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Robert T. Jensen
Nolan H. Miller

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ABSTRACT

Many developing countries use food-price subsidies or price controls to improve the nutrition of the poor. However, subsidizing goods on which households spend a high proportion of their budget can create large wealth effects. Consumers may then substitute towards foods with higher non-nutritional attributes (e.g., taste), but lower nutritional content per unit of currency, weakening or perhaps even reversing the intended impact of the subsidy. We analyze data from a randomized program of large price subsidies for poor households in two provinces of China and find no evidence that the subsidies improved nutrition. In fact, it may have had a negative impact for some households.

Robert T. Jensen
UCLA School of Public Affairs
3250 School of Public Affairs Building
Box 951656
Los Angeles, CA 90095-1656
and NBER
robertjensen@ucla.edu

Nolan H. Miller
College of Business
University of Illinois at Urbana Champaign
4033 BIF
515 East Gregory Drive
Champaign, IL 61820
and NBER
nmiller@illinois.edu

I. INTRODUCTION

A number of low-income countries use consumer-price subsidies or price controls to protect or improve the nutrition of the poor. For example, both India and Egypt spend about one percent of GDP subsidizing basic foods such as rice and wheat, making them among the largest forms of social assistance in both countries.[1] Critics often attack such policies on the grounds that they distort market signals, lead to shortages, promote smuggling and black market activity, or in practice are poorly targeted and disproportionately benefit the least poor. However, the more fundamental question remains: do food subsidies actually improve nutrition?

While the proposition that subsidizing the prices of staple foods will improve nutrition seems straightforward, the prediction from theory is ambiguous. Consider a simplified depiction of an impoverished consumer near a subsistence level of nutrition, whose diet consists of only two foods: a "basic" or staple good (like rice, wheat, or maize) and a "fancy" good (like meat). The basic good offers a high level of calories at low cost, while the fancy good is preferred because of its taste but provides few calories per unit of currency. The poorest consumers will eat a lot of the staple in order to get enough calories and other nutrients to meet their basic needs, and use whatever money they have left over to purchase meat. As a result, consumers spend a high fraction of their budget on, and receive most of their nutrition from, the staple. By lowering the cost of the staple, subsidies free up substantial funds to be spent in other ways, i.e., they induce large wealth effects. As households respond by substituting toward the types of goods that wealthier households consume, they may switch away from these nutritious staples, which are typically strongly inferior goods, and toward foods (such as meat) that offer more taste or that add variety to the diet but are more costly sources of nutrients,[2] or toward non-food items. More generally, if consumers value the non-nutritional attributes of foods in addition to the nutritional attributes, the net nutritional consequences of a subsidy will depend on how consumers substitute among foods (as well as between food and non-food items). If this substitution toward less-nutritive foods is substantial enough, consumers may weaken or potentially even reverse the intended nutritional impact of the subsidies.

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[1] Further, the use of such programs is expanding worldwide in response to recent increases in world food prices (The Economist, 2007a, b, c).

[2] There is a large literature concerned with estimating the income elasticity of demand for calories, including, for example, Behrman and Deolalikar (1987); Bouis and Haddad (1992); and Deaton and Subramanian (1996). See Strauss and Thomas (1995) and Deaton (1997) for summaries.

While price subsidy programs may be an effective welfare tool independent of their nutritional consequences, assessing their nutritional impact is important since nutritional objectives are often a primary justification for introducing such programs, or for choosing them over other welfare policies. In addition, food-based welfare programs such as subsidies often enjoy greater public and political support than, for example, unconditional cash transfers, specifically because of the perception and general presumption that they improve nutrition, whereas there is no "control" over how cash would be spent by recipients. Finally, given the widespread incidence of under-nutrition in the developing world,[3] the commitment to addressing hunger stated in the first UN Millennium Development Goal, and the well-established links between nutrition and health and welfare, it is important to understand which programs most effectively address the problem.

Consumer price subsidies have been studied widely, with a particular focus on the incidence and targeting of such programs in practice (see Behrman and Deolalikar, 1988, for a summary). However, surprisingly few studies have considered their nutritional impact.[4] Two notable exceptions are Kochar (2005), who finds that India's subsidy program has only a limited effect on caloric intake, and Tarozzi (2005), who finds similarly limited effects on children's weight in one state of India. However, as Kochar (2005) notes, the limited impact of India's program is primarily due to low take-up rates and low purchases of subsidized goods conditional on take-up. The reasons for low take-up and use are unclear, although they may result from unique incentives under the program for shopkeepers to undersupply subsidized goods (Kochar 2005).[5] It therefore remains important to determine whether a subsidy that more effectively reaches the poor does improve nutrition.

[3] The FAO estimates that 850 million people worldwide are under-nourished (FAO 2006).

[4] There have been assessments of the nutritional impacts of related programs. For example, Stifel and Alderman (2006) find that a program in Peru providing milk and milk substitutes had no effect on child nutrition.

[5] And although these studies improve dramatically upon earlier evaluations, some empirical problems may bias both estimates of the program effect towards zero. For example, Kochar's study relies in part on variation across households in the value of the subsidy and the quantity of the subsidized good for which a household is eligible, which is largely determined by whether they are below the poverty line (BPL). However, BPL status is not measured in the data and must be estimated from observable characteristics. Any mistakes in classification, "assigning" the program to the non-poor and "non-assigning" it to the poor will bias towards finding no effect of the subsidy. Complicating factors further is that in practice BPL "cards" are poorly targeted, with only 57% of eligible poor receiving benefits and 21% of all benefits accruing to non-eligible households (Planning Commission 2005). And while variation over time and space in the value of the benefits is also used, such variation may not be exogenous with respect to consumption. Additionally, BPL status is an eligibility requirement for a variety of other government welfare programs which also affect consumption (including food-for-work, which would reduce food purchases). Thus, it is difficult to attribute differences in consumption to the subsidy program alone (especially since

There is also a large, related literature on the nutritional impact of price changes in developing countries, much of which is summarized by Behrman and Deolalikar (1988). These studies, which include Williamson-Gray (1982), Pitt (1983), Strauss (1984), Pitt and Rosenzweig (1985, 1986), Behrman and Deolalikar (1987), Behrman, Deolalikar and Wolfe (1988) and Guo et al. (1999), have generally found mixed results. While some have found the more intuitive result that calorie intake decreases when food prices increase, several others have found the opposite. While the latter results may be attributable in some studies to the impact of food prices on incomes of farm households rather than pure consumer price effects, in several studies this effect holds even when accounting for any such income effects. One lingering concern with much of this literature however is whether price variation can be treated as exogenous.[6]

In this paper we present results from a field experiment exploring the response of poor households in China to food price subsidies. For five months, randomly selected households in two provinces, Hunan and Gansu, were given vouchers that subsidized purchases of their province-specific dietary staple: rice in Hunan and wheat flour in Gansu. The study households were chosen from among those officially designated as the "urban poor," a population that includes approximately 90 million individuals throughout China (Ravallion 2007). This sample provides a useful test case, since consumer price subsidies are typically intended to improve the nutrition of the poorest. In a previous study (Jensen and Miller 2008a), we used this experiment as a source of exogenous price variation to test for the existence of Giffen behavior (i.e., an increase in demand for a good in response to an increase in the price of that good), and, more generally, to document the behavior of households living near the boundary of subsistence. In the present paper, our interest is in the broader household consumption response to a price subsidy, and in particular the impact the subsidy has on nutritional outcomes.

