statistical date function of students' average amount of each payment in canteens and shops in three school years

5 Effect of Government Student Grant

Government Student Grant, supported by the Chinese government, aims at helping college students who encounter financial difficulty in continuing their college career. The amount of this aid is between 1,000CNY and 4,000CNY, based on the evaluation of student's financial status. Since the aid can be extended every year, one student may get more than 4,000CNY in her/his college life if she/he can obtain multiple supports. So it is important to find the students who are really in need of this aid. The general process to obtain this aid is that, first, students need to apply for it, then the authority of college will evaluate the application, finally those students who pass the evaluation could be supported.

Table 1 shows the count about the students receiving different amount of Government Student Grant every school year. For these 4,529 students, 1,995 students have received this aid for at least once, and nearly 1,000 students have received the aid twice during the university.

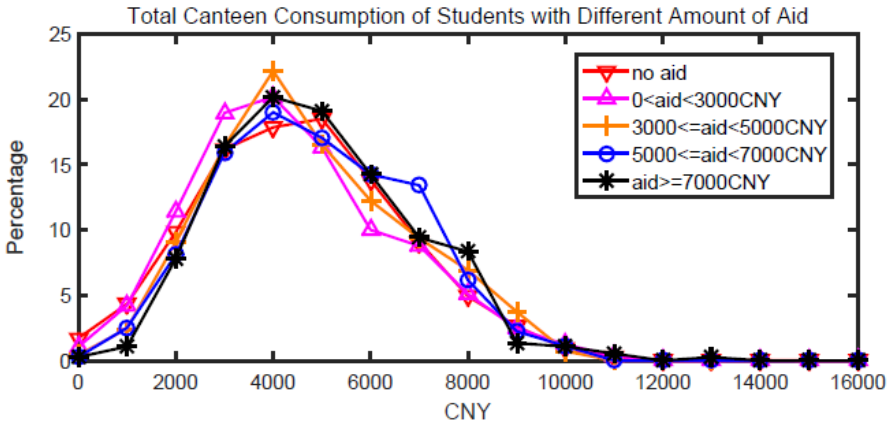
Table 1. Students receiving different amount of government student grant in every school year

Term/Amount	1000	1500	2000	3000	4000
Grade 1	162	119	123	202	0
Grade 2	221	183	261	268	90
Grade 3	227	286	120	227	116
Grade 4	0	226	298	216	201

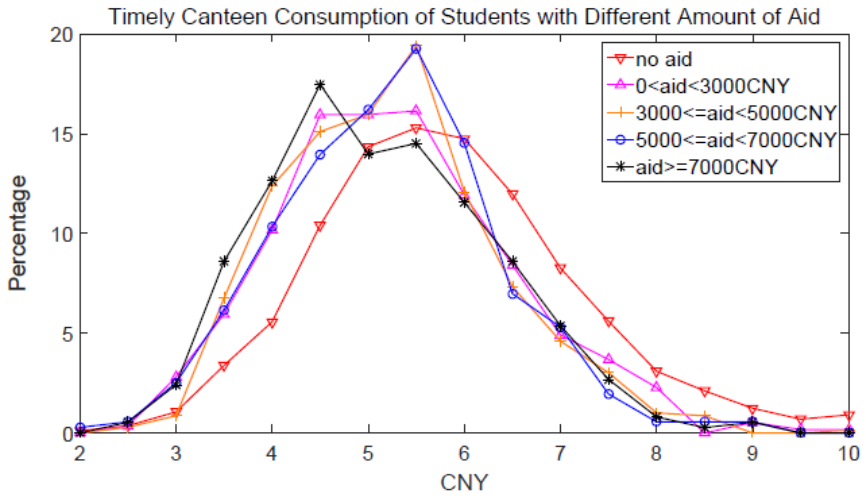
The Government Student Grant at helping poor students and to find the students who really need it is of great importance as the author have referred above. Generally the investigation of the economic condition of a student is done by the authority of college in different ways. In this study, the consumption data set was used to investigate the consumption of students receiving the aid.

