

Does an intra-household flypaper effect exist?  
Evidence from the education fee reduction reform in rural China

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**Abstract**

This paper is the first to show the existence of an intra-household flypaper effect in conditional cash transfer programs in developing countries. I evaluate the impact of recent education fee reductions in rural China on different categories of household expenditures, including spending on individual children. Using data from waves of the Gansu Survey of Children and Families that pre- and post-dated the reform, I exploit cohort comparisons, the variation in the extent of education fee reductions across different villages, and the variation in the transfers received by children enrolled in different grades within the same family to identify the impacts of the reform. I find that a one *Yuan* increase in the individual intended transfer from the reform leads to 0.448 *Yuan* decrease in the individual required education expenditure, but leads to a 0.519 *Yuan* increase in the individual voluntary education expenditure. But there is no significant impact on household total income per capita, total expenditure per capita, and other categories of expenditures, including expenditure on food, non-food consumption and service, and health care. Households with more educated mother spend more of the benefits on voluntary educational expenditures, and more is spent on education of girls, older kids and kids enrolled in middle schools.

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# 1 Introduction

Government transfers in developing countries often address the challenge posed by poverty and low level of education attainment among vulnerable populations, especially children. An important question in considering the effectiveness of such transfers is the extent to which transfers to a child “stick” to him or her or, as implied by many models of household decision-making (e.g., Becker, 1974), targeted individual transfers are equivalent to an increase in total household resources and are neutralized by reallocations of resources away from the target child toward other family members. The existence of an intra-household flypaper effect (IFE) thus is an essential justification for policies targeted toward children. Indeed, Becker (1981) attributes the failure of compensatory education programs for minority children to the absence of a strong IFE.

In recent years, conditional cash transfer (CCT) programs like PROGRESA in Mexico have become extremely popular in developing countries.<sup>1</sup> Cash transfers made conditional on child enrollment can be thought of as a subsidy that reduces the price of education for each targeted child. Since the subsidy reduces a household’s expenditures on the targeted child, the question arises as to how the saved funds are spent, in particular whether the funds benefit (or stick to) the targeted child or whether they act similarly to a generic household income transfer. However, perhaps partly due to data limitations, no previous studies have examined this issue.<sup>2</sup> Rather, evaluations of CCT programs have focused on the programs’ impact on educational attainment<sup>3</sup>, health and nutrition<sup>4</sup>, work<sup>5</sup>, migration<sup>6</sup>, fertility<sup>7</sup>, and spillover effects among households in the same community<sup>8</sup>. If there is an IFE for conditional cash transfers, then the programs could benefit targeted children in ways that go well beyond the impact of the program on school enrolment<sup>9</sup>. Testing for the existence of the IFE also yields insights into the nature of intra-household decision-making in developing countries.

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<sup>1</sup>For example, such programs exist in Bangladesh, Pakistan, Argentina, Chile, Colombia, Brazil, Mexico, Nicaragua, and Honduras.

<sup>2</sup>Some research focuses on the implications for intra-household allocation of the fact that the funds are transferred to women, not men. See Attanasio and Lechene (2002), Rubalcava, Teruel and Thomas (2006) and Bobonis (2004).

<sup>3</sup>Schultz (2004), Behrman and Sengupta (2005), de Janvry et al. (2006), Schady and Araujo (2006), Khandker, Pitt and Fuwa (2003), Filmer and Schady (2006) and Maluccio and Flores (2004).

<sup>4</sup>Behrman and Hoddinott (2005), Rivera et al. (2004), Gertler (2004) and Morris et al. (2004).

<sup>5</sup>Parker and Skoufias (2000, 2001), Gertler, Martinez and Rubio-Codina (2006), Schady and Araujo (2006) and Yap, Sedlacek and Orazem (2002).

<sup>6</sup>Angelucci (2004) and Stecklov et al. (2005).

<sup>7</sup>Schultz (2004), Stecklov et al. (2006) and Todd and Wolpin (2006).

<sup>8</sup>Bobonis and Finan (2005) and Angelucci and De Giorgi (2006).

<sup>9</sup>Park and Shi (2008).

In this paper, I test for the first time whether an intra-household flypaper effect exists for child-targeted transfers by investigating the impact on household expenditures of an education fee reduction reform that took place in rural China in 2005. As part of the large-scale program called the Two Exemptions One Subsidy (TEOS), students enrolled in primary and middle schools were exempted from school fees charged by schools, and students from poor families were exempted from textbook charges and received living subsidies if they lived in school dormitories. Since only enrolled children received any benefits from the program, the program was equivalent to conditional (on enrolment) cash transfer programs widely implemented in other developing countries.

In this paper, I test the IFE by estimating the impact of TEOS reform on individual-specific household expenditures, focusing in particular on how the reform affected voluntary educational expenditures (on supplies, tutoring, etc.) and required educational expenditures (primarily school and textbook fees) on targeted children and their siblings. Detailed information of household expenditures is required to do this analysis. I use Chinese rural household data from the Gansu Survey of Children and Families (GSCF), a longitudinal study the last wave of which I helped supervise and for which I designed questions to collect comprehensive information on access to the TEOS program and household expenditures on food (23 categories), non-food consumption (17 categories), and educational expenditures on each child (both required and voluntary).

Our identification strategy exploits the fact that household surveys were conducted before and after the reform, there was variation across schools in the amount of fee reductions due mainly to differences in the amount of fees charged prior to the reform, and access to subsidies and the amount of subsidies varied with the age (or grade level) of children in the household. The GSCF collected three waves of data in 2000, 2004, and 2007. The first two waves of survey were conducted before the reform and the third wave of survey was conducted after the reform. I compare the spending of households with similar age children before and after the reforms living in the same village, and see how differences in the amount of education fee reductions across schools and for children in different grades affected household expenditure patterns. In this paper, I use Intended Transfer as the main treatment variable, which is calculated based on program rules. Using a household fixed effects specification to examine child-specific expenditures, I find that a one *Yuan* increase in individual intended transfers from the reform leads to a 0.448 *Yuan* decrease in individual required educational expenditures, but leads to a 0.519 *Yuan* increase in individual voluntary educational expenditures; the magnitudes of these two effects are not significantly different. Then I check the impact of the reform on household level expenditures. I find that a one *Yuan* increase in the household intended transfers per capita from the reform leads to 0.613 *Yuan* decrease in household required educational expenditures per capita,

and a 0.651 *Yuan* increase in household voluntary educational expenditures per capita; again the magnitudes of these two effects are not significantly different. But there is no significant impact of the reform on household total income per capita, total expenditure per capita, or other specific categories of expenditures. The results provide strong evidence that the IFE exists. Parents spent the saved money from the fee reductions on voluntary educational expenditures on the same child. I also find that given the same amount of intended transfers households having better educated mothers spend more on education, and parents spend more on girls, older children and children enrolled in middle school.

The only previous literature that has studied the IFE in developing countries is a small empirical literature examining the impact of school feeding programs.<sup>10</sup> Jacoby (2002) studied the impact of school feeding programs in the Philippines on children’s caloric intake. He compared children’s caloric intake on schooling days and non-schooling days, and found that parents of program participants did not withdraw snack calories from their children on school days, so that daily caloric intake rose roughly one-for-one with feeding program calories. He also found that the IFE is weaker but still nonzero in poorer households. Using a similar methodology, Afridi (2005) also found that 49% to 100% of nutrients provided a mandated school meal program in India “stuck” to the children receiving meals. While both studies provide support for the existence of the IFE, their results could be driven by specific features of food consumption and school feeding program, for example it may be difficult to substitute more consumption in one meal with less consumption at other times, or home food availability may be related to factors affecting home production. In contrast, cash transfers or subsidies are fully monetized, providing more opportunity for passing on program benefits to other household members and so providing a purer test of the IFE.

One study asking a similar question to ours but in a developed country context is by Kooreman (2000), who showed that marginal propensity to consume child clothing out of exogenous child benefits was much larger than the marginal propensity out of other income sources by studying Dutch child benefit system. However, only time variation of policy changes is used in Kooreman (2000) to identify the effect of the child benefit, therefore, the results could be driven by the time trend of expenditures in the absence of the policy.

The rest of the paper is organized as follows. The second section introduces China’s recent education fee reduction reform in rural areas. The third section provides a simple conceptual framework for analysis. The fourth section describes the data and empirical

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<sup>10</sup>There exists a much larger literature on the flypaper effect in public finance (see Hines and Thaler (1995) for a review). More recent papers include Knight (2002), Choi, Laibson, and Madrian (2007), Walle and Mu (2007), and Lalvani (2002). A number of papers in this literature find positive evidence that earmarked funds do increase spending on targeted areas.

strategy. The fifth section presents the results. The sixth provides some robustness checks, followed by a concluding section.

## 2 Education fee reduction reform in rural China

Under the decentralized fiscal system established after China's economic reforms began in 1979, compulsory education in China has been financed by local governments. Because of imbalanced economic development, poorer localities lacking local financial resource bases frequently have had no choice but to pass the financing burden down to farm households. The free compulsory education espoused by official policy has never been achieved in practice, and educational fees in fact can account for a large share of total educational costs and of household incomes. Before recent reforms, individual schools enjoyed significant discretion in setting various fees for students. This system led to frequent complaints about excessive fee charging and the heavy burden placed on farmers.

In the past 5 years there have been a number of reforms to the system of rural educational finance in China. One of the main objectives of recent reforms is to reduce the rural educational fees charged to students in order to reduce farmers' burdens. The focus of this paper is on the most recent of these reforms, known widely as the "Two Exemptions One Subsidy (TEOS, or *liang mian yi bu*)" policy, which targets children engaged in compulsory education, which in China includes primary school (typically grades 1-6) and lower secondary, or middle school (grades 7-9). According to government documents, TEOS was initiated nationally in the beginning of calendar year 2005 in all nationally designated poor counties (Ministry of Finance and Ministry of Education, 2005). The population of national poor counties accounts for about one fourth of China's total rural population. The policy was expanded to all of rural China in 2006, since which time it also has been called the new security system for rural compulsory education (*nongcun yiwu jiaoyu baozhan xin jizhe*)<sup>11</sup>. In this paper, I do not distinguish between these two names, and call the program TEOS throughout.

The policy's two exemptions refer to school fees (*xueza fei*) and charges for textbooks (*keben fei*), which previously had been charged of students. The one subsidy refers to living subsidy to partially cover the costs of students living in school dormitories. These three differ somewhat in their coverage and financing. The exemption of school fees targeted all rural children, and funding for this exemption is shared proportionally by the central and local governments. The textbook charge exemption was targeted at the children of poor households only, and the central government took the full responsibility for providing funding. The subsidy for living expenses was also targeted at the poor, but was

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<sup>11</sup>Guangming Daily (2007).

financed by local governments who were asked to put their programs in place by the end of 2007. If a student were fully exempted from all three types of expenses (school fees, textbook fees, and dormitory living costs), based on field visits in Gansu the only remaining fee he or she would typically be asked to pay by the school would be to purchase notebooks.

In Tables 1-2, I report evidence on the timing of the implementation of the TEOS reform based on county and household questionnaires from the Gansu survey. Among the 20 counties surveyed, 15 percent reported implementing the school fees exemption in primary schools in the fall of 2004, another 50 percent reported starting in spring 2005, and the rest reported starting in spring 2006 (Table 1). The textbook fee exemptions began a little bit earlier, with 30 percent of counties starting in fall 2004, and another 45 percent in spring 2005. As for the school fees exemption, by spring 2006 all counties had implemented the textbook fee exemption. The results are nearly identical for middle schools (Table 1).

Implementation of the living subsidies was much slower, especially in primary schools. Only 10 percent of counties reported providing living subsidies in spring 2005, 65 percent of counties reported having started the program by spring 2006 when both exemption policies were fully implemented, and 30 percent of counties still had not begun providing subsidies by the time of the survey in summer 2007. Implementation was much faster in middle schools, which typically have many more students living in dormitories. 60 percent of counties started providing living subsidies in spring 2005, and by spring 2006, 95 percent of counties had begun providing living subsidies.