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these other benefits may vary over space and time along with the subsidy program). Finally, prices are not directly measured in the data, but derived as unit values (expenditure divided by quantity). Such variation could reflect differences in the variety or quality of the grain households choose or measurement error, which would again bias towards finding no effect. Tarozzi (2005) exploits an increase in the value of the subsidy coupled with variation in survey interview dates across households to estimate the impact of the program via duration of exposure. However, actual receipt of benefits is not observed, and again low take-up would lead towards finding no effect. Additionally, due to data limitations the study focuses only on children under the age of 4, whose nutritional status it may be easier to buffer due to their lower needs. Finally, variation in survey interview date only provides differences in program exposure of 1 to 3 months, which may be insufficient time for the nutritional impacts to be felt.

[6] For example, higher demand for food (and thus greater caloric intake) could increase prices, rather than the reverse. Alternatively, spatial or time series price variation may be correlated with factors affecting nutrient demand.

Our study offers several important advantages over previous studies of subsidies. First, take-up of the subsidy was universal among eligible households, unlike the case for India's program. Second, we have clean, exogenous price variation with which to identify the effects of the subsidy. Finally, we measure consumption from dietary intake diaries rather than expenditure data, which may not as accurately measure consumption or nutrition due to food given (or fed) to others or wasted, or meals eaten elsewhere, such as food provided at work or purchased at food stalls or restaurants.

Using consumption surveys gathered before, during and after the subsidy was introduced, we find no evidence that the subsidy improved nutrition for the pooled sample. Considering the provinces separately, we find that poor households in Hunan actually *reduce* their intake of calories and several important vitamins and minerals in response to the price subsidy. In Gansu, intake does not decline for any nutrient group; the point estimates are generally positive for calories and protein but negative for vitamins and minerals, though in all cases the effects are small and not statistically significantly different from zero. Thus, we find no evidence that subsidies improve nutrition for the poor, and may in fact even harm it in some cases. Finally, in both provinces there is evidence that in response to the subsidy, households alter their consumption patterns in ways intended to improve the non-nutritional attributes (specifically, taste) of their diets.

The paper continues in Section II, where we discuss the field experiment, data, and estimation strategy. Section III presents the results and Section IV discusses and concludes.

II. DATA AND EMPIRICAL STRATEGY

II.A. The Experiment

Our field experiment provided randomly selected poor households in two Chinese provinces with subsidies for their locally-relevant staple good: rice in Hunan, and wheat flour (used primarily to make buns, a simple bread called *mo* or noodles) in Gansu.[7] Households were randomly assigned to either a control group or one of three treatment groups. Households in the treatment groups were given printed vouchers entitling them to a price reduction of 0.10, 0.20 or

[7] Poor urban households in Gansu primarily prepare these foods at home using wheat flour. However, they also sometimes purchase packaged noodles or other prepared wheat-based foods like bread. Our subsidy only applied to raw wheat flour, and thus did not affect the prices of these prepared foods (which account for approximately 5-10 percent of total household wheat consumption in our sample).

0.30 yuan (Rmb; 1 Rmb ≈$0.13) off the price of each *jin* (1 *jin* = 500g) of the staple good. The subsidy level stayed fixed for each household over the course of the study. These subsidies represented substantial price changes, since the average pre-intervention price of rice in Hunan was 1.2 yuan/*jin*, and the average for wheat flour in Gansu was 1.04 yuan/*jin*.[8] The vouchers were printed in quantities of 1, 5 and 10 *jin*, and the month's supply of vouchers was distributed at the start of each month, with each household receiving vouchers for 750g per person per day (about twice the average per capita consumption as measured by our pre-intervention survey). All vouchers remained valid until the end of the intervention, giving households time to spend down any accumulated vouchers at the end of the study. Households were told in advance they would receive vouchers for five months and that any un-redeemed vouchers would not be honored after the end of the intervention.

The vouchers were redeemable at local grain shops, the owners of which were later reimbursed for the cost of the vouchers and given a fixed payment for complying with our guidelines in implementing the subsidy. Households could only use the vouchers to purchase the province-specific staple good, and were not permitted to resell the vouchers or the goods purchased with the vouchers (they were told there would be auditing and accounting to make sure they were in compliance with the rules, and that any violations would result in them being removed from the study without any additional compensation). Jensen and Miller (2008a) discuss additional safeguards put in place to prevent cheating or "cashing out," and provide evidence from voucher use that suggests that if any such cheating took place at all, it was extremely limited. We also provide evidence to suggest it is unlikely that the vouchers affected consumption through a behavioral or "salience" effect as opposed to a pure price effect, or to the extent that those effects occurred, they would actually work counter to our predictions and results, and thus do not weaken our conclusions.[9]

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[8] Using our expenditure data (discussed below), we can rule out that shopkeepers took advantage of the subsidy by increasing prices for subsidy households, by comparing prices net of the subsidy for treatment and control groups. Shopkeepers were told they would be monitored and audited to ensure they followed the program rules. Further, grain prices move slowly and somewhat predictably (often, by season), so any changes would have been easily detected, and contested, by subsidy households.

[9] For example, if vouchers increased the salience of the staple, we would expect consumption of it to increase; since these are the cheapest sources of calories, we would then expect calories to increase as well, the opposite of what we conclude here. Alternatively, and perhaps less likely, households may view the vouchers as providing adverse signals about the staple; for example, they may view the attempt to sell more rice as an indication that there is something wrong with the current stock, in which case they might want to consume less of it (though consumers were told the subsidies were being provided by outside researchers rather than merchants, farmers or the

II.B. Data

The survey and intervention were conducted by employees of the provincial level agencies of the Chinese National Bureau of Statistics. The sample consisted of 100-150 households in each of 11 county seats in the two provinces (Anren, Baoqing, Longshan, Pingjiang, Shimen and Taojiang in Hunan, and Anding, Ganzhou, Kongdong, Qingzhou and Yuzhong in Gansu), for a total of 1,300 households (650 in each province), with 3,661 individuals. Within each county, households were chosen at random from lists of the "urban poor" maintained by the local offices of the Ministry of Civil Affairs. Households on this list fall below a locally-defined poverty threshold (the *Di Bao* line), typically between 100 and 200 yuan per person per month or \$0.41 − \$0.82 per person per day, which is below even the World Bank's "extreme" poverty line of one dollar per person per day. These are the type of households that price subsidies are typically designed to provide with nutritional protection: they are China's poorest, and they are also extremely poor by international standards. This sample therefore provides a useful case for studying the impacts of a price subsidy.