5.1 Consumption of All Students Has the Same Trend with the Government Student Grant

This study divided the students into 5 groups according to their total aid gained in the 4 school years, that is, 2,534 students with no aid, 570 students with aid below 3,000 CNY, 895 students between 3,000 to 5,000 CNY, 358 between 5,000 to 7,000 CNY and 172 with more than 7,000 CNY.



(a) Comparison of total canteen consumption with different amount of aid in three school years

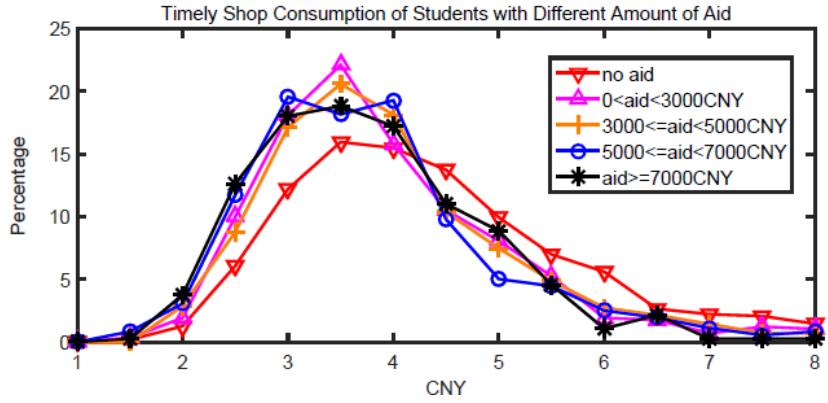


(b) Comparison of timely canteen consumption with different amount of aid in three school years

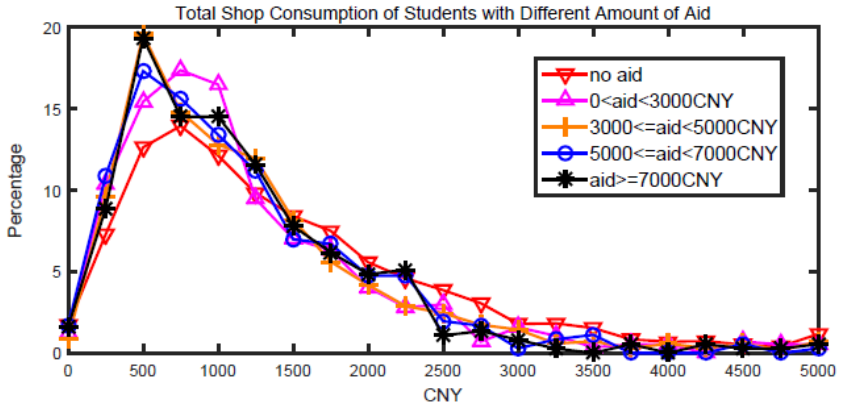
Fig. 6. Comparison of canteen consumption with different amount of aid in three school years

The statistical date function on average of total canteen consumption and the average of canteen consumption per meal from these five groups are presented in Fig. 6(a) and Fig. 6(b), respectively. It can be found from Fig. 6(a) that the total consumption from students with no aid are quite similar to those with aid obviously, but Fig. 6(b) demonstrates the differences. The per-meal consumption in canteens from those students with no aid are still obviously higher than that of those with aid. Two implications can be obtained. First, the students aid has been distributed to the proper students, which improves their food quality in the canteens. Second, such aid still can not remedy the financial gap among students. Such observation and implication still hold such as the author validate such analysis on campus shops, which is presented in Fig. 7.

There is no obvious difference in students with different amount of aid. There may be two reason: from the view of the quantity of data set, the quantity of the four groups of students with aid are relatively small, even a quarter of the group without aid together, so the size of data may be too small to show statistical regularity; on the other hand, the classification of aid level may not simply depend on the economic condition of the students. The students who get the aid may be guaranteed to be poorer than those who don't get aids, because when evaluating a student's aid level can get, the performance of students in college may be considered by the authority. In this way the reason can be explained why the consumption of students with and without aid differs a little. At the same time, it can also be seen that through the Government Student Grant, college students can live a normal life and ensure the completion of their studies, that's the significance.