Evidence from the household data is presented in Table 2. Because the coverage is based on recall, I restrict attention to students who have been in their current school since fall 2004 (primary students in grades 3-6 and middle school students in grade 9). Since the textbook fee exemption and living subsidies are targeted to children from poor households, it is possible that the coverage rates for students in the sample could be significantly lower than for schools or counties. In fact this is true for the living subsidy. No students report receiving living subsidies until spring 2005 and by spring 2007 only 0.92 percent of primary students and 8.96 percent of middle school students report receiving living subsidies (Table 2). In contrast, a very high proportion of students report receiving the textbook fee exemption—86 and 78 percent of primary and middle school students in spring 2007 (Table 2). The large difference in coverage of textbook exemptions and living subsidies likely is due to the fact that as a poor province Gansu receives a large amount of central subsidies for textbook exemptions, but lacks local resources to finance living subsidies (which are not centrally financed). Finally, a small percentage of primary school students (4 percent) and middle school students (9 percent) report not receiving the school fees exemption in 2007. This could be due to misreporting or attendance at private schools.

The exemption for school fees essentially exempted students from paying the previous comprehensive education fees<sup>12</sup>, minus the notebook fee which had been a part of the single fee but could be charged of students separately under the TEOS policy. The value of the exemption thus varied by county and school level, depending on the value of the single fee established prior to TEOS. From the Gansu survey data in 2007<sup>13</sup>, I estimate the average value of this exemption to be 54.23 *Yuan* for primary students and 70.05 *Yuan* for middle school students each year. The value of the exemption is estimated based on the comprehensive education fees charged by the nearest school prior to TEOS, which was asked in the school questionnaire.

According to a document issued by the Gansu Educational Bureau, the subsidy provided to counties in 2007 for textbook purchases under TEOS was 35 *Yuan* (24.66 *Yuan* in 2000 value) per semester for primary school students and 70 *Yuan* (49.32 *Yuan* in 2000 value) per semester for middle school students. Since counties within the province buy the same textbooks, the value of the textbooks actually provided, and thus the value of the subsidy, should be uniform throughout the province. In most cases, county education bureaus provided the textbook fee exemption by purchasing a fixed number of textbooks each year, and designated a certain number for free distribution to poor students. The criterion for allocating the free textbooks was the students' household income per capita. But there was also variation in the number of free textbooks available to students in specific grade levels or schools, due to unexpected variation in class size or poor planning. Also, variation in the number of needy students across grades and schools could lead to differences in the extent to which the poorest students received the exemption. In our field research, we encountered a number of cases in which students received the textbook fee exemption in some semesters but not in others. Overall, 79.58 percent of primary school students and 72.69 percent of middle school students reported receiving textbook fee exemptions in the past year. Of these, 76.69 and 78.62 percent received the exemption in both semesters.

The provincial education bureau recommended a living subsidy for poor students of one *Yuan* per day for 239 days per year, or 239 *Yuan* per year and 120 *Yuan* per semester (Gansu Education Bureau, 2006). However, according to the 2007 survey data, the average subsidy amount for primary and middle school students receiving the subsidy was 164.97 and 158.37 *Yuan* per year. Only 0.92 and 8.96 percent of primary and middle school students received the subsidy.

If we add up the mean values of the two exemptions and one subsidy, the annual sav-

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<sup>12</sup>It is the sum of school fees, textbook charge, and notebook fee.

<sup>13</sup>This survey is introduced in Section 4.1.

ing for primary and middle school students in rural Gansu who received all three benefits was 268.52 and 327.06 *Yuan* per year in 2007<sup>14</sup>. This compares to estimates provided by China's Ministry of Education (MOE) for western and central China of 416.18-502.74 *Yuan* for primary students and 566.73-612.43 *Yuan* for middle school students (Table 3). The MOE also estimates savings for students receiving only the school fees exemption, and those receiving the two exemptions only and no living subsidy (Table 3). These are higher than our estimates for Gansu. This comparison might show that the TEOS reform did not fully achieve its goal, which is also shown in the regression results below.

### 3 Conceptual framework

My goal is not to examine the impact of the education fee reduction reform on children's enrolment, but rather taking the enrolment decision as given, to examine how the fee reductions affect household expenditure decisions. In this section, I first show that for households with enrolled children, the education fee reduction is equivalent to a financial transfer to households. Then I provide a simple conceptual framework to understand how I am testing the IFE in this paper.

Parents are assumed to maximize a household utility function  $U(X, E^*)$ , where  $X$  is a vector including different categories of consumption and  $E^*$  is the number of enrolled children and is taken to be exogenous. The household maximization problem can be represented as follows:

$$\begin{aligned} & \max_X \{U(X, E^*)\} \\ \text{S.t. } & P_X * X + P_E * E^* \leq I \end{aligned} \quad (1)$$

Here,  $P_X$  is a vector of prices,  $P_E$  is a required education fee, and  $I$  is household income. We assume that the education fee reduction reform reduces the required education fee to  $\overline{P_E}$ ; then the maximization problem becomes:

$$\begin{aligned} & \max_X \{U(X, E^*)\} \\ \text{S.t. } & P_X * X + P_E * E^* \leq I + (P_E - \overline{P_E}) * E^* \end{aligned} \quad (2)$$

Comparing (1) and (2) in the above, we can see that reducing the required education fee is equivalent to a cash transfer to households equal to  $(P_E - \overline{P_E}) * E^*$ . The other thing we can see from this last expression is that the amount of the transfer depends on the price of education households pay before the reform, i.e.  $P_E$ . The higher is  $P_E$ , the greater the implicit cash transfer.

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<sup>14</sup>They are represented by 2000 value

With greater income, the household will increase consumption as shown in Figure 1. In Figure 1, voluntary education expenditure is on the X-axis, and all other expenditures are on the Y-axis. With income equal to  $I_0$  before the reform, households choose to consume  $A$ . If the reform reduces required education fees in a manner equivalent to increasing income from  $I_0$  to  $I_1$ , optimal consumption will be at point  $B$  if households redistribute the money among all expenditures, but will be at point  $C$  if households continue to spend the extra money on education. One could similarly interpret the X-axis as measuring all expenditures on the targeted children, and expenditures on other household members on the Y-axis. Focusing on voluntary educational expenditures in particular, if the IFE exists, then the impact of the reform on household voluntary education expenditure should be positively significant, and much greater than the impact on other household expenditures.

## 4 Data and empirical strategy

### 4.1 Data

The data used in this paper was collected in the Gansu Survey of Children and Families (GSCF). The GSCF is a longitudinal study which was conducted in Gansu province in China. Gansu is in the western part of China, and is one of the poorest provinces. In 2007, GDP per capita in Gansu was 9527 *Yuan*<sup>15</sup>(about 1389 dollars using the exchange rate on July 1st in 2008<sup>16</sup>.), and the population was about 26 million<sup>17</sup>. The sample is representative of rural Gansu, excluding minority counties, and is drawn from 100 villages in 42 townships and 20 counties. Figure 2 shows the distribution of these 20 counties in Gansu province.

The GSCF follows a cohort of rural children aged 9-12 in the year 2000, the first wave of the survey. The children and their families were re-interviewed in 2004 (wave 2) when the children were 13-16 years old, and in 2007 (wave 3) when they were 16-19 years old. The third wave also surveyed a new cohort of children aged 9-15 in 2007 and their families. The GSCF has a linked survey design which includes child, household, mother, father, homeroom teacher, school principal, and village leader questionnaires. For purposes of this paper, of relevance is that the survey collected detailed information for target children and all siblings on enrolment status, grade level, and different types of educational expenditures, as well as on household income, expenditures, and wealth. Questions on income included a battery of questions on specific crops produced, livestock raised, self-employment income, wage income, prices, and inputs used in each type of production.

<sup>15</sup>This number is from <http://tieba.baidu.com/f?kz=306047423>.

<sup>16</sup>1 Dollar = 6.86 *Yuan*. The exchange rate is from <http://www.x-rates.com/d/CNY/table.html>.

<sup>17</sup>The population number is from Gansu Bureau of statistics( <http://210.72.51.4/doc/ShowArticle.asp?ArticleID=3408>)

The expenditure module consisted of 23 categories of food expenditure and 17 categories of non-food expenditures asked in each wave of the survey. Also, there are questions on over 40 different types of fixed capital and consumer durable goods. In the third wave, I designed a special section in the household questionnaire asking about situations of fees exemption and living subsidy received by each enrolled child in the family. School and county education bureau questionnaires also described policy implementation during the recent period of education fee reforms. More detailed information of GSCF is listed in its official website (<http://china.pop.upenn.edu/>).

In this paper, I use data on households with children enrolled in school and for the main analysis focus on the survey data for the years 2000 and 2007. For the sake of comparison, in each year only households having a sampled child aged from 9-12 years are used in the analysis. After dropping observations with missing values, the final sample includes 2134 households, 1629 in 2000 and 505 in 2007. Table 4 lists the characteristics of these households. In this table, all monetary values are deflated to year 2000 values using the provincial rural consumer price index. The average household size is about 4.5 in 2000 and 4.3 in 2007. From Table 4, we can see that the demographic structures of households in 2000 and 2007 are very similar to each other. This table also includes the mean value of mothers' and fathers' schooling years. We can see that father's schooling years in both 2000 and 2007 are greater than that of mothers. And we can also see that both mother and father's schooling years are greater in 2007 than in 2000. Father's schooling year is 6.95 in 2000 and 7.25 in 2007; while mother's schooling years is 4.19 in 2000 and 5.27 in 2007. The younger cohorts is more educated than the older one. Land is an important endowment for rural households. This table lists the average value of land area per capita for both years; it is 2.08 *Mu* in 2000 and 2.06 *Mu* in 2007. Households in 2007 have higher income and spend more money; the income per capita is 1052.82 *Yuan* in 2000 and 1375.75 *Yuan* in 2007; the expenditure per capita is 1065.75 *Yuan* in 2000 and 1318.83 *Yuan* in 2007. This table also includes the ratios of number of enrolled kids to family size. Generally speaking, the ratios of enrolled kids in both years are almost the same, 0.42 in 2000 and 0.41 in 2007. As far as kids enrolled in different levels of schools are concerned, the ratio of kids in primary schools is higher in 2000, 0.37, and 0.34 in 2007; however, ratio of kids enrolled in middle schools is slightly higher in 2007, which is 0.06, but 0.05 in 2000; the ratio of kids enrolled in other levels of schools is 0.003 in 2000, but higher in 2007, which is 0.01. It shows that the enrolment structures within households in both years are not very sensitive to the reform.

In the individual level analysis, only data on enrolled children are used. After observations with missing value are dropped, there are 3865 children (3001 in 2000 and 864 in 2007) remaining in the sample. Table 5 provides summary statistics for these children. In

2000, the average age is 11.35, while the average age is 11.80 in 2007. There are fewer girls than boys in the sample; girls account for 48.2% in 2000 and 48.4% in 2007. While all the children used in the sample are enrolled, the structures of the enrolment are a little different in both years. Among all the enrolled children, 88.3% children are enrolled in primary schools in 2000, but the percentage is lower in 2007, 81.1% children are enrolled in primary school. However, the percentage of children enrolled in middle school is higher in 2007, 16.4%, than in 2000, 11.1%. The percentage of children enrolled in other levels of schools is also slighter higher in 2007, 2%, than in 2000, 1%.

## 4.2 Identification strategy

### 4.2.1 Within household comparison

GSCF collected information of required and voluntary education expenditures for each enrolled children, which makes it possible to exploit within-household variation to identify the impact of the reform on individual education expenditures. Children living in the same family might get different transfers from the reform if they are enrolled in different grades. Children enrolled in high school could not get any money from the reform, and children enrolled in middle school could get more transfers from the reform than children enrolled in primary school. We can compare education expenditures on children living in the same family, but enrolled in different grades, to identify the impact of the reform on education expenditures. However, if just cross-section data is used, the impact of the reform can not be differentiated from the systematic difference in the education expenditures on children enrolled in different grades in the absence of the reform. Fortunately, children surveyed in 2000 can be used as a control group. Intuitively, I compare education expenditures on children enrolled in different grades but living in the same family, and then subtract the systematic difference of education expenditures. It can be considered as a version of difference-in-difference strategy. And it provides the most convincing estimates in this paper.