The questionnaire consisted of a standard income and expenditure survey, gathering information on the demographic characteristics of household members as well as data on employment, income, asset ownership and expenditures. A key component of the survey was a 24-hour food recall diary completed by each household member.[10] Respondents were asked to report everything they ate and drank the previous day, whether inside or outside the home,[11] by

government). However, Jensen and Miller (2008a) shows that subsidy-induced consumption changes vary with measures of wealth, suggesting that any salience effect would also have to vary with wealth, which seems less likely. Finally, if the consumption of the treatment groups responded both to having received any subsidy at all (i.e., the signal or salience effect) and to size of the subsidy received, we could eliminate the former and identify the nutrient elasticity off of the size of the subsidy alone by running regressions excluding the control group. Doing so yields very similar results to those below, indicating that the effects are not driven by some common signaling or salience effect among the treatment groups. However, it is of course possible that larger subsidies create stronger signaling effects, so these results do not imply there were no such effects at all.

[10] Alternative methods for assessing food intake include the household inventory and food frequency approaches (see Strauss and Thomas 1995, 1998). With the household inventory approach, enumerators use scales to weigh ingredients before cooking, and waste following consumption. This method is likely to more accurately measure foods eaten within the home (but not outside) than the 24 hour individual food recall used here, since for example it will not be subject to variation in preparation. However, a validation study by Zhai et. al (1996) using data from a survey that applied both the diary and household inventory approaches finds that the two yield similar results, especially for calories (provided attention is given to cooking oil in the diary). Given this validation, plus the high costs and intrusiveness of the inventory approach (enumerators need to be present all day to weigh all food preparation and waste), we chose to implement the intake diary.

[11] Though because the sample households were so poor, very little food (less than 2 percent of calories) was eaten outside the home. While this may seem small, this is similar to what was found by Popkin, Lu and Zhai (2002) using

specifically listing the components of all foods eaten.[12] These foods were recorded in detail in order to match with the 636 food items listed in the 1991 Food Composition Tables constructed by the Institute of Nutrition and Food Hygiene at the Chinese Academy of Preventative Medicine. Because the households in our sample are very poor, most diets are very simple and consist of a small number of basic (non -processed, -prepared or -packaged) foods like rice, bean curd or stir-fried cabbage. Consequently, concerns about coding the specific quantities of the various ingredients in a complex dish or meal are not significant.

Data were gathered in three rounds, conducted in April, September and December of 2006. After completing the first survey, treatment households were told they would receive the price subsidies for five months, from June through October. Thus, the initial interviews occurred before treatment households knew of or received the subsidies, the second occurred after the subsidy had been in place for slightly more than 3 months, and the final interviews were conducted 1 to 2 months after the subsidy had ended, by which time treatment households would likely have exhausted any stocks of rice or wheat flour they may have purchased with the subsidy, and will therefore again be purchasing at the full market price. Sample attrition was extremely low, since the three rounds occurred in a relatively short span. Only 11 of 1,300 households (less than one percent) in the first round did not appear in the second round. All households in the second round were interviewed in the third round.

II. C. Food Nutrient Content Data

The 1991 China Food Composition Tables contain data on calorie and protein content for each food item, which we can use to convert the food diary entries into calorie and protein intake. However, while measuring total calorie intake is straightforward, protein intake is more difficult since a "complete" protein consists of 12 essential amino acids. Animal protein such as meat or eggs contains all of these amino acids and therefore provides a complete protein. By contrast, the protein found in grains and pulses lacks one or more of these essential amino acids. However, if a person's diet contains both grains and pulses, in combination they do supply

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intake diary data for China (the authors also note that this is not due to a weakness of that data collection strategy, since the same approach yields evidence of substantial food consumption away from home in the Philippines).

[12] While it may seem difficult to recall or estimate how many grams of, say, rice was eaten with a meal, for the extreme poor who are on a very limited budget, food is often apportioned and accounted for much more carefully. Further, diets for these extremely poor households often vary little or not at all from day-to-day, except on special occasions, so recalling the quantity of specific food items is not as difficult.

complete protein (i.e., they supply adequate levels of all amino acids). For example, while both rice and wheat are relatively deficient in the essential amino acid lysine, consuming these foods along with even a fairly small amount of bean curd provides sufficient lysine to make up for this deficiency. Thus, while nutrition tables such as that used here report protein values, the true amount of "available" protein will depend on the combination of foods they eat and their amino acid contents. Unfortunately, data on amino acid content is not available in the Food Composition Tables, nor is there an agreed-upon empirical model for converting detailed food consumption into protein intake. We therefore simply use the reported protein contents, without adjusting for protein completeness. This will likely lead us to overestimate protein consumption overall. And under our hypothesis that households may substitute away from basic foods like grains and towards luxuries like meat, we would likely underestimate protein gains from the subsidy. However, the results are robust to a range of alternative estimates of protein content.[13]

For other nutrients, we match our food consumption data with the 2007 release of the United States Department of Agriculture (USDA) National Nutrient Database for Standard Reference. This database provides complete content information for 10 minerals (calcium, iron, magnesium, phosphorus, potassium, sodium, zinc, copper, manganese and selenium) and 9 vitamins (vitamins A, C, B_1 (thiamin), B_2 (riboflavin), B_3 (niacin), B_5 (pantothenic acid), B_6, B_9 (folic acid) and B_{12}) for approximately 7,500 foods.[14] However, there are some important limitations to matching this information with our data. First, the food item descriptions in the USDA tables differ from those in the Chinese tables used for coding our data. We therefore had to hand-match foods based on their descriptions, which may have lead to coding errors. Further, there were cases where one of the two databases contained more detailed varieties or components

[13] We use two alternative measures of protein. First, we use Protein Digestibility Corrected Amino Acid Scores (PDCAAS), the method designated as preferred by an expert body of the FAO and WHO (FAO/WHO 1990). PDCAAS's range from 0 to 1 and assess protein based on the quantity of the limiting amino acid in a food as a percent of the content of that same amino acid in a reference pattern of amino acids (further adjusted for digestibility). However, these scores are only available for a small subset of foods. As an alternative but related approach, we match our data to the USDA National Nutrient Database (discussed below), which contains amino acid content for about 80 percent of foods recorded in our survey. For each individual we add up the intake of all amino acids, and measure protein availability as the amount of the amino acid the individual consumes the least of. In other words, if the individual consumes 2 grams of lysine and 3 or more of all other amino acids, we assign a protein measure of 2 (this creates differences in units between protein and amino acid intake, but will not affect our results since we will examine percent changes in intake). Both approaches yield similar conclusions to using unadjusted protein content.

[14] While nutritionists recognize at least 30 essential vitamins and minerals, data are not available for these other nutrients for 20 percent or more of foods matched between our intake data and the nutrient database, so we exclude them from our analysis.

of foods than the other,[15] so the matches are imprecise.[16] Finally, for some of the foods recorded in our data there were no corresponding matches in the USDA database, and thus we do not have augmented nutrition data for these foods. Overall, we are unable to match 5.5 percent of the foods entries reported in our consumption diaries. However, many of these items are plants or roots used for tea or in traditional Chinese medicine, and therefore have very little nutritional content, especially in the quantities typically consumed. For example, based on the China Food Composition Tables, these unmatched foods account for only 0.8 percent of average caloric intake and less than 0.001 percent of protein intake. Thus, although we omit these foods from our measures of vitamin and mineral intake, it is unlikely they substantially affect the results. Further, we find that the subsidy had no effect on the total consumption of these foods, so, again, their exclusion is unlikely to bias our estimates of the effect of the subsidy on mineral and vitamin intake.