(a) Comparison of total shop consumption with different amount of aid in three school years



(b) Comparison of timely shop consumption with different amount of aid in three school years

Fig. 7. Comparison of shop consumption with different amount of aid in three school years

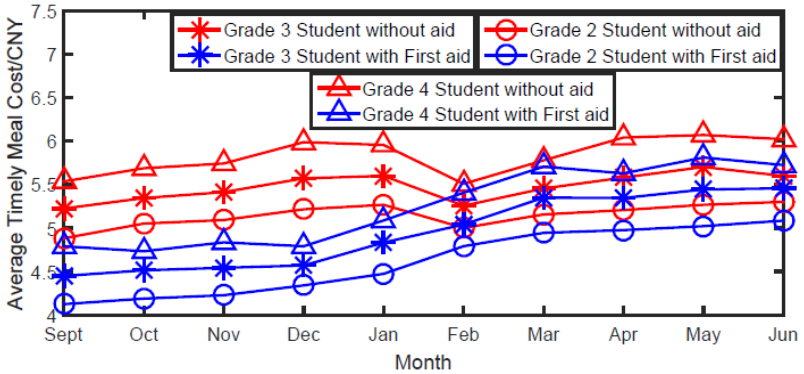


Fig. 8. Comparison of average timely meal consumption between students without aid all 4 years and with first aid this year from Grade 2 to Grade 4

Note. (a) Red line denote students without aid while blue line denote students gaining aid in the year. (b) Circle, octagon and triangle represent Grade 2, Grade 3 and Grade 4 respectively. (c) Y Axis: The average cost of one meal in the month. (d) X Axis: The month.

Next by means of comparing the students' consumption behavior before receiving the aid and after that, the author explains the concrete effect of this aid. As introduced above, students' average canteen consumption per meal is the best index which the researchers can find to evaluate their living standard. Fig. 8 shows students' average meal consumption in every month of one complete school year. From the perspective three school years' meal consumption, the students who get aid this year for the first time are compared with those who have never get aid. In the figure, those who receive aid consume much less in their each meal, about 0.7CNY, than those without aid before February of every school year. But this gap decrease sharply to about 0.2CNY in every February. This observation can be explained by one reason: the money of aid is distributed to the students from January to February from the authority of college, so the students' living condition can be immediately improved in time. This evidence strengthens the confidence on the effectiveness of Government Student Grant.

6 Discussion

There are several aspects to discuss this work.

First, the data set used in this research can only stand for the partial consuming behavior of college students, since the students may spend money outside the campus, like restaurants, supermarkets, or even online shopping. So such expenditure data is beyond this research which may affect students' real financial statistics of the concerned. But the students spend most of their time in campus and the consuming in campus can represent the major statistical properties, so the conclusion of this paper is still sufficiently reliable.

Second, the parameters in the definition of mean in canteens may have slight influence on the statistical date function of canteen consumption behavior. The definition in this paper is designed according to the experience of the authors in the university, which in fact can reflect the real situation of college students, but there might be still slight incorrectness as far as the data used is concerned. However, the data used in this study have quite long-time duration, three school years, so such slight bias will not affect the analysis of this work.

Finally, this work implies that current Chinese high education system is still relatively fair, which can accommodate the students from all social levels. In addition, the analysis reveals that the Government Student Grant plays important role in supporting such fairness, which can help those students in temporary financial difficulties to continue their education career.

7 Conclusion

This paper reveals the quite big wealth disparity among Chinese college students, by analyzing the three years' daily consuming data in campus. Although such wealth gap issue in whole China has been discussed a lot, but as for such empirical discussion using real world data towards the special and important college students' population. This research work opens a pioneering way.

To sum up, it must exist that the big wealth disparity between college students who live in campus. In addition, the aid from both college and the government for poor students is verified of great importance. In practice, this research work finds that the aids have been given to the proper students in worse financial condition, which proves that the Government Student Grant is a very meaningful input for the students' future career.

Finally, this research work can be still extended in several directions. For example, it may design a proper method to calculate or estimate the Gini coefficient of college students population which can demonstrate the social wealth status, and also integrate the learning outcomes of the college students with this consuming data to evaluate the correlation between the financial status and the learning outcomes.

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