In order to estimate the impact of the reform on individual education expenditures, I estimate the following regression equation:

$$EE_{iht} = \alpha_0 + \alpha_1 * IT_{iht} + \alpha_2 * X_{iht} + HF_{ht} + \varepsilon_{iht} \quad (3)$$

In equation (3),  $EE_{iht}$  is a vector of outcome variables, including education expenditures (required and voluntary) of children  $i$  living in household  $h$  in year  $t$ ;  $X_{iht}$  is a vector of individual characteristics, including dummy for girl and age;  $HF_{ht}$  is household fixed effect for household  $h$  surveyed in year  $t$ . And  $\varepsilon_{iht}$  is an error term with mean equal to zero. In the estimation, robust standard error is calculated by clustering in village level.

The most important variable in this equation is  $IT_{iht}$  which is defined as *Intended Transfer* from the reform to children  $i$  living in household  $h$  in year  $t$ . There are two reasons to use intended transfer but not actual transfer; one is to reduce measurement error, since all the monetary information to construct this variable is from the official documents which reduce the retrospective error of the interviewees; in addition, it also helps to investigate whether the target children get what they should get from the reform. In practice, each eligible child should get three benefits from the reform; one is from reduced school fees, to which all children enrolled in primary school or middle school are entitled; the second is exempted textbook fee charge, which is only given to children from poor families, i.e., eligibility depends on household income levels; the third part comes from the living subsidy; again only children from the poor families and living in the school can obtain this subsidy. In the household questionnaire of the survey in 2007, we ask directly whether each child gets the textbook fee exemption and living subsidy. The value of the textbook fee exempted is 70 *Yuan* for primary school students and 140 *Yuan* for middle school students per year; while the value of living subsidy is 239 *Yuan* per student per year. It is the hardest to measure money transferred from exempted school fees because of the lack of information. School questionnaire in GSCF only asks question about the sum of school fees, notebook charges, and textbook fees for each school before the reform. Therefore, money transferred from school fees exemption for each child  $i$  in 2007 is calculated as follows:

$$SF_{i,2007} = pre\_charge_s - notebookfee_{i,2007} - textbookfee_{i,2007} \quad (4)$$

Here,  $pre\_charge_s$  is the education fee charged by school  $s$  before the reform<sup>18</sup>, which is asked in school questionnaire; notebook charge is equal to 10 *Yuan* for primary students and it is equal to 15 *Yuan* for middle school students; textbook fee is equal to 70 *Yuan* for primary school students and 140 *Yuan* for middle school students. Therefore, for each child enrolled in primary or middle school, total intended transferred money is equal to transfer from exempted school fees if she does not get textbook fee exemption or living subsidy; it is equal to exempted school fees plus 70 or 140 if she is exempted from textbook fee too; and the total intended transferred money is equal to the exempted school fees plus 70 or 140, and then plus 239 if she gets both textbook exemption and living subsidy.

Since the eligibility for students to get textbook fee exemption and living subsidy mainly depends on household income, and the amount of exempted textbook charge and living subsidy are the same for all the kids eligible to get them (70 for primary school students and 140 for middle school students, living subsidy is 239). Therefore, by including household income in the regressions as a control, the variation from textbook fee exemption and

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<sup>18</sup>In this paper, each village is assigned a nearest primary school, each township is assigned a nearest middle school. Students living in each village are assumed to attend the nearest school.

living subsidy is absorbed. In other words, the variation in the variable of intended transfer comes from the variation in the extent of school fees exemption<sup>19</sup>. As shown in function (4) in the above, the variation of the extent of school fees exemption comes from three parts: pre-reform education fees, notebook fee charge, and textbook fee charge. Since notebook fee charge and textbook fee charge are the same for students enrolled in the same level of school. Conditional on the grade the child is enrolled, the variation of the extent of school fees exemption comes from pre-reform total education fees, which is different for different schools in different villages. This point is irrelevant in the within-household comparison, but is important for regressions in Section 4.2.2. And I will also test it in Section 6.1.

By using the within-household variation to identify the effect of the reform, we can implicitly control any observable and unobservable village and household level variables. But the identification assumption should be that the systematic difference between education expenditures on children enrolled in different levels of schools does not change in the absence of the reform. This assumption might be violated if the time path of education expenditures on children enrolled in higher level school is different from the time path of education expenditures on children enrolled in lower level school, or/and if parents' preference toward different children changes. I test this identification assumption by taking advantage of special survey design of the GSCF data. GSCF includes three waves of data, two (year 2000 and 2004) before the reform and one (year 2007) after the reform. Since children surveyed in year 2000 and 2004 were not affected by the reform, so I am able to do control experiment to test this identification assumption.

#### **4.2.2 Variation in the extent of fee reductions across different villages**

Before the reform, different schools in different villages charged different education fees; therefore, when the reform removed the education fees, children living in villages having higher education fees before the reform benefited more from the reform. We can compare education expenditures on children, who were surveyed in 2007 when the reform had been implemented, living in villages having higher pre-reform education fees with education expenditures on children living in villages having lower pre-reform education fees. However, cross-sectional comparisons cannot differentiate the impact of the reform from the village characteristics which might also be related with education expenditures. Since GSCF also collected information in 2000; therefore, those children surveyed in 2000 are used as a con-

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<sup>19</sup>Indeed, there is still some variation from the fact that some households have kids living in the school but some other households have kids not living in the school, and the number of kids living in the schools should also be included in the regression as a control, but GSCF didn't ask this question in 2000. However, the number of households having kids living in the schools is expected to be trivial, accounting for only 0.2% in 2007, and most of the kids living in the school are enrolled in middle schools, therefore, inclusion of the number of kids enrolled in middle schools absorbs this variation to a large extent.

trol group in this paper. In other words, I compare children living in the same village but surveyed before the reform and after the reform, by which the fixed village characteristics can be cancelled out; and then I compare the before-after difference in the education expenditures of children living in the villages having higher pre-reform education fees with the before-after difference in education expenditures of those living in the villages having lower pre-reform education fees. The identification idea used here is a “continuous” version of difference-in-difference strategy.

A crucial identification assumption is that the change of education expenditures from 2000 to 2007 in villages benefiting more from the reform should not be systematically different from those in villages benefiting less from the reform in the absence of the reform. I can test this assumption by using the first two waves (in years 2000 and 2004) of data. The identification will also be violated if there exist some time-varying and region-specific effects correlated with transfers (essentially the pre-reform education fee) from the reform and potentially affect household education expenditures. Unfortunately, the mechanism for schools in different villages to charge different fees before the reform is not clear. But, since GSCF collected detailed village level variables, which makes it possible to include a large number of village variables in year 2000 (interacted with year 2007 dummy) to control these time-varying and region specific effects. In the regression, I include illiterate ratio, ratio of primary school graduates in labor force, primary school enrolment rate, middle school enrolment rate, indicator for having pre-school classes, distance of primary school from the village seat, log value of money given to schools by village, indicator for having primary school run by the village, indicator for having middle school run by the village, indicator for having railway through the village, indicator for having bus stop in the village, log value of average agricultural income per capita, log value of average industrial income per capita, ratio of households engaged in non-agricultural work, ratio of households running household enterprise, log value of wage for men doing non-agricultural work, log value of wage for women doing non-agricultural work, log value of wage to hire labor for agricultural production, indicator for having enterprises owned by county, indicator for having enterprises owned by township, indicator for having private enterprises. Combined with village fixed effects, inclusion of these variables in regression function helps to correct bias due to possible endogeneity of the pre-reform education fees charged in different villages.

Another concern is that there might be some other concurrent government programs correlated with the level of education fee charged before the reform and potentially affected education expenditures. Indeed, Chinese government exempted all agriculture-related taxes in 2006; this policy should not affect the estimation since it is not related with education fees and common for all the households in different villages. To the best of my knowledge, there are no other programs concurrent with the education fee reduction reform in Gansu.

Therefore, the following regression function is estimated:

$$EE_{iht} = \alpha_0 + \alpha_1 * IT_{iht} + \alpha_2 * IT_{-iht} + \alpha_3 * XX_{iht} + \alpha_4 * HH_{ht} + V_{v,2000} * Year_{2007} + Village_v + Year_t + \varepsilon_{iht} \quad (5)$$

In this function,  $EE_{iht}$  on the left hand side is defined the same as that in function (3), which is a vector of outcome variables, including required education expenditure and voluntary education expenditure. In order to control heterogeneity between treatment group and control group, I include a vector of individual characteristics,  $XX_{iht}$ , including dummy for girl, age, and dummies of grades; and a vector of household characteristics,  $HH_{ht}$ , which is a vector of household characteristics, including household demographic structure<sup>20</sup>, household endowments<sup>21</sup>, and log of household real income per capita. As discussed above, I include the interactions of village variables in 2000 and indicator for year 2007,  $V_{v,2000} * Year_{2007}$ , as control. I also control for average village and cohort education expenditure by including village fixed effect,  $Village_v$ , and year fixed effect,  $Year_t$ . In the function,  $\varepsilon_{iht}$  is an error term with mean value equal to zero. The most important variables in this regression function are  $IT_{iht}$  and  $IT_{-iht}$ .  $IT_{iht}$  is intended transfer child  $i$  in household  $h$  gets from the reform in year  $t$ . The coefficient before this variable,  $\alpha_1$ , captures the impact of the reform on child  $i$ .  $IT_{-iht}$  is the sum of intended transfer of all other children living in the same family. The coefficient before this variable,  $\alpha_2$ , captures spillover effect of intended transfer other children in the same family gets. In the estimation, robust standard error is calculated by clustering in village level.

In spite of everything I do to control for possible bias in the estimation of function (5), the estimated results might still be driven by some unobservable household or village changes in education expenditures. But if so, then we should expect to see the same effects of  $IT_{iht}$  and  $IT_{-iht}$  on individual education expenditures. Therefore, the estimation of function (5) itself can also provide evidence to see whether the unobservable household or village changes in education expenditures affect the estimation.

As discussed in section 3, if the IFE exists, we should be able to see a significant positive impact of the reform on voluntary education expenditure, but insignificant impact on other expenditure categories. Therefore, estimation of the reform's impact on household level expenditures can also provide evidence for the existence of the IFE. I can exploit the same variations, that is cohort variation and variation in the extent of fee reductions in

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<sup>20</sup>Household demographic structure includes ratio of male from 0-5, 6-12, 13-16, 17-19, 20-29, 30-39, 40-49, 50-54, 55 and above, ratio of female from 0-5, 6-12, 13-16, 17-19, 20-29, 30-39, 40-49, 50-54, 55 and above, and total number of family members.

<sup>21</sup>Household endowments include land area per capita, father's schooling year, and mother's schooling year.

different villages, to identify the impact of the reform on household level expenditures. The following regression function is estimated:

$$E_{ht}^m = \alpha_0 + \alpha_1 * ITPS_{ht} + \alpha_2 * H_{ht} + V_{v,2000} * Year_{2007} + Village_v + Year_t + \varepsilon_{ht} \quad (6)$$

In equation (6),  $E_{ht}^m$  on the left hand side is a vector of outcome variables, including household income per capita, household total expenditure<sup>22</sup> per capita, and specific categories of expenditures per capita, including food<sup>23</sup>, non-food goods and service<sup>24</sup>, health care<sup>25</sup>, required educational expenditures<sup>26</sup> and voluntary educational expenditures<sup>27</sup>.  $ITPS_{ht}$  is intended transfer per capita household h should get in year t from the reform. The value is equal to zero in pre-reform year, i.e. year 2000. In the year 2007, it is equal to the sum of intended transfers to each enrolled child in the household divided by the number of family members.  $H_{ht}$  is a vector of household variables, including household demographic structure, household endowments, log of household real income per capita, and the number of children enrolled in different grades<sup>28</sup>. The variables of household demographic structure, household endowments and log value of household income per capita are defined the same as those in function (5). Interactions of village variables in 2000 and dummy for year 2007,  $V_{v,2000} * Year_{2007}$ , are included in the regression to control time-varying and region-specific factors. I also control for village average expenditure levels and cohort average expenditure levels by including village fixed effects,  $Village_v$ , and year fixed effects,  $Year_t$ .  $\varepsilon_{ht}$  is an error term with mean equal to zero. In the estimation, robust standard error is calculated by clustering in village level.