We use the merged USDA data to create summary measures of per capita vitamin and mineral intake. In particular, for each household *h* we first compute a normalized intake for each vitamin *v* (or mineral *m*) by adding up total household intake of that vitamin (mineral) for all individuals *i* in the household and then dividing by the total recommended amount that household should be consuming (based on gender- and age-specific USDA Dietary Reference Intakes, DRIs).[17] We then aggregate across all vitamins (minerals), and divide by the number of vitamins *V* (or minerals *M*) and the number of people in the household, i.e.,

$$V_h = \frac{\sum_v \left(\sum_i Vitamin_{v,i} / \sum_i DRI_{v,i} \right)}{V \cdot \#\, people_h}$$

$$M_h = \frac{\sum_m \left(\sum_i Mineral_{m,i} / \sum_i DRI_{m,i} \right)}{M \cdot \#\, people_h}$$

Thus, V_h and M_h can be interpreted as an average vitamin or mineral sufficiency or adequacy index; they represent the average per-person intake per vitamin (mineral), with measures greater

[15] For example, the Chinese tables contains separate entries for the leaves, stems and roots of raw mustard greens, whereas the USDA data contain only one entry for the whole plant in its raw form.

[16] In the few cases where there were multiple, non-distinguishable entries for a particular food in either database, we matched using the entries with the smallest sum of absolute differences for the three nutrients in common to both data sets (calories, protein and fat).

[17] The DRIs are from the National Academy of Sciences, Institute of Medicine, Food and Nutrition Board's summary table, "Dietary Reference Intakes: Recommended Intakes for Individuals." The table is available online from the USDA National Agricultural Library, Food and Nutrition Information Center, http://fnic.nal.usda.gov/.

than one indicating that on average members of the household are consuming above the DRIs for the average vitamin (mineral) and values less than one indicating they are below the DRIs. Normalizing vitamins and minerals by their associated DRIs is important because the quantities in which the individual vitamins and minerals are typically consumed (and thus the DRIs) vary by orders of magnitude, from grams to micrograms (10^{-6}g). We discuss some limitations of these aggregated measures below.

II.D. Covariate Balance

Table 1 provides means, standard deviations and pairwise tests of equality for treatment and control groups for key variables in the baseline survey. Overall, for the pooled sample in the first four columns, the randomization appears to have achieved balance across the control and three treatment groups. The differences across all groups for all key variables are small, and none are statistically significant.

However, splitting the sample by province reveals some notable differences. For example, while only a few of the pairwise differences are statistically significant, in both provinces some baseline nutrition measures appear to vary monotonically with the treatment. In particular, baseline caloric intake strictly increases with the subsidy size in Hunan and strictly decreases in Gansu. Focusing on the endpoint cases, in Hunan the 0.3 subsidy group consumes 84 more calories (about 5 percent) than the control group (statistically significant at the 10 percent level). In Gansu, the 0.3 subsidy group consumes 82 fewer calories (about 5 percent) than the control group (significant at the 5 percent level). While the strictly monotonic pattern does not hold for protein, vitamins and minerals in the two provinces, it remains the case that in Hunan, intake of these three nutrients is highest in the 0.3 subsidy group and lowest in the control group (with the differences statistically significant at the 5 to 10 percent level for protein and vitamins), and vice-versa for Gansu (with the difference statistically significant for protein at the 1 percent level). For family size and expenditure per capita, there is no evident pattern in either province, and only one of the 24 pairwise differences for these two variables is statistically significant (family size for the 0.2 vs. the 0.3 subsidy groups in Hunan).

While the patterns in calories, and to a lesser extent the other nutrients, are puzzling, we believe they are the result of chance, rather than any systematic factor. Since any fixed initial differences arising at random can be easily addressed empirically, the most important empirical concern is whether the initial differences reflect differential underlying trends. For example, we may be concerned that our implementing agency gave higher subsidies to households that were on a downward trend in calories in Gansu before our intervention (perhaps due to illness or declining wages or employment prospects in their industry), and to those on an upward trend in Hunan (such households might be expecting income increases, which might enable them to bribe the implementing agency). In these cases, calories would have changed differentially even in the absence of the subsidy, and our estimates would be biased. However, we believe that subsidy assignment based on such differential trends could not have occurred. Randomization and assignment to control and treatment groups was made by the authors, not the implementing agency. Further, the subsidy assignment was made after some preliminary household demographic data were collected for the sample and household identification codes were assigned, and thus we can verify that the implementing agency could not have switched household identification codes after subsidy assignment was made. It is these assignment categories and household identifiers that we use for the analysis, so the implementing agency could not have altered the treatment assignment featured in table 1.[18] Therefore, we believe that the differences in initial nutrient intake are due to random sampling and the (relatively) small size of our sample, rather than any systematic factors. However, it will be important for our empirical strategy to take these patterns into consideration as fixed differences across subsidy groups, and thus it will be more appropriate to either consider changes in nutrient intake across survey rounds or to use a household fixed-effects strategy, rather than simply regressing treatment period (round 2) nutrient intake on the subsidy level, as would otherwise be appropriate in a randomized trial setting.

II.E. Assessing Baseline Nutrient Intake

The nutrient intakes in table 1 represent averages across all age and sex groups. As a more useful benchmark for assessing baseline intake, the mean pre-intervention caloric intake among working-aged adults (18 − 60) for the pooled sample is 2,023 kcal for men and 1,726 kcal for women. While we can’t rule out some undercounting of calories, these values are far below even the low range of international standards (2,335 − 3,164 kcal for adult men and 1,846 −

[18] While they may not have later implemented the program as we chose, i.e., giving the vouchers out differently than we had assigned them, monitoring and auditing were put in place, and show no evidence to support this possibility.

2,154 kcal for adult women, depending on level of physical activity (FAO/WHO/UNU 1985)).[19] This again suggests that our sample represents a group that subsidies are typically intended to help, i.e., the undernourished.[20] For protein, the recommended intake is one gram per kg of weight per day, and is generally not segregated by age or sex, so we can use the means in table 1 to assess intake. While we unfortunately did not gather data on weight in our survey, evidence from an alternative data set, the China Health and Nutrition Survey (CHNS), shows average weight for a comparable sample of urban poor persons is about 54kg.[21] Thus, as a rough approximation, individuals in our sample are about 11 percent below the recommended daily protein intake (with average intake greater in Gansu than Hunan).

Overall deprivation appears however to be somewhat lower for other nutrients, with individuals close to or slightly above the recommended vitamin and mineral intakes.[22] However, these averages mask significant variation across vitamins and minerals, including cases of shortfalls for some nutrients offset by intakes above the DRI for others. Table 2 shows the baseline intake levels for each vitamin and mineral relative to the associated DRI. For the pooled sample, intake on average is close to or above requirements for four of the ten minerals (iron, copper, manganese, selenium) and five of the nine vitamins (vitamin C, thiamin, riboflavin, niacin, and folate). By contrast, intake is one third or less of the DRI for calcium, potassium, sodium and vitamin B_{12}, and about one half for magnesium, phosphorous, zinc and vitamin A. There is some variation by province. In both, dietary intake is close to or above requirements for iron, copper, manganese, selenium, vitamin C, thiamin, niacin, and folate, while households in Gansu are also above the DRI for riboflavin, and similarly for pantotheonic acid and vitamin B_6 in Hunan. Both provinces have average intakes of one-third or less of the DRI for vitamin B_{12}, potassium and sodium, while households in Gansu are also similarly deficient in calcium. Finally, both provinces have intake of about half the requirements for magnesium, phosphorous and vitamin A, with Hunan adding calcium and Gansu adding zinc and pantotheonic acid.

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[19] While individuals in our sample are somewhat shorter and weigh less than the populations for which these standards are constructed, we have cited the requirement levels for the lowest bodyweight categories (54kg or 119 pounds for men, and 47 kg or 103 pounds for women), which are likely to be low even for our sample.

[20] The FAO estimates that about 150 million people in China are undernourished (FAO 2006).

[21] The CHNS is a collected by the Carolina Population Center at the University of North Carolina at Chapel Hill and the National Institute of Nutrition and Food Safety at the Chinese Center for Disease Control and Prevention. The data are available at http://www.cpc.unc.edu/projects/china.

[22] In this table the values are already normalized by the age- and sex- specific DRIs, so we do not need to present them for subgroups in order to address sufficiency of intake

Finally, since we motivated our analysis by considering households whose diets primarily consist of a large quantity of a staple good and a little bit of a luxury good (i.e., a more expensive source of nutrition like meat), table 3 provides data on the basic consumption patterns in the two provinces in the pre-intervention survey round. The dominance of staple goods in household diets is best seen for the disaggregated sample since the staple food differs by province. In Hunan, households receive on average 64 percent of their calories from rice, while in Gansu wheat-based foods comprise 69 percent of calories.[23] The reliance on basic, staple foods for nutrition is underscored even more by the fact that the average total calorie share from all cereals or grains is 72 percent in Hunan and 77 percent in Gansu. Further, in both provinces, on average 13 percent of calories come from edible oils (mostly vegetable oil), which is primarily used in cooking, and is generally not a substitute for other forms of consumption or nutrition. Thus, the consumption of all other foods combined on average contributes only 10 percent of calories in Gansu, and 15 percent in Hunan. In Hunan, the greatest remaining share comes from meat, comprising 7 percent of average caloric intake. In Gansu meat consumption is much lower, with pulses (primarily bean curd or tofu) providing a larger share of calories than meat. This difference is likely due to the lower income levels in Gansu; pulses are often referred to as "poor man's meat" because they are a cheaper source of protein (when combined with other foods typically eaten as staples, as noted above).

II.F. Estimation Strategy

Given the random assignment of the subsidy and the panel nature of our survey, plus the slight differences in pre-intervention caloric intake noted above, our basic empirical strategy is to compare changes in nutrient intakes for treatment and control groups. Our primary specification focuses on the household as the unit of observation rather than the individual, both for consistency with the literature on food and nutrition in developing countries and because with food diary surveys there is a concern that in some cases a primary respondent may simply report what food was prepared for the household and then divide it roughly among members, rather than each individual reporting their actual consumption. To the extent that such reporting takes

[23] These goods are also the cheapest source of calories in each province: rice in Hunan yields 1399 calories/yuan, while wheat in Gansu yields 1655 calories/yuan. By contrast, the calories per yuan for other common foods are: wheat (1221), millet (537), pork (331), bean curd (239), and cabbage (141) in Hunan, and millet (1105), rice (980), pork (340), bean curd (224), and cabbage (173) for Gansu.

place, it is more appropriate to focus on the household as the unit of observation. Below, we show that using individual level data yields nearly identical results.[24]

In our preferred specification, we regress the percent change in per capita nutrient intake for household *h* in period *t* on the change in the subsidy, measured as a percent of the average market price of the subsidized good.[25] The percent change formulation normalizes for factors such as household age and sex composition and activity level, and allows us to directly interpret the coefficients as elasticities (consistent with the literature on nutrient intake). For each household, we observe two changes: the change between periods 2 and 1 ($t = 2$), capturing the effect of imposing the subsidy, and the change between periods 3 and 2 ($t = 3$), capturing the effect of removing the subsidy. Thus we estimate:

$$\%\Delta Nutrient_{h,t} = \alpha + \beta \%\Delta Subsidy_{h,t} + \Delta\varepsilon_{h,t} \qquad (1)$$

where $\%\Delta Nutrient_{h,t}$ is the percent change from period $t-1$ to period t of household *h*'s per capita consumption of the given nutrient and $\%\Delta Subsidy_{h,t}$ is the percent change in the price of the staple due to the subsidy over the same period (positive for $t = 2$ and negative for $t = 3$). All regressions also include a round indicator variable. We compute all changes as arc-percent-changes (i.e., $100 \cdot (x_t - x_{t-1}) / (.5 \cdot (x_t + x_{t-1}))$.[26] The percent value of the subsidy is computed as 100 times the change in the subsidy divided by the average (net of subsidy) market price of the staple good in the two corresponding rounds. Below, we show that the results are robust to a wide range of alternative specifications, including log-log, simple (i.e., non-arc) elasticities, specifying the dependent and/or independent variables in levels, using household total nutrient intake rather than per capita measures, including additional controls and/or county*time fixed effects for additional precision, and, as noted, using individual level data.

[24] One question that can only be addressed using individual level data is whether households respond to the subsidy by providing more food/nutrition to specific members. For example, Pitt, Rosenzweig, and Hassan (1990) find that households concentrate calories on household members involved in activities where productivity is the most responsive to health (and nutrition). Alternatively, households may choose to focus nutrients on those whose health or development is most vulnerable to nutritional shocks, such as children or the elderly. Additional results (available from the authors) show that the effects do not vary significantly across age*gender groups.

[25] One concern with this strategy is that price (independent of the subsidy) is likely to be endogenous. For example, a food demand shock will increase both nutrient intake and the price of foods. However, below we show that the results are robust to using just the level of the subsidy without normalizing by the market price, or to including county*time fixed effects so that identification is due only to variation in price within a county due to the subsidy.

[26] The arc-percent-change specification is preferred over the simple percent change because the subsidies represent large changes, and because the arc formulation has the desirable property of being symmetric over time.