In estimating functions (5) and (6), one important caveat bears mentioning. According

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<sup>22</sup>Total expenditure is equal to the sum of expenditure on food, expenditure on non-food consumption and service, expenditure on health care, expenditure on required education items, and expenditure on voluntary education items.

<sup>23</sup>Expenditure on food is the sum of expenditures on rice, flour, maize, beans, bean products, other grains, potatoes and sweet potatoes, grain products, corn, pork, beef and mutton, chicken, other meat, marine products, eggs, vegetables, edible oils, dried and fresh fruits and nuts, spices, cigarette and alcohol, soft drinks, canned food, restaurant food, and money spent on food proceeding.

<sup>24</sup>Expenditure on non-food consumption and service is the sum of expenditures on washing and cleaning supplies, miscellaneous household items and hardware, clothing consumption, bedding, transportation maintenance and parts, electronic appliances maintenance, transportation costs, postage, communication devices maintenance fees, rent, house decoration and renovation, electricity, fuel, cultural products, cultural service fee, personal goods (including jewelry, makeup, etc.), and personal service fees (including salon, bath, photos, etc.).

<sup>25</sup>Expenditures on health care is the sum of expenditure on buying medicine, and health insurance.

<sup>26</sup>Expenditures on required education items is the sum of tuition and textbook fee.

<sup>27</sup>Expenditures on voluntary education items is the sum of expenditure on supplies of pens, exercise books, etc., supplementary tutoring, school uniforms, and other education items.

<sup>28</sup>This vector of variables includes number of children enrolled in primary school, middle school, high school, and other school levels.

to Park and Shi (2008), the fee reduction reform has no significant effects on the enrolment of 9-12 years old children, but it does have significant positive effects on the enrolment of 13-16 years old children. In this paper, I take the enrolment decision as given by using households having enrolled children as sample for analysis and including numbers of kids enrolled in different grades as control. The results shown in this paper should not be extended to interpret the behaviors of households without any children enrolled in schools. However, even we interpret the results in this way; there are still some ways in which the results could be biased. Although only households having children enrolled in school are used for analysis, the households sending children (especially 13-16 years old children) to school only after the reform reduced education fees might be different from those households sending children to school before the reform removed education fees in terms of some unobservable characteristics. For example, parents sending children to school only after the education fee was removed might be less willing to invest on children’s education, then sample surveyed in 2007 includes more such households in villages benefiting more from the reform (i.e. having higher pre-reform education fees), then the estimates of the impact of the reform on voluntary education expenditure might be under-biased. However, the bias should not be expected to be large. One reason is because 9-12 years old children account for majority of the sample (67%), but 13-16 years old children only account for 25% of the sample.<sup>29</sup> Another reason is that the impact of the reform on middle school enrolment is trivial, it is precisely estimated though. Park and Shi (2008) showed that 10% increase in money transferred from the reform only led to 0.4% increase in the probability of middle school enrolment. Indeed, the middle school enrolment rate increased from 88.92% to 91.44% (the enrolment rates of boys were almost the same before the reform and after the reform, increasing from 91.01% to 91.86%, but the enrolment rate of girls increased from 86.59% before the reform to 90.94%).

## 5 Empirical results

### 5.1 Descriptive results

Table 6 lists the descriptive results, which also show the basic difference-in-difference idea used to identify the impact of the reform in this paper. In the table, “Treated” group includes villages having average intended money transferred from the reform above the median, and “Untreated” group includes villages having average intended money transferred below the median. Year 2000 is pre-reform period and year 2007 is post-reform period.

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<sup>29</sup>There are also 5% children aged from 6-8 years, although Park and Shi (2008) did not investigate the impact of the reform on them, the impact should not be significant since these children were only be likely to be enrolled in primary schools, and the impact of the reform on enrolment in primary school is not significant.

This table lists results for total expenditure per capita and other categories of expenditures per capita, including expenditure on food, expenditure on non-food consumption and service, expenditure on health care, required education expenditure, and voluntary education expenditure. From the table, we can see that compared with the untreated group, the expenditures of the treated group are always higher. One important reason might be because treated group includes villages having higher intended transfers, i.e. higher pre-reform education fees, which could be related with better economic status of these villages, leading to higher household expenditures level. Secondly, we can see that, compared with pre-reform period, i.e. year 2000, expenditures in post-reform period, i.e. year 2007, are higher, whether for treated or untreated group. Besides the time effects, households could spend more because they got money from the education fee reduction reform. The difference-in-difference results are shown in the right-bottom cell in each section in table 6. We can see that the effects are significant only for required education expenditure per capita and voluntary education expenditure per capita; both of them are significant in 1% level. The difference-in-difference result for required education expenditure per capita is -40.27, which means the average required education expenditure per capita in treated villages decreased 40.27 *Yuan* more than that in untreated villages. While the difference-in-difference result for voluntary education expenditure per capita is 55.33, which means that the average voluntary education expenditure per capita in treated village increased 55.33 *Yuan* more than that in untreated villages. All other results are not significant. It provides preliminary evidence for the existence of the IFE, i.e. households used money saved from reduced required education fee to spend on the voluntary education items. Since it cannot control for other variables, this paper provides more reliable regression results in the following.

## 5.2 Individual regression

Table 7 presents the estimates of the reform's impact on individual education expenditures. This table is divided into two panels. Panel A shows the main results using samples from the first wave (year 2000) and the third wave (year 2007); and panel B shows the results of a control experiment using samples from the first wave (year 2000) and the second wave (year 2004). Columns (1) and (2) show the results from the estimation of equation (3), and columns (3) and (4) show the results from the estimation of equation (5). Because there are many control variables in the regressions, this paper absorbs their coefficients, and just presents the coefficient of the individual intended transfer and the coefficient of the sum of all other children's intended transfer in the same family, both of which are what we are mostly interested in.

Column (1) shows the impact of the reform on required education expenditure, and the coefficient shown in this column is -0.448, significant in 1% level. It means that one *Yuan*

intended transfer from the reform leads to 0.448 *Yuan* decreases in required education expenditure. The intended transfer does not lead to one-for-one decrease in the required education expenditure. It might reveal the fact that the reform did not fully achieve its goal and households were still paying some education fees which were claimed to be eliminated. And column (2) shows the impact of the reform on voluntary education expenditure in individual level; the coefficient in this column is equal to 0.519, significant in 5% level. This coefficient means that one *Yuan* intended transfer from the reform can lead to 0.519 *Yuan* increase in voluntary education expenditure. These two coefficients have opposite signs, and the magnitudes of them are close to each other. I test the null hypothesis that the sum of these two coefficients is equal to zero. The P-value of Wald test is equal to 0.833, which means that there is no significant difference between the magnitudes of these two coefficients. Column (3) also shows the impact of the reform on required education expenditure in individual level, estimated from regression function (5); from this column we can see that the coefficient before the individual level intended saving is -0.422, statistically significant in 1% level. The coefficient before the sum of all other children's intended transfer in the same family is -0.085, but not significant at all. Column (4) shows the impact of the reform on voluntary education expenditure in individual level. We can see that the coefficient of individual intended saving is 0.586, significant in 5% level; but the coefficient of the sum of all other children's intended saving in the same family is equal to 0.012, not significant. I also test the null hypothesis that the magnitudes of the coefficients before individual intended transfer in columns (3) and (4) are not different. The P-value of Wald test is equal to 0.550, which means that the difference between the magnitudes of these two coefficients is not statistically significant. In addition, if we compare the coefficients in columns (1) and (3), and compare the coefficients in columns (2) and (4), we can see that the estimated impacts of the reform using these two different specifications are very close to each other. In addition, as I point out in Section 4.2.2, if the results are driven by unobservable village or household changes in education expenditures, the individual intended transfer,  $IT_{iht}$ , and the sum of all other children's intended transfer,  $IT_{-iht}$ , should have same effects on education expenditures. But the results in Table 7 show that they are different. So we can see that the potential unobservable village or household changes in education expenditures do not affect the estimation.

Panel B in Table 7 shows the results from the control experiment using data from year 2000 and year 2004. The critical thing is how to generate hypothetical intended transfer for each enrolled children surveyed in year 2004. In order to do it, I get the mean value of intended transfer for children enrolled in each grade and living in each village in 2007, and then I assign this average value to children enrolled in the same grade and living in the same village in 2004, by which the hypothetical intended transfer for each enrolled children in 2004 is constructed. Columns (1) and (2) show the results testing the identification

assumption that the systematic difference of education expenditures between children enrolled in different grades does not change across the time. Both coefficients in these two columns are not significant, which supports the assumption. The last two columns in panel B test whether the time trends of household education expenditures are different in different villages in the absence of the reform. From columns (3) to (4), we can also see that no coefficients are statistically significant. It provides evidence that there are no different time trends of individual education expenditures in different villages in the absence of the reform.

In this paper, I also investigate the heterogeneous impact of the reform on voluntary education expenditure in terms of individual characteristics, including gender, birth order, and grade enrolled. All the heterogeneous tests are based on regression function (5). Table 8 shows the estimation of the heterogeneous impacts of the reform. Columns (1) to (3) correspond to the heterogeneous impacts in terms of gender, birth order, and grade enrolled respectively. We can see from column (1) that the coefficient before the interaction term of girl dummy and individual intended transfer is 0.585, statistically significant in 1% level. It shows that with one *Yuan* increase in intended transfer, girls can get 0.585 *Yuan* more than boys in terms of voluntary education expenditures from their parents. The second column shows the coefficient of the interaction of birth order with individual intended transfer; it is equal to -0.471, statistically significant in 1% level. This result shows that with the same amount increase in the intended transfer from the reform, parents spend more on older children. It is consistent with what is shown in column (3). The coefficient of the interaction of individual intended transfer and middle school dummy is shown in column (3), which is equal to 0.864, statistically significant in 5% level. The comparison group in column (3) is children enrolled in primary schools; then the result shows that with one *Yuan* increase in intended transfer from the reform, parents would spend 0.864 *Yuan* more on children enrolled in middle school in terms of voluntary education expenditure.

### 5.3 Household regression

Table 9 presents the household results. Panel A in Table 9 is the main results using data from waves of years 2000 and 2007, while results in panel B are results from a control experiment using data from waves of years 2000 and 2004. Because there are many control variables in the regressions, this paper absorbs their coefficients, and just presents the coefficient of the intended transfer per capita, which is what we are mostly interested in.

Let's look at the results in panel A first. Column (1) shows the impact of the fee reduction reform on the household income per capita. The reform is expected to affect income if households use money from the reform to invest and then make more money. However, the result shows that there is no significant impact of the reform on income. The coefficient is -0.677. Column (2) shows the impact on total expenditure per capita. While the coefficient

is -2.222, it is not significant either. Since household saving is equal to income minus total expenditure, we can derive from these two estimated results that there is also no impact of the reform on household saving, i.e. households do not save the money from the reduced education fees.