III. RESULTS

III.A. Nutritional Outcomes

Table 4A presents the primary results for intake of calories, protein, vitamins and minerals for the full sample. Standard errors are clustered at the household level.[27] Before turning to our preferred specification (equation (1)), the first column for each nutrient category provides results from regressions following the basic experimental set-up, where round 2 intake is regressed on the subsidy level. Given the baseline treatment-control differences in some nutrients revealed in table 1, we would not interpret these results as estimates of the causal effect of the treatment; they are presented simply for consistency with the literature. The subsidy coefficients have been converted to elasticities (evaluated at sample means), for consistency with the results in the other specifications (and the standard errors adjusted accordingly). For each of the nutrient measures we cannot reject that the subsidy had no effect on intake. The point estimates of the elasticities are in fact all negative, though they are extremely small and none are statistically significant.

The second column for each nutrient contains the results from the specification in equation (1), with no other covariates added. The advantage of this specification is that it controls for fixed differences in baseline nutrient intake and other characteristics across groups. Provided there were no pre-existing differential trends in nutrient intake across these groups, we can interpret these results as the causal effect of the subsidy. Again, for each nutrient we cannot reject that the subsidy had no effect. The point estimates of the elasticities are small, ranging from about -0.02 to -0.07. The estimates make it possible to reject anything other than fairly modest positive effects of the subsidy. For example, at the 95 percent level we can reject elasticities greater than 0.15 for each of the nutrients.

Finally, in order to absorb any residual variation and potentially obtain more precise estimates, in the last column for each nutrient we add a vector of percent changes in other control variables including earned income, unearned income (government payments, pensions, remittances, rent and interest from assets) and household size. While there is the concern that

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[27] This clustering accounts for serial correlation in the errors within households. However, one concern is that there may be shocks that are correlated over time and across households within a county, which might suggest clustering at the county level. However, estimates of standard errors under clustering are not consistent when the number of clusters is small relative to the number of observations within each cluster (see Wooldridge, 2003). Since our sampling used only 6 counties in Hunan and 5 in Gansu, we do not believe it is appropriate to cluster the standard errors at this level. However, table 5 shows that the results are robust to doing so.

these variables may themselves be affected by the subsidy, below we show that this is not the case.[28] Overall, the results are not changed substantially by adding these controls. All of the point estimates remain negative and extremely small, and none are statistically significantly different than zero.

While the pooled sample represents our estimate of the overall effect of the subsidy, it is worthwhile to consider the two provinces separately. Besides the difference in the staple food subsidized, table 1 revealed that there are important differences between the provinces. For example, pre-intervention mean expenditure per capita in the Gansu sample is approximately 30 percent lower than in the Hunan sample (on average, the locally-defined poverty thresholds are set lower in Gansu). Households in Gansu also consume fewer calories on average than those in Hunan, which might limit their willingness to substitute towards foods with higher non-nutritional attributes (consistent with the results in table 3 that households in Gansu do not consume as much meat, a primary luxury food, as households in Hunan). Finally, the cost of meat in Gansu is higher than in Hunan;[29] thus, even with the savings from the subsidy, the price of the usual luxury good households would typically substitute towards may be too high for households in Gansu to afford. Thus, we might expect different responses to the subsidy in the two provinces.

Table 4B focuses on Hunan. As with the pooled sample, for each of the nutrients, the estimated impact of the subsidy is negative when using the changes specification. The coefficient for calories is significantly different from zero (p-values of 0.057 and 0.051 without and with controls, respectively). While the calorie elasticities are relatively small, they indicate that the price subsidy actually caused a *decline* in intake. For protein, minerals and vitamins, the point estimates are negative, but we cannot reject that the subsidy had no effect on intake. We note however that using the un-differenced regression of round 2 intake levels on the subsidy, the elasticities are positive for each nutrient, and statistically significant for vitamins, though each of the elasticities is small. The positive effect here can again be attributed to the higher baseline levels of intake for the higher subsidy groups observed in table 1. When these baseline levels are differenced out, the effect of the subsidy is broadly negative.

[28] Though these behaviors may still be endogenous with respect to the nutritional measures (for example, greater caloric intake leading to increased productivity and thus higher earnings).
[29] The mean price of the cheapest meat in both provinces (fish) is 5.7 yuan/kg in Gansu and 4.0 yuan/kg in Hunan.

The results for Gansu, presented in table 4C, differ from those for Hunan. Here, the estimated elasticities are positive for calories, protein and vitamins, though none is significantly different from zero. Thus, we cannot reject that the subsidy had no effect on nutrient intake in Gansu. The largest nutrient elasticity, 0.148 for calories, is still fairly modest, while the others are extremely small (less than 0.08). Of course, while we cannot reject the subsidy having no effect, we also cannot rule out more substantial effects. For example, for calories, protein, minerals and vitamins we cannot reject elasticities of 0.34, 0.30, 0.19 and 0.28, respectively, at the 95 percent significance level. Finally, and again the reverse of Hunan, here the simple un-differenced regressions yield the opposite signs, with negative (though small and not statistically significant) effects of the subsidy on intake.

One limitation to the summary measures of vitamin and mineral intake is that they treat changes in (normalized) intakes of each vitamin and mineral equally. However, increased intake of a nutrient for which the individual is currently far below adequate levels is likely to be of greater health consequence than one for which they currently have already achieved required levels. Further, being over the DRI on some nutrients is not likely to offset the health effects of being under on others. A final limitation is that some vitamins and minerals are often considered to be greater public health concerns, such as iron and vitamin A, not just because deficiencies are more widespread, but because those deficiencies have more serious consequences for health and well-being.

The columns labeled "Coefficient" in Table 2 provide regression results for all 19 individual vitamins and minerals individually using specifications like (1) above. We do not adjust the *p*-values for the multiplicity of the tests (i.e., with nearly 20 regressions per province, we would expect that even by chance, at least one would yield a statistically significant coefficient even if the true effect were zero for all of them), for example by using Bonferroni-style adjustments to the *p*-values. Thus, these hypothesis tests should be interpreted with caution, as such adjustments would decrease the likelihood of rejection of zero.

For the pooled sample, the elasticity point estimates have mixed signs, though most (14 of 19) are negative. The effects are statistically significant (at the 5 or 10 percent level) for calcium, manganese and vitamin A. From a nutrition perspective, it is worth noting that households are on average deficient in all three micronutrients at baseline (receiving about one-third to one-half of the DRI).[30] Most of the positive point estimates are very small (less than 0.07), excluding vitamin B_{12} (0.29). However, for many vitamins and minerals, the standard errors are large. While we can rule out elasticities greater than 0.15 for 13 of the vitamins and minerals, we cannot rule out moderate to large elasticities for the others (ranging from about 0.30 for phosphorous, selenium and ribovflavin to 0.40−0.80 for sodium, vitamin C and vitamin B_{12}).

For Hunan, 17 of the 19 estimated elasticities are negative. However, they are only statistically significant (at the 5 to 10 percent level) for calcium, manganese, folate and vitamin A. The declines are large for two particularly important nutrients: calcium, where the point estimates suggest a 1 percent price subsidy leads to a nearly 0.51 percent reduction in intake, and vitamin A, where a 1 percent subsidy leads to a 0.83 percent reduction. Among other things, these two nutrients are important for the growth and maintenance of bones, and deficiencies can lead to a variety of significant, long-term health problems. This is especially important in light of the fact that on average households were receiving less than half the DRIs for these minerals at baseline.

In Gansu, the signs of the point estimates for the various vitamins and minerals are more mixed, though none are statistically significant. The point estimates are extremely small in most cases, with all elasticities less than 0.11 except for selenium (0.15) and vitamin C (0.19), which are still fairly small. However, the standard errors are again in many cases large, so we cannot rule out moderate to large positive effects for a number of nutrients. For example, we cannot rule out elasticities of 0.50 or greater for selenium, vitamin C, sodium, vitamin B_{12} and vitamin A (with households deficient at baseline for the latter three).

III.B. Robustness

In table 5, we present results from a range of alternative specifications, including: using individuals as the unit of observation rather than the household; simple (i.e., non-arc) elasticities; a log-log specification; using calorie intake and price subsidy levels, rather than percent changes; using household total nutrient intakes rather than per capita measures; clustering standard errors

[30] Of course, this does not indicate that those who cut back were those who were initially deficient at baseline. Given difficulties in assessing deficiency, since need varies with many (observed and unobserved) characteristics, we do not explore heterogeneity along this dimension. Alternatives such as measuring the deficit of nutrient intake (i.e., adding up only shortfalls), would be similarly limited. Further, such a measure would require making assumptions on the shape of the relationship between intake relative to DRIs and other outcomes (for example, moving from a deficit of 0.12 to 0.20 might have a greater impact on health than moving from 0.82 to 0.90) or assuming there is no beneficial effect of increased nutrient intake above the DRI.

at the county level; and including county*time fixed effects for added precision (allowing us to in effect compare the changes for households with different subsidy levels within the same community, thus controlling for any county-level factors that change over time, such as the prices of foods, labor market conditions or the value of government transfer programs). The coefficients are fairly stable across the various specifications. In a few cases, particular coefficients occasionally move from just above to just below marginal statistical significance or vice-versa, though these typically represent only slight changes in p-values, and we would not want to make much of the marginal significance or not in these cases. For Hunan, the effect on calories is consistently negative and statistically significant, with point estimates of the elasticity varying from 0.15 to 0.25. The effect on protein, mineral and vitamin intake in Hunan are generally negative, but only a few are (marginally) statistically significant, so there is no robust evidence of declines. In Gansu, the results are again fairly robust to alternative specifications. The point estimate of the calorie elasticity in particular varies only from about 0.10 to 0.20, though it is only (marginally) statistically significant in one of the specifications, where household totals instead of per capita measures are used.[31] The elasticities are generally positive for the other nutrients, but are in general fairly small and none are statistically significant. Overall, we again conclude that there is no evidence the subsidy improved nutrition, and may have perhaps slightly worsened calorie intake in Hunan.

III.C. Relationship Between Nutrient Elasticities and Wealth

Our primary conclusions represent the average effect of the subsidy in our sample. An important possibility to explore is whether the analysis overlooks important heterogeneity in the response. In particular, we might expect that the poorest households, those who are presumably consuming the lowest levels of nutrients relative to need, might be less inclined to tradeoff taste for nutrients than wealthier households are. And for a policy maker, the effect on the most nutrient-deprived might be more important than the average effect. Therefore, although our sample already focuses exclusively on urban households officially classified as the poorest, it is worth exploring whether the subsidies might have at least improved nutrition among the poorest of the poor. While one must of course be mindful of the potential problems in interpreting results

[31] However, this variation itself is not robust to the other variations, such as using levels rather than percent changes, a log-log specification, or clustering standard errors at the county level.

based on ex-post stratifications of the data, we believe this exercise is valuable both because the prediction of heterogeneous response would follow from basic consumer theory for consumers near subsistence (see Jensen and Miller 2008a) and because, again, this is likely to be of greater policy interest than the average effect.

Ideally, stratifying the sample would be done according to some measure of nutritional intake adequacy, or by whether households are above or below a subsistence threshold. Unfortunately, there is no consensus on what the true subsistence threshold is, or indeed whether it even exists (see for example the discussion in Dasgupta 1993). We therefore take a simple, flexible approach to exploring heterogeneity via a series of locally weighted regressions. At each level of (pre-intervention) log expenditure per capita,[32] we estimate equation (1) using a window of observations on either side of that point; within that window we estimate a weighted regression, where observations closest to the central point receive the most weight (we use a biweight kernel, though the results are robust to alternatives). Figure 1 plots the resulting coefficients, i.e., the subsidy price elasticities, at each level of wealth, along with the associated 95 percent confidence intervals.[33]

For calories in panel A, the figures yield similar patterns for the two provinces. In both cases, the wealthiest households respond to the subsidy by decreasing calories (though this is only statistically significant over a small range in Hunan, and not at all in Gansu). The figure also shows that the decline in calories associated with the subsidy in Hunan was largely driven by wealthier (but still quite poor) households. By contrast, the point estimates of the elasticities are positive for the poorest households in both provinces, though they only become statistically significant in Gansu for the very bottom of the expenditure distribution (corresponding to around \$0.10 − 0.15 per person per day). In fact, there is a rough consistency between the results in the two provinces. The crossing point from negative to positive point estimates occurs at log

[32] Although it might seem more meaningful to estimate the effects based on initial caloric intake rather than expenditure, categorizing individuals in this way is problematic. Calorie needs vary widely by age, sex, height, weight, body fat and muscle composition, level of physical activity, health status and a range of other factors. Thus, you could have two individuals with the same caloric intake, but one has a physically demanding job and is consuming fewer calories than needed, while the other is retired and consuming more calories than needed for subsistence. However, performing the analysis using baseline caloric intake yields broadly similar conclusions to those below (though the evidence that calories increase for the most deprived households in Gansu is weaker).

[33] In Jensen and Miller (2008a), we argue that the share of calories a household consumes in the form of a staple good is a reliable indicator of whether a household is consuming at, above or below subsistence. Using this alternative variable yields broadly similar conclusions to those observed with expenditures, so for simplicity we present only the expenditure-based results.

monthly expenditures per capita of 5.5 in Hunan and 5.0 in Gansu. Thus, while not robustly statistically significant, there is perhaps some suggestive evidence that the very poorest of the poor may have increased caloric intake. Though, again we are cautious not to over-interpret these results given that this ex-post stratification deviates from our original experimental design, and since the effect is only statistically significant over a very small range, and only in Gansu.

The same pattern of the response to the subsidy along the wealth distribution generally does not appear for other nutrients in panels B−D, however. While there is evidence of a negative relationship between expenditure and the elasticities of protein, vitamin and mineral intake in Hunan, the elasticity is almost uniformly negative throughout the expenditure distribution, and the positive point estimates are not statistically significant over any range (though this approach does reduce sample sizes, decreasing precision). Thus, as above, overall for Hunan we generally conclude the subsidy did not improve intake of any nutrient, and perhaps decreased it for calories.