Columns (3) to (7) show the impact of the reform on different categories of expenditures. Columns (3) to (7) correspond to expenditure on food, non-food goods and service, health care, required education items, and voluntary education items respectively. Firstly, from columns (3), (4) and (5), we can see that the impact of education fee reduction reform on expenditures on food, non-food goods and service, and health care per capita are not significant. The coefficients shown in columns (3), (4) and (5) are all negative; they are equal to -0.014, -1.770 and -0.476 respectively. We can see that only the impacts on required education expenditure and voluntary education expenditure are significant. Columns (6) and (7) show the coefficients. The coefficient shown in column (6) is -0.613, significant in 1% level. It means that one *Yuan* intended transfer per capita from the reform leads to 0.613 *Yuan* reduction in the required education payment per capita. Consistent with results from individual regression, the intended transfer does not lead to one-for-one reduction in the required education fees. Again it shows that the reform did not completely achieve its goal. Column (7) shows the impact of the reform on household voluntary education expenditure per capita. The coefficient shown in this column is 0.651, significant at 5% level. One *Yuan* intended transfer per capita from the reform leads to 0.651 *Yuan* increases in voluntary education expenditure per capita. We can see that although the magnitudes of coefficients in column (6) and column (7) are not exactly the same, they are very close to each other and have the opposite signs. Indeed, the P-value of Wald test testing the null hypothesis that the magnitudes of these two coefficients are the same is 0.899, which means that the difference between the magnitudes of these two coefficients is not significant. In addition to insignificant impact of the reform on other categories of expenditures, we can draw a conclusion that the income effect of the reform does not exist and the parents spend money transferred from the reform still on education.

Panel B shows the results from a control experiment testing the pre-assumption that the time trend of household expenditures in villages benefiting more from the reform is not systematically different from villages benefiting less from the reform. The household hypothetical intended transfer per capita is equal to the summation of the hypothetical intended transfer of children living in the same family divided by the number of family members. The method used to construct individual level hypothetical intended transfer is discussed in Section 5.2. All other control variables are defined the same as those in panel A. From panel B, we can see that no coefficients are significant. It shows that the time trends of households' expenditures in different villages are not systematically different in the absence

of the reform.

From Table 9, we see that on average one *Yuan* intended saving per capita leads to 0.651 *Yuan* increases in voluntary education expenditure per capita. It would be interesting to see the heterogeneous effects of the reform on voluntary education expenditure in terms of household characteristics. In this paper, I investigate the heterogeneous effects of the reform on household voluntary expenditure per capita in term of household income per capita, total number of enrolled children, mother's schooling year, and father's schooling year. Columns (1) to (4) in Table 10 correspond to these four household characteristics respectively. From column (1), we can see that the coefficient of the interaction of log value of household income per capita and household intended transfer from the reform per capita is 0.148; but it is not statistically significant. The second column shows the heterogeneous impact in terms of total number of enrolled children in the family. The coefficient of the interaction term is equal to 0.274, also not statistically significant. Columns (3) and (4) show the heterogeneous impact of the reform in terms of mother and father's schooling years respectively. Although both coefficients of the interaction terms are positive, only the coefficient of the interaction with mother's schooling years is significant. It is equal to 0.083, significant at 5% level. And the coefficient of the interaction term with father's schooling years is 0.037, but not statistically significant. These two results show that, compared with father's education, mother's education is more important in determining the education investment on children. It is consistent with other findings that mothers care more about children's education than fathers<sup>30</sup>.

## 6 Robustness checks

### 6.1 Do variations from textbook exemption and living subsidy drive the results?

In this paper, I argue that the variation in the intended transfer is from variation of the school fees charged before the reform in different villages, while the variations from exempted textbook charge and living subsidy are absorbed if household income is controlled. In this section, I am going to test whether this argument is valid. I assume all children enrolled in primary schools and middle schools are eligible to be exempted from textbook fee charge, but no one gets living subsidy. Then I construct a new variable, which I call *Intended Transfer II*. It is equal to school fees exemption, which is defined in equation (4) in section 4.2.1, plus 70 (140) if the child is enrolled in primary school (if the child is enrolled in middle school.). The household intended transfer II per capita is equal to the sum of intended transfer II of all the children living in the household divided by the number of

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<sup>30</sup>Thomas, 1990, and Duflo, 2000.

total family members. By doing so, the variation of intended transfer II is totally from the variation in pre-reform school fees. Then, I re-estimate functions (3), (5) and (6) by replacing intended transfer with newly constructed intended transfer II. The results are shown in Table 11 and Table 12.

Table 11 shows the results from individual level regressions, but using newly defined intended transfer II as treatment variable. The first two columns show the results from estimating function (3). The coefficient shown in column (1) is equal to -0.447, significant in 1% level. However, the coefficient shown in column (2) is equal to 0.543, significant in 5% level. Columns (3) and (4) show the estimated results of function (5). Coefficient in column (3) is equal to -0.421, significant in 1% level, but the coefficient in column (4) is equal to 0.537, significant in 10% level. We can compare these four coefficients in Table 11 with those corresponding coefficients shown in Table 7. We can see that the estimated impacts of the reform on required education fee are almost the same. The P-values of Wald test are 0.975 and 0.519 for coefficient shown in columns (1) and (3) respectively. Although the estimated impacts of the reform on voluntary education expenditure in Table 11 are not as close to those shown in Table 7 as the impacts on required education expenditure, they are not statistically significant. The P-values of Wald test are 0.467 and 0.534.

Table 12 shows the results from household level regression. From this table, we can see that only the coefficients shown in columns (6) and (7) are significant. The coefficient in column (6) is equal to -0.608, significant in 1% level. We should compare this coefficient with that shown in column (6) in Table 9, which is equal to -0.613. We can see that they are almost the same. Indeed, I test the hypothesis that these two coefficients are equal, and P-value of Wald test is 0.880, which means that these two coefficients are not significantly different. Then we can turn to the coefficient shown in column (7) in Table 12. This coefficient is equal to 0.627, significant in 5% level. The corresponding coefficient in column (7) in Table 9 is equal to 0.651. These two coefficients are very close to each other, and the P-value of Wald test testing their equality is 0.755, which also shows that these two coefficients are not significantly different.

The results discussed in above show that the variations from textbook fee charge and living subsidy do not have any effects on the estimation.

## **6.2 The impacts of required education fees on expenditures: IV strategy**

In this section, I investigate the impact of required education expenditure on other expenditures directly. In order to exploit the variation in required education expenditure due to the education fee reduction reform, I use intended transfer from the reform as IV for

required education expenditure. Table 13 shows the estimated coefficients. Column (1) in the table shows the result of individual level regression, and columns (2) to (7) in the same table show the results of household level regressions.

Column (1) in Table 13 shows the result of individual level regression. In this column, the individual intended transfer from the reform and the sum of other children's intended transfer from the reform in the same family are used as IVs for individual required education expenditure and the sum of other children's required education expenditure in the same family. I do not present the regression result for the first stage in Table 13, but the F-values are 26.83 and 60.12 in the first stage regression of individual required education expenditure and the sum of all other children's required education expenditure in the same family. These two F-values are larger than 10, which mean that the IVs used are not weak<sup>31</sup>. In column (1), the coefficient before individual required education expenditure is -1.312, significant in 10% level, while the coefficient before the sum of other children's required education expenditure is not significant. It means that one *Yuan* decrease in individual required education expenditure leads to 1.312 *Yuan* increases in voluntary education expenditure on this child. I also test the hypothesis that this coefficient is equal to -1. The P-value of F test is equal to 0.643, which means that the coefficient is not significantly different from -1. The result shown in Table 13 is consistent with that shown in table 7. In column (1) in Table 7, one *Yuan* increase in the intended transfer from the reform leads to 0.422 *Yuan* decreases in required education expenditure and 0.586 *Yuan* increases in voluntary education expenditure, which means that one *Yuan* decrease in required education expenditure leads to 1.389 *Yuan* increases in voluntary education expenditure, which is slightly larger but still very similar to the estimates shown in Table 13.

Then, let's turn to the results shown in columns (2) to (7) in Table 13. In all these columns, household intended transfer from the reform per capita is used as an IV for household required education expenditure per capita. The first stage regression has been shown in Table 9. The F-value of the first stage regression is equal to 20.10. It is larger than 10, which means household intended transfer from the reform per capita is not a weak IV for household required education expenditure per capita<sup>32</sup>. We can see that only the coefficient in column (7), i.e., the regression of household voluntary education expenditure per capita, is significant. The coefficient is equal to -1.061, significant in 5% level. It means that one *Yuan* decrease in required education expenditure per capita leads to 1.061 *Yuan* increases in voluntary education expenditure per capita. Although the coefficient is not exactly equal to -1, the P-value of F test testing the hypothesis that the coefficient is equal to -1 is 0.608, which means that the coefficient is not significantly different from -1. The

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<sup>31</sup>Bound, Jaeger and Baker, 1995.

<sup>32</sup>Bound, Jaeger and Baker, 1995.

result estimated here is also consistent with that shown in Table 9. In Table 9, one *Yuan* intended transfer per capita from the reform leads to 0.613 *Yuan* decreases in required education expenditure per capita and 0.651 *Yuan* increases in voluntary education expenditure per capita, from which we can derive that one *Yuan* decrease in required education expenditure per capita leads to 1.062 *Yuan* increases in voluntary education expenditure per capita. In table 13, all other coefficients shown in columns (2) to (6) are not significant, which means that the change in the required education expenditure due to the reform does not affect household expenditures except for household voluntary education expenditure.

### 6.3 Measurement error

Measurement error is always a problem for analyses using household survey data since most of the information is retrospective. In this paper, there are two main possible sources of measurement errors. One is from dependent variables (different categories of household expenditures), and the second one is from household income per capita as control variable in the regressions. I will discuss these two cases in this section.

Considering measurement error in the dependent variable, we can use  $y$  to represent measured dependent variable,  $y^*$  to represent true value of dependent variable, and  $\varepsilon$  to represent measurement error. Then, we have  $y = y^* + \varepsilon$ . The regression function can be written as the following:

$$y = \alpha_0 + X * \beta + \varepsilon + e \quad (7)$$

Then, only if  $COV(X, e) \neq 0$ , which means that the measurement error is systematically correlated with independent variables, the OLS estimates are biased. In this paper, it could be possible that parents having higher education might report expenditures more accurately, which leads to inconsistency in the estimation of the coefficients. However, without enough information, we can not know whether measurement error is correlated with parents' education or not. Another consequence of measurement error in the dependent variable is that it leads to larger variance of OLS estimates, but it does not violate any assumptions for OLS estimates to have desirable large-sample properties.

Now, I am about to discuss the measurement error in the household income. The measurement error in independent variable leads to attenuation bias of the estimates. In order to see the effects of measurement error on the coefficient of interest, I use the average value of income of all other households living in the save village in the same year as IV. A critical assumption for the validity of this IV is that the ways in which different households induce measurement error in recording household income are independent. Table 14 shows the results in individual level (columns (1) to (2)) and in household level (columns (3) to (8)).

We can see the results in columns (1) to (2) first. The one shown in column (1) is -0.498, significant in 5% level; the one shown in column (2) is 0.527, significant in 10% level. Compared with the coefficients shown in columns (1) to (2) in Table 7, although the estimated impact of the reform on individual required education expenditure is larger, but the estimated impact of the reform on individual voluntary education expenditure is smaller in Table 14, both coefficients shown in Table 7 and Table 14 are very close to each other too. And then we can see the results in columns (3) to (8). The coefficients shown in columns (3) to (6) are not significant, which is the same as those shown in panel A in Table 9. The coefficients shown in columns (7) and (8) are significant. The coefficient shown in column (7) is -0.601, significant in 1% level; and the coefficient shown in column (8) is 0.692, significant in 5% level. Comparing with the corresponding coefficients shown in Table 9, we can see that although the estimated impact of the reform on household required education expenditure is slightly smaller in Table 14, but the estimated impact of the reform on household voluntary education expenditure is slightly larger in Table 14, both coefficients shown in table 9 and table 14 are very close to each other.

From the above discussion, we can see that although there might be some measurement errors in the variables, the estimation of the reform's impact is not affected.

## 7 Conclusion

This paper tests the existence of intra-household flypaper effect by investigating the impact of the education fee reduction reform in rural China on expenditures in individual and household levels respectively.

Using year 2000 and year 2007's data from Gansu Survey of Children and Families (GSCF), I find that one *Yuan* increase in the individual intended transfer from the reform leads to 0.422 *Yuan* decreases in the individual required education expenditure, but leads to 0.586 *Yuan* increases in the individual voluntary education expenditure. These two values are not significantly different. And then I investigate the impact of the reform on household level expenditures. I find that one *Yuan* increase in the household intended transfer per capita from the reform leads to 0.613 *Yuan* decreases in household required education expenditure per capita, and 0.651 *Yuan* increases in household voluntary education expenditure per capita. But there are no significant impacts of the reform on household total income per capita, total expenditure per capita, and other categories of expenditures, including expenditure on food, non-food consumption and service, and health care. I also find that with the same amount of increase in the intended transfer from the reform, households having more educated mother spend more on voluntary education items, and the parents spend more on girls, older kids and kids enrolled in middle schools. This paper provides a

strong evidence for the existence of intra-household flypaper effect.

The findings in this paper also have policy implications. Besides the commonly recognized positive impacts of governments' educational subsidy programs on target children's enrolment, this paper shows that these programs also increase parents' investment on enrolled children's education, which increases their short- and long-run welfare. It also shows that when evaluating governments' educational subsidy programs, we should include the flypaper effects into benefit-cost analysis.

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Figure 1 Impact of the fee reduction reform on household expenditures

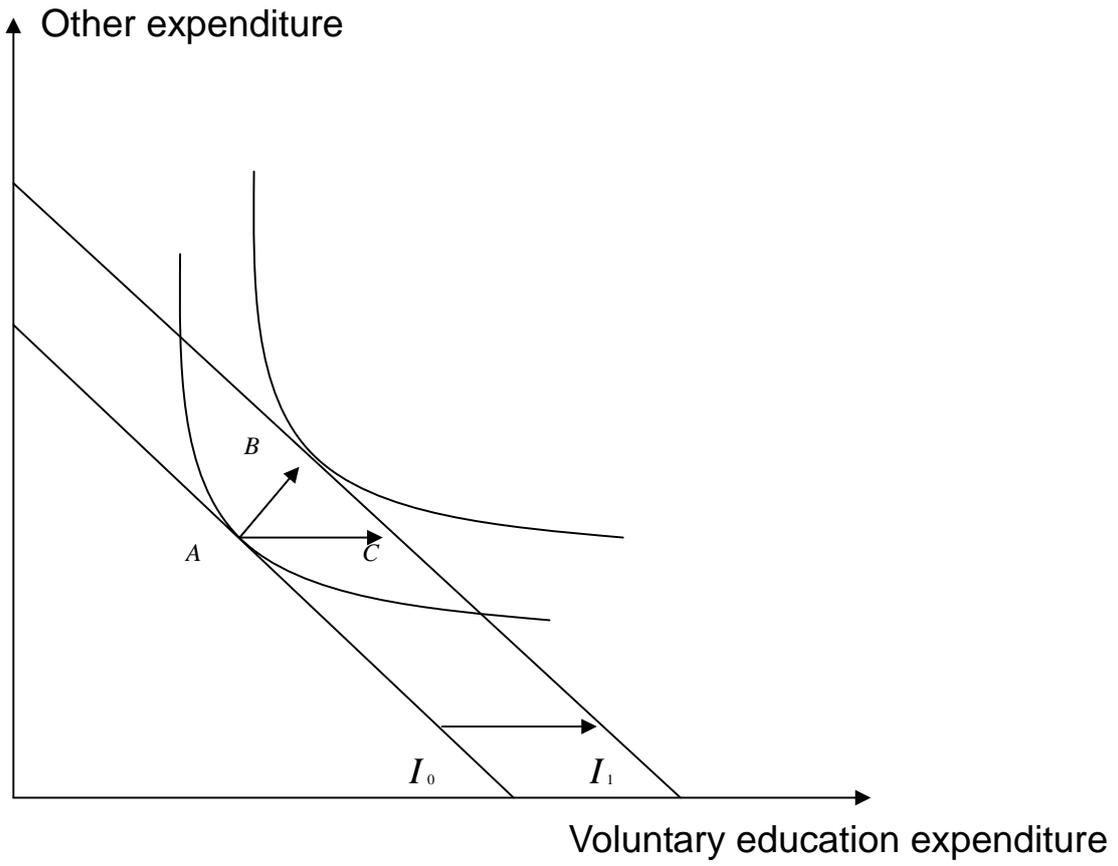
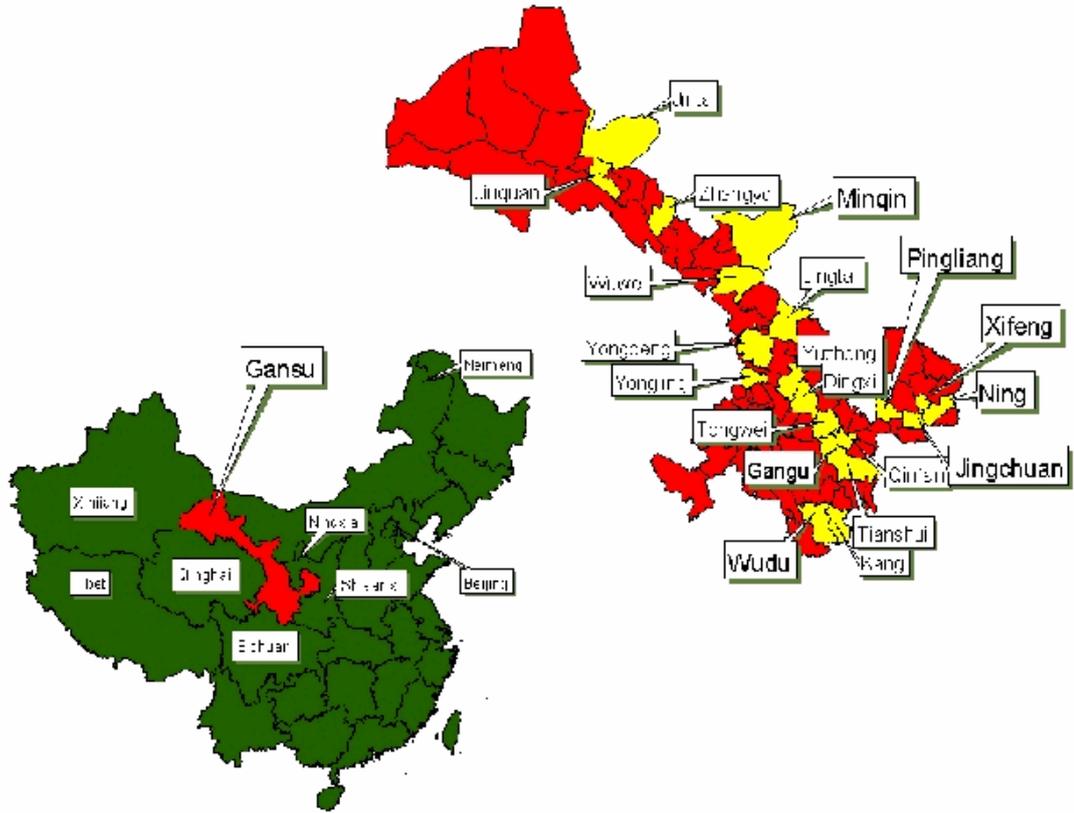


Figure2. Gansu Province and GSCF Counties.



Map 1. Gansu Province, GSCF Counties Marked

Source: Hannum (2001)

**Table 1. Percentage of counties claiming to implement TEOS in each semester (%)**

<u>Primary School</u>						
	Fall, 2004	Spring, 2005	Fall, 2005	Spring, 2006	Fall, 2006	Spring, 2007
School Fees Exemption	15	65	65	100	100	100
Textbook Exemption	30	75	75	100	100	100
Living Subsidy	0	10	15	65	70	70
<u>Middle School</u>						
	Fall, 2004	Spring, 2005	Fall, 2005	Spring, 2006	Fall, 2006	Spring, 2007
School Fees Exemption	15	65	65	100	100	100
Textbook Exemption	30	80	80	100	100	100
Living Subsidy	0	60	65	95	95	95
Num. of Counties	20	20	20	20	20	20

**Table 2. Percentage of children claiming to have TEOS in each semester (%)**

<u>Primary School</u>							
	Fall, 2004	Spring, 2005	Fall, 2005	Spring, 2006	Fall, 2006	Spring, 2007	Total student number
School Fees Exemption	7.32	44.24	52.10	61.94	92.07	95.73	1311
Textbook Exemption	7.70	40.12	48.97	60.34	80.70	85.74	1311
Living Subsidy	0.00	0.31	0.31	0.69	0.84	0.92	1311
<u>Middle School</u>							
	Fall, 2004	Spring, 2005	Fall, 2005	Spring, 2006	Fall, 2006	Spring, 2007	Total student number
School Fees Exemption	8.53	40.30	49.47	56.29	88.06	91.04	469
Textbook Exemption	8.10	41.36	49.89	56.50	74.63	78.04	469
Living Subsidy	0.21	3.20	3.20	4.90	7.25	8.96	469

(1) The total student sample is constructed according to the following (a) children must be in school, (b) children reporting policy time later than "liu ji" time were dropped; (c) children having drop-out experience were dropped; (d) primary school student sample includes students in grade 3 to grade 6 in 2007; middle school student sample includes student in grade 3.

(2) Those reporting policies earlier than the year when the policies existed or later than the time when the surveyed was conducted were dropped.

**Table 3. Two exemptions one subsidy policy value of subsidies per student**

	School fees (zafei) exemption	+ textbook fee exemption	+ living subsidy
	(yuan/year)	(yuan/year)	(yuan/year)
<u>Gansu Province estimates from GSCF</u>			
Primary school students	54.23	103.55	268.52
Middle school students	70.05	168.69	327.06
<u>Western/Central China estimates by Ministry of Education<sup>1</sup></u>			
Primary school students	127.97-164.53	191.96-228.52	466.18-502.74
Middle school students	164.53-210.24	292.50-338.21	566.73-612.43

<sup>1</sup>Ministry of Finance and Ministry of Education (2005), the values are deflated to Yuan in year 2000.

**Table 4 Household characteristics**

Variables	2000	2000	2007	2007
	Mean	S.D.	Mean	S.D.
Household size	4.489	1.084	4.265	1.140
Male aged 0-5/household size	0.017	0.061	0.021	0.065
Male aged 6-12/household size	0.195	0.155	0.168	0.154
Male aged 13-16/household size	0.054	0.108	0.056	0.118
Male aged 17-19/household size	0.006	0.035	0.007	0.040
Male aged 20-29/household size	0.008	0.042	0.003	0.030
Male aged 30-39/household size	0.140	0.116	0.148	0.124
Male aged 40-49/household size	0.045	0.092	0.051	0.102
Male aged 50-54/household size	0.006	0.038	0.005	0.037
Male aged 55 and above/household size	0.026	0.065	0.037	0.081
Female aged 0-5/household size	0.008	0.044	0.018	0.066
Female aged 6-12/household size	0.152	0.155	0.124	0.148
Female aged 13-16/household size	0.066	0.115	0.066	0.118
Female aged 17-19/household size	0.008	0.041	0.013	0.051
Female aged 20-29/household size	0.014	0.054	0.005	0.033
Female aged 30-39/household size	0.193	0.104	0.189	0.116
Female aged 40-49/household size	0.023	0.071	0.038	0.095
Female aged 50-54/household size	0.005	0.034	0.007	0.040
Female aged 55 and above/household size	0.035	0.076	0.044	0.086
Father's schooling year	6.953	3.566	7.251	2.899
Mother's schooling year	4.192	3.513	5.275	3.436
Land area per capita (Mu)	2.075	1.497	2.060	1.457
Total expenditure per capita (Yuan)	1065.753	1101.159	1318.828	1001.087
Income per capita (Yuan)	1052.819	1359.057	1375.746	1659.385
Kids enrolled/household size	0.419	0.145	0.413	0.150
Kids enrolled in primary school/household size	0.371	0.148	0.340	0.151
Kids enrolled in middle school/household size	0.045	0.098	0.064	0.118
Kids enrolled in other schools/household size	0.003	0.026	0.010	0.047
Observation	1629	1629	505	505

All the money has been deflated to year 2000 value

**Table 5 Individual characteristics**

Variable	2000	2000	2007	2007
	Mean	S.D.	Mean	S.D.
Minority indicator	0.020	0.139	0.009	0.096
Age	11.347	2.010	11.797	2.268
Female indicator	0.482	0.500	0.484	0.500
Indicator for being enrolled in primary school	0.883	0.322	0.811	0.391
Indicator for being enrolled in middle school	0.111	0.314	0.164	0.371
Indicator for being enrolled in other levels of school	0.006	0.079	0.024	0.154
Observation	3001	3001	864	864

**Table 6. Descriptive results**

	<u>Total expenditure per capita</u>			<u>Expenditure on food per capita</u>		
	Treated	Untreated	Treated-Untreated	Treated	Untreated	Treated-Untreated
2000	1178.58	922.65	255.93	301.36	218.53	82.83
2007	1516.85	1080.65	436.20	457.37	351.80	105.57
2007-2000	338.27	158.00	180.27	156.01	133.27	22.74
	<u>Expenditure on non-food goods and service per capita</u>			<u>Expenditure on health care per capita</u>		
	Treated	Untreated	Treated-Untreated	Treated	Untreated	Treated-Untreated
2000	544.75	434.88	109.87	157.89	157.86	0.03
2007	677.13	489.13	188.00	235.13	170.64	64.49
2007-2000	132.38	54.25	78.13	77.24	12.78	64.46
	<u>Required education expenditure per capita</u>			<u>Voluntary education expenditure per capita</u>		
	Treated	Untreated	Treated-Untreated	Treated	Untreated	Treated-Untreated
2000	114.72	65.03	49.69	59.86	46.34	13.51
2007	23.86	14.44	9.42	124.66	55.81	68.84
2007-2000	-90.87	-50.59	-40.27***	64.80	9.47	55.33***

\* 10% significant level; \*\* 5% significant level; \*\*\* 1% significant level.

In this table, "Treated" group includes the villages where the average saving from the reform is above the median value. "Untreated" group includes the villages where the average saving from the reform is below the median value.

**Table 7 Impacts of education fee reduction reform on individual education expenditures**

	(1)	(2)	(3)	(4)
	Required education expenditure	Voluntary education expenditure	Required education expenditure	Voluntary education expenditure
<b>Panel A 2000-2007</b>				
Individual intended transfer from the reform	-0.448 (0.081)***	0.519 (0.236)**	-0.422 (0.142)***	0.586 (0.255)**
Sum of other kids' intended transfer from the reform			-0.085 (0.090)	0.012 (0.118)
Observations	3865	3865	3865	3865
R-squared	0.86	0.79	0.38	0.49
<b>Panel B 2000-2004</b>				
Individual hypothetical intended transfer from the reform	-0.235 (0.151)	0.336 (0.226)	0.021 (0.122)	0.328 (0.251)
Sum of other kids' hypothetical intended transfer from the reform			0.043 (0.095)	-0.016 (0.139)
Observations	5342	5342	5342	5342
R-squared	0.88	0.78	0.66	0.52
Village variables in 2000	No	No	Yes	Yes
Individual characteristics	Yes	Yes	Yes	Yes
Dummies for grade enrolled	Yes	Yes	Yes	Yes
Household endowments	No	No	Yes	Yes
Household demographis structure	No	No	Yes	Yes
Household income per capita	No	No	Yes	Yes
Household fixed effect	Yes	Yes	No	No
Year fixed effect	No	No	Yes	Yes
Village fixed effect	No	No	Yes	Yes

Robust standard errors in parentheses; \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%;

(1) village variables in 2000 include illiterate ratio, ratio of primary school graduates in labor force, primary school enrollment rate, middle school enrollment rate, indicator for having preschool classes, distance of primary school from the village seat, log value of money given to schools by village, indicator for having primary school run by the village, indicator for having middle school run by the village, indicator for having railway through the village, indicator for having bus stop in the village, log value of average agricultural income per capita, log value of average industrial income per capita, ratio of households engaged in non-agricultural work, ratio of households running household enterprise, log value of wage for men doing non-agricultural work, log value of wage for women doing non-agricultural work, log value of wage to hire labor for agricultural production, indicator for having enterprises owned by county, indicator for having enterprises owned by township, indicator for having private enterprises.

(2) individual characteristics include indicator for female and age

(3) dummies for grade enrolled include indicator for being enrolled in grade1-grade6 in primary schools, grade1-grade3 in middle schools, grade1-grade3 in high schools and other levels of schools

(4) household endowments include land area per capita, mother's schooling year and father's schooling year

(5) household demographic structure includes ratio of male aged 0-5, ratio of male aged 6-12, ratio of male aged 13-16, ratio of male aged 17-19 ratio of male aged 20-29, ratio of male aged 30-39, ratio of male aged 40-49, ratio of male aged above 54, ratio of female aged 0-5 ratio of female aged 6-12, ratio of female aged 13-16, ratio of female aged 17-19, ratio of female aged 20-29, ratio of female aged 30-39, ratio of female aged 40-49, ratio of female aged 50-54 and total number of family members.

**Table 8 Heterogeneity of the reform's impacts on individual voluntary expenditure on education items**

	(1)	(2)	(3)
	Individual voluntary education expenditure	Individual voluntary education expenditure	Individual voluntary education expenditure
Individual intended transfer from the reform*indicator for female	0.585 (0.219)***		
Individual intended transfer from the reform*birth order		-0.471 (0.166)***	
Individual intended transfer from the reform*middle school dummy			0.864 (0.369)**
Individual intended transfer from the reform	0.343 (0.266)	0.934 (0.295)***	-0.053 (0.327)
Household aggregate saving from the reform	Yes	Yes	Yes
Birth order	No	Yes	No
Village variables in 2000	Yes	Yes	Yes
Individual characteristics	Yes	Yes	Yes
Dummies for grade enrolled	Yes	Yes	Yes
Household endowments	Yes	Yes	Yes
Household demographis structure	Yes	Yes	Yes
Household income per capita	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes
Village fixed effect	Yes	Yes	Yes
Observations	3865	3865	3865
R-squared	0.49	0.49	0.46

Robust standard errors in parentheses; \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%

(1) village variables in 2000 include illiterate ratio, ratio of primary school graduates in labor force, primary school enrollment rate, middle school enrollment rate, indicator for having preschool classes, distance of primary school from the village seat, log value of money given to schools by village, indicator for having primary school run by the village, indicator for having middle school run by the village, indicator for having railway through the village, indicator for having bus stop in the village, log value of average agricultural income per capita, log value of average industrial income per capita, ratio of households engaged in non-agricultural work, ratio of households running household enterprise, log value of wage for men doing non-agricultural work, log value of wage for women doing non-agricultural work, log value of wage to hire labor for agricultural production, indicator for having enterprises owned by county, indicator for having enterprises owned by township, indicator for having private enterprises.

(2) individual characteristics include indicator for female and age

(3) dummies for grade enrolled include indicator for being enrolled in grade1-grade6 in primary schools, grade1-grade3 in middle schools, grade1-grade3 in high schools and other levels of schools

(4) household endowments include land area per capita, mother's schooling year and father's schooling year

(5) household demographic structure includes ratio of male aged 0-5, ratio of male aged 6-12, ratio of male aged 13-16, ratio of male aged 17-19 ratio of male aged 20-29, ratio of male aged 30-39, ratio of male aged 40-49, ratio of male aged 50-54, ratio of male aged above 54, ratio of female aged 0-5 ratio of female aged 6-12, ratio of female aged 13-16, ratio of female aged 17-19, ratio of female aged 20-29, ratio of female aged 30-39, ratio of female aged 40-49, ratio of female aged 50-54 and total number of family members.

**Table 9 Impacts of education fee reduction reform on household expenditure**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Household income per capita	Total expenditure per capita	Expenditure on food per capita	Expenditure on non-food consumption and service per capita	Expenditure on health care per capita	Expenditure on required education items per capita	Expenditure on voluntary education items per capita
<b>Panel A 2000-2007</b>							
Intended transfer/total family member	-0.677 (2.869)	-2.222 (2.214)	-0.014 (0.464)	-1.770 (1.539)	-0.476 (0.700)	-0.613 (0.137)***	0.651 (0.264)**
Observations	2134	2134	2134	2134	2134	2134	2134
R-squared	0.25	0.22	0.50	0.13	0.11	0.45	0.53
<b>Panel B 2000-2004</b>							
Hypothetical intended transfer /total family member	4.498 (5.665)	0.844 (2.013)	-0.227 (0.542)	-0.007 (1.080)	0.699 (1.259)	0.149 (0.109)	0.231 (0.198)
Observations	2991	2991	2991	2991	2991	2991	2991
R-squared	0.21	0.28	0.43	0.17	0.06	0.63	0.58
Village variables in year 2000	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Log value of household income per capita	No	Yes	Yes	Yes	Yes	Yes	Yes
Household endowments	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Num. of kids enrolled	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Household demographic structure	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Village fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Robust standard errors in parentheses, standard errors are calculated clustering over villages; \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%

(1) village variables in 2000 include illiterate ratio, ratio of primary school graduates in labor force, primary school enrollment rate, middle school enrollment rate, indicator for having preschool classes, distance of primary school from the village seat, log value of money given to schools by village, indicator for having primary school run by the village, indicator for having middle school run by the village, indicator for having railway through the village, indicator for having bus stop in the village, log value of average agricultural income per capita, log value of average industrial income per capita, ratio of households engaged in non-agricultural work, ratio of households running household enterprise, log value of wage for men doing non-agricultural work, log value of wage for women doing non-agricultural work, log value of wage to hire labor for agricultural production, indicator for having enterprises owned by county, indicator for having enterprises owned by township, indicator for having private enterprises.

(2) household endowments include land area per capita, mother's schooling year and father's schooling year.

(3) number of kids enrolled includes number of kids enrolled in primary school, number of kids enrolled in middle school, number of kids enrolled in high school and number of kids enrolled in other level of schools

(4) household demographic structure includes ratio of male aged 0-5, ratio of male aged 6-12, ratio of male aged 13-16, ratio of male aged 17-19, ratio of male aged 20-29, ratio of male aged 30-39, ratio of male aged 40-49, ratio of male aged 50-54, ratio of male aged above 54, ratio of female aged 0-5, ratio of female aged 6-12, ratio of female aged 13-16, ratio of female aged 17-19, ratio of female aged 20-29, ratio of female aged 30-39, ratio of female aged 40-49, ratio of female aged 50-54 and total number of family members.

**Table 10 Heterogeneity of the reform's impacts on household expenditure on voluntary education items per capita**

	(1)	(2)	(3)	(4)
	Expenditure on voluntary education items per capita			
Intended transfer from the reform per capita(*)log value of household income per capita	0.148 (0.121)			
Intended transfer from the reform per capita(*)total number of enrolled kids		0.274 (0.202)		
Intended transfer from the reform per capita(*)mother's schooling year			0.083 (0.040)**	
Intended transfer from the reform per capita(*)father's schooling year				0.037 (0.051)
Intended transfer from the reform per capita	-0.348 (0.828)	-0.081 (0.443)	0.048 (0.399)	0.353 (0.529)
Village variables in year 2000	Yes	Yes	Yes	Yes
Log value of household income per capita	Yes	Yes	Yes	Yes
Household endowments	Yes	Yes	Yes	Yes
Num. of kids enrolled	Yes	Yes	Yes	Yes
Household demographic structure	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes
Village fixed effect	Yes	Yes	Yes	Yes
Observations	2134	2134	2134	2134
R-squared	0.53	0.36	0.53	0.53

Robust standard errors in parentheses; \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%

(1) village variables in 2000 include illiterate ratio, ratio of primary school graduates in labor force, primary school enrollment rate, middle school enrollment rate, indicator for having preschool classes, distance of primary school from the village seat, log value of money given to schools by village, indicator for having primary school run by the village, indicator for having middle school run by the village, indicator for having railway through the village, indicator for having bus stop in the village, log value of average agricultural income per capita, log value of average industrial income per capita, ratio of households engaged in non-agricultural work, ratio of households running household enterprise, log value of wage for men doing non-agricultural work, log value of wage for women doing non-agricultural work, log value of wage to hire labor for agricultural production, indicator for having enterprises owned by county, indicator for having enterprises owned by township, indicator for having private enterprises.

(2) household endowments include land area per capita, mother's schooling year and father's schooling year.

(3) number of kids enrolled includes number of kids enrolled in primary school, number of kids enrolled in middle school, number of kids enrolled in high school and number of kids enrolled in other level of schools

(4) household demographic structure includes ratio of male aged 0-5, ratio of male aged 6-12, ratio of male aged 13-16, ratio of male aged 17-19, ratio of male aged 20-29, ratio of male aged 30-39, ratio of male aged 40-49, ratio of male aged 50-54, ratio of male aged above 54, ratio of female aged 0-5, ratio of female aged 6-12, ratio of female aged 13-16, ratio of female aged 17-19, ratio of female aged 20-29, ratio of female aged 30-39, ratio of female aged 40-49, ratio of female aged 50-54 and total number of family members.

**Table 11 Robustness check using intended transfer II in individual regression**

	(1)	(2)	(3)	(4)
	Required education expenditure	Voluntary education expenditure	Required education expenditure	Voluntary education expenditure
Individual intended transfer II from the reform	-0.447 (0.083)***	0.543 (0.242)**	-0.421 (0.152)***	0.537 (0.283)*
Sum of other kids' intended transfer II from the reform			-0.054 (0.080)	0.019 (0.101)
Observations	3865	3865	3865	3865
R-squared	0.86	0.79	0.38	0.49
Village variables in 2000	No	No	Yes	Yes
Individual characteristics	Yes	Yes	Yes	Yes
Dummies for grade enrolled	Yes	Yes	Yes	Yes
Household endowments	No	No	Yes	Yes
Household demographic structure	No	No	Yes	Yes
Household income per capita	No	No	Yes	Yes
Household fixed effect	Yes	Yes	No	No
Year fixed effect	No	No	Yes	Yes
Village fixed effect	No	No	Yes	Yes

Robust standard errors in parentheses; \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%.

(1) village variables in 2000 include illiterate ratio, ratio of primary school graduates in labor force, primary school enrollment rate, middle school enrollment rate, indicator for having preschool classes, distance of primary school from the village seat, log value of money given to schools by village, indicator for having primary school run by the village, indicator for having middle school run by the village, indicator for having railway through the village, indicator for having bus stop in the village, log value of average agricultural income per capita, log value of average industrial income per capita, ratio of households engaged in non-agricultural work, ratio of households running household enterprise, log value of wage for men doing non-agricultural work, log value of wage for women doing non-agricultural work, log value of wage to hire labor for agricultural production, indicator for having enterprises owned by county, indicator for having enterprises owned by township, indicator for having private enterprises.

(2) individual characteristics include indicator for female and age

(3) dummies for grade enrolled include indicator for being enrolled in grade1-grade6 in primary schools, grade1-grade3 in middle schools, grade1-grade3 in high schools and other levels of schools

(4) household endowments include land area per capita, mother's schooling year and father's schooling year

(5) household demographic structure includes ratio of male aged 0-5, ratio of male aged 6-12, ratio of male aged 13-16, ratio of male aged 17-19 ratio of male aged 20-29, ratio of male aged 30-39, ratio of male aged 40-49, ratio of male aged 50-54, ratio of male aged above 54, ratio of female aged 0-5 ratio of female aged 6-12, ratio of female aged 13-16, ratio of female aged 17-19, ratio of female aged 20-29, ratio of female aged 30-39, ratio of female aged 40-49, ratio of female aged 50-54 and total number of family members.

**Table 12 Robustness check using intended transfer II in household level regression**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Household income per capita	Total expenditure per capita	Expenditure on food per capita	Expenditure on non-food consumption and service per capita	Expenditure on health care per capita	Expenditure on required education items per capita	Expenditure on voluntary education items per capita
Intended transfer II/total family member	-1.914 (2.123)	-2.505 (2.421)	-0.294 (0.452)	-1.980 (1.878)	-0.250 (0.643)	-0.608 (0.129)***	0.627 (0.265)**
Village variables in year 2000	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Log value of household income per capita	No	Yes	Yes	Yes	Yes	Yes	Yes
Household endowments	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Num. of kids enrolled	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Household demographic structure	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Village fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2134	2134	2134	2134	2134	2134	2134
R-squared	0.56	0.22	0.50	0.14	0.11	0.45	0.53

Robust standard errors in parentheses, standard errors are calculated clustering over villages; \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%

(1) village variables in 2000 include illiterate ratio, ratio of primary school graduates in labor force, primary school enrollment rate, middle school enrollment rate, indicator for having preschool classes, distance of primary school from the village seat, log value of money given to schools by village, indicator for having primary school run by the village, indicator for having middle school run by the village, indicator for having railway through the village, indicator for having bus stop in the village, log value of average agricultural income per capita, log value of average industrial income per capita, ratio of households engaged in non-agricultural work, ratio of households running household enterprise, log value of wage for men doing non-agricultural work, log value of wage for women doing non-agricultural work, log value of wage to hire labor for agricultural production, indicator for having enterprises owned by county, indicator for having enterprises owned by township, indicator for having private enterprises.

(2) household endowments include land area per capita, mother's schooling year and father's schooling year.

(3) number of kids enrolled includes number of kids enrolled in primary school, number of kids enrolled in middle school, number of kids enrolled in high school and number of kids enrolled in other level of schools

(4) household demographic structure includes ratio of male aged 0-5, ratio of male aged 6-12, ratio of male aged 13-16, ratio of male aged 17-19, ratio of male aged 20-29, ratio of male aged 30-39, ratio of male aged 40-49, ratio of male aged 50-54, ratio of male aged above 54, ratio of female aged 0-5, ratio of female aged 6-12, ratio of female aged 13-16, ratio of female aged 17-19, ratio of female aged 20-29, ratio of female aged 30-39, ratio of female aged 40-49, ratio of female aged 50-54 and total number of family members.

**Table 13. Robustness check of change in the specification of regressions**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Individual voluntary education expenditure	Household income per capita	Household total expenditure per capita	Expenditure on food per capita	Expenditure on non-food consumption and service per capita	Expenditure on health care per capita	Expenditure on voluntary education items per capita
Expenditure on required education items per capita (Household intended transfer from the reform per capita as IV)		1.748	3.626	0.023	2.888	0.776	-1.061
		(3.524)	(3.471)	(0.757)	(2.426)	(1.139)	(0.510)**
Individual required education expenditure (Individual intended transfer from the reform as IV)	-1.312						
	(0.671)*						
Sum of other kids' required education expenditure(Sum of other kids' intended transfer in the same family as IV)	0.074						
	(0.120)						
Village variables in year 2000	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Log value of household income per capita	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Household endowments	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Num. of kids enrolled	No	Yes	Yes	Yes	Yes	Yes	Yes
Household demographic structure	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Individual characteristics	Yes	No	No	No	No	No	No
Dummies for grade enrolled	Yes	No	No	No	No	No	No
Year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Village fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3865	2134	2134	2134	2134	2134	2134
R-squared		0.55	0.20	0.50	0.08	0.08	

Robust standard errors in parentheses; \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%.

(1) village variables in 2000 include illiterate ratio, ratio of primary school graduates in labor force, primary school enrollment rate, middle school enrollment rate, indicator for having preschool classes, distance of primary school from the village seat, log value of money given to schools by village, indicator for having primary school run by the village, indicator for having middle school run by the village, indicator for having railway through the village, indicator for having bus stop in the village, log value of average agricultural income per capita, log value of average industrial income per capita, ratio of households engaged in non-agricultural work, ratio of households running household enterprise, log value of wage for men doing non-agricultural work, log value of wage for women doing non-agricultural work, log value of wage to hire labor for agricultural production, indicator for having enterprises owned by county, indicator for having enterprises owned by township, indicator for having private enterprises.

(2) household endowments include land area per capita, mother's schooling year and father's schooling year.

(3) number of kids enrolled includes number of kids enrolled in primary school, number of kids enrolled in middle school, number of kids enrolled in high school and number of kids enrolled in other level of schools

(4) household demographic structure includes ratio of male aged 0-5, ratio of male aged 6-12, ratio of male aged 13-16, ratio of male aged 17-19, ratio of male aged 20-29, ratio of male aged 30-39, ratio of male aged 40-49, ratio of male aged 50-54, ratio of male aged above 54, ratio of female aged 0-5, ratio of female aged 6-12, ratio of female aged 13-16, ratio of female aged 17-19, ratio of female aged 20-29, ratio of female aged 30-39, ratio of female aged 40-49, ratio of female aged 50-54 and total number of family members.

(5) individual characteristics include indicator for female and age

(6) dummies for grade enrolled include indicator for being enrolled in grade1-grade6 in primary schools, grade1-grade3 in middle schools, grade1-grade3 in high schools and other levels of schools

(7) The F-value of the first stage regression is 20.10 for IV estimates in the household level regressions; The F-value of the first stage regression is 26.83 for individual saving as IV, and it is equal to 60.12 for sum of other kids' saving as IV in individual regression.

**Table 14 Impacts of education fee reduction reform on expenditures after correcting for measurement error**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Individual required education expenditure	Individual voluntary education expenditure	Total expenditure per capita	Expenditure on food per capita	Expenditure on non-food consumption and service per capita	Expenditure on health care per capita	Expenditure on required education items per capita	Expenditure on voluntary education items per capita
Intended transfer/total family member			-2.012 (2.359)	0.059 (0.601)	-1.661 (1.572)	-0.501 (0.709)	-0.601 (0.139)***	0.692 (0.310)**
Individual intended transfer	-0.498 (0.232)**	0.527 (0.293)*						
Sum of other kids' intended transfer	-0.157 (0.147)	-0.012 (0.173)						
Village variables in year 2000	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Log value of household income per capita	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Household endowments	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Num. of kids enrolled	No	NO	Yes	Yes	Yes	Yes	Yes	Yes
Household demographic structure	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Individual characteristics	Yes	Yes	No	No	No	No	No	No
Dummies for grade enrolled	Yes	Yes	No	No	No	No	No	No
Year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Village fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3865	3865	2134	2134	2134	2134	2134	2134
R-squared		0.01	0.06	0.22	0.07	0.09	0.30	

Robust standard errors in parentheses, standard errors are calculated clustering over villages; \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%.

(1) village variables in 2000 include illiterate ratio, ratio of primary school graduates in labor force, primary school enrollment rate, middle school enrollment rate, indicator for having preschool classes, distance of primary school from the village seat, log value of money given to schools by village, indicator for having primary school run by the village, indicator for having middle school run by the village, indicator for having railway through the village, indicator for having bus stop in the village, log value of average agricultural income per capita, log value of average industrial income per capita, ratio of households engaged in non-agricultural work, ratio of households running household enterprise, log value of wage for men doing non-agricultural work, log value of wage for women doing non-agricultural work, log value of wage to hire labor for agricultural production, indicator for having enterprises owned by county, indicator for having enterprises owned by township, indicator for having private enterprises.

(2) household endowments include land area per capita, mother's schooling year and father's schooling year.

(3) number of kids enrolled includes number of kids enrolled in primary school, number of kids enrolled in middle school, number of kids enrolled in high school and number of kids enrolled in other level of schools

(4) household demographic structure includes ratio of male aged 0-5, ratio of male aged 6-12, ratio of male aged 13-16, ratio of male aged 17-19, ratio of male aged 20-29, ratio of male aged 30-39, ratio of male aged 40-49, ratio of male aged 50-54, ratio of male aged above 54, ratio of female aged 0-5, ratio of female aged 6-12, ratio of female aged 13-16, ratio of female aged 17-19, ratio of female aged 20-29, ratio of female aged 30-39, ratio of female aged 40-49, ratio of female aged 50-54 and total number of family members.

(5) individual characteristics include indicator for female and age

(6) dummies for grade enrolled include indicator for being enrolled in grade1-grade6 in primary schools, grade1-grade3 in middle schools, grade1-grade3 in high schools and other levels of schools