For Gansu, there is no evidence for a downward sloping relationship in wealth for the protein, mineral and vitamin elasticities. The point estimates are generally positive for much of the expenditure distribution, but there is no range over which they are statistically significant. Thus, while there may be some suggestive evidence of a calorie improvement for the very poorest households in Gansu, there is no evidence of gains in any other nutrients. Below, we will show that these results are consistent with changes in food consumption patterns.

III.D. Food Substitution Patterns

The motivating hypothesis for this study is that when faced with a decline in the price of a staple food, households will change the composition of the basket of goods they consume, possibly substituting toward foods with higher non-nutritional attributes (or that add variety to their diet). In table 6, we consider the impact of the subsidy on dietary patterns using the percent change in consumption of various aggregated food categories, using data from the food intake diaries as the dependent variables in regressions like (1) above. Given the widely differing results by province, for the remaining analyses we omit the results for the pooled sample. We also present *p*-values adjusted for multiple testing, using Bonferroni-style adjustments due to

Holm (1979) and Benjamini and Hochberg (1995).[34] However, we note that our original model for this paper and Jensen and Miller (2008) yielded a specific prediction that a price subsidy on a staple good would (negatively) affect consumption of the staple good and (positively) a "fancy" good like meat or pulses, with the other food categories presented here simply for completeness; thus, in principle, the unadjusted *p*-values for rice/wheat, meat and pulses are the correct ones. In the final column of the table, we also provide the *p*-values of standard *F*-tests of the null hypothesis that the effect of the subsidy is zero for all of the consumption groups.

The results provide insight into the effect of the subsidy on nutrient intake. In Hunan, the rice price subsidy causes consumers to cut back on their consumption of rice, i.e., the Giffen behavior documented in Jensen and Miller (2008a). In addition, they cut back on their consumption of vegetables (a category dominated primarily by cabbage and spinach), pulses (primarily bean curd or tofu) and fats (primarily cooking oils). Offsetting these cutbacks is an increase in seafood consumption (primarily fish, the cheapest meat in both provinces). While we only know the foods eaten, not how they were combined as eaten, our field work revealed that the primary diet for most households in our Hunan sample was rice, eaten with bean curd and cabbage or spinach, stir-fried in oil. The results in table 6 therefore suggest that in response to the subsidy, households in Hunan substituted away from this primary meal (with statistically significant reduction for each of these food items) in favor of adding fish to their diet. While a great deal of calories were lost from the reduced consumption of rice and pulses (cabbage and spinach have very few calories), only part of this loss was recovered through the increased consumption of fish, leading to a net decline in calories. Additionally, the large decline in vitamin A in Hunan is likely explained by the reduced consumption of spinach, which is among the richest sources of that vitamin. However, we note that none of the coefficients are statistically significant when *p*-values are adjusted using the more conservative Holm correction, and only fruits/vegetables and fats are (marginally) significant using the Benjamini-Hochberg adjustment.

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[34] Holm (1979) ranks *p*-values across the *k* tests from largest to smallest and multiplies each *p*-value by its rank from 1 to *k*. Benjamini and Hochberg (1995) also ranks *p*-values across *k* tests from largest to smallest, but multiplies each *p*-value by *k*/rank. Benjamini-Hochberg is a less conservative test and thus more likely to allow false positives. We view these as two bookend adjustment options. Though Holm isn't as conservative as the unadjusted Bonferroni method where each *p*-value is simply multiplied by the number of tests, it yields a similar rate of false-positives as this conservative approach, and less rejection of true positives.

In addition to documenting patterns of food substitution, these results also show that while the subsidy had only modest effects on nutrition, it is not the case that households did not respond at all to the subsidy (or that our data or empirical strategy were inadequate for detecting such changes). Rather, there were substantial changes in household food consumption patterns in response to the price subsidy, which in the aggregate, had a negative, though small, impact on nutrition.[35]

In Gansu, there is less evidence of systematic substitution across foods. For the most part, the elasticities for the most commonly eaten foods are positive but not significantly different from zero. The only coefficient that is statistically significantly is for fats, a category that primarily consists of edible oil (though the significance is not robust to adjustment for multiple testing). In Gansu, oil is sometimes eaten with or brushed on top of the simple home-made bread *mo* (the dominant form in which wheat is consumed in our sample) in order to add flavor; alternatively, both the flavor and texture of *mo* can be enhanced by adding more oil to the dough before cooking. Therefore, one interpretation of this result is that, as in Hunan, subsidized households again sought to add taste to their diet; but since they could still not afford meat or seafood, they instead opted for the lower cost option of increasing edible oils. Since consumption of other foods such as the staple did not decline, overall average caloric intake did not decline. In fact, per unit currency, oil adds more calories than wheat, but little or nothing in the way of other nutrients, which could explain why the subsidy had a positive effect on calories in Gansu (though not statistically significant except perhaps for the poorest of the poor) but no effect on any other nutrient categories. Thus, even any marginal gains in calories for Gansu comes with the caveat that the gain may be driven purely by additional consumption of edible oil, largely devoid of any other nutrients.

III.E. Behavioral Responses

A final consideration is whether the subsidies lead to any behavioral responses. For example, the subsidy represents a wealth shock that might increase the demand for leisure and

[35] We also note that we cannot reject that total expenditures on non-food items did not change as a result of the subsidy in either province. In the appendix table, we consider the effects of the subsidy on disaggregated expenditure categories. The only statistically significant results are an increase in communications expenditures in Hunan (most likely, cell phones; though the large elasticity represents only a small change in expenditure because the baseline level is extremely small), and an increase in food expenditures in Gansu (perhaps consistent with the increased consumption of oil noted below, which is expensive in relative terms). Though these coefficients are not significant when adjustments are made for multiple testing.

reduce labor supply. We would still want to consider such changes an effect of the subsidy. And such a result would be of interest in light of the large literature estimating the behavioral responses to public programs. However, the interpretation of the nutrition results might then differ, as we would want to assess changes in, say, calories, relative to reduced need as a result of lower physical activity.

Table 7 shows the impact of the subsidy on labor supply, earnings (wages and salary), unearned income and household composition,[36] using regressions like (1) above, with percent changes in these other variables as the dependent variable (though the results are robust to alternative specifications like those explored in table 5). Overall, there is no evidence that the subsidy had any effect on these behaviors. This is perhaps not surprising, given the extreme poverty of the households in our sample (and, regarding household composition, the scarcity of large extended families due to decades of the one-child policy).

IV. DISCUSSION AND CONCLUSION

Overall, we find no evidence that the consumer price subsidy improved nutrition, and it may have actually reduced caloric intake in one of our provinces. This is despite the fact that the households in our sample are extremely poor, both by Chinese and international standards, and appear to be very undernourished by international standards. That is, they are exactly the households at which subsidy programs are typically targeted. While the subsidies did not appear to strongly affect nutrition, they did affect household consumption patterns. Especially in Hunan, they induced substitution away from the subsidized, staple food toward other foods with higher non-nutritional attributes.

While our analysis focused on nutrition rather than health or welfare, there are clear links from the former to the latter.[37] In fact, changes in nutritional status are perhaps more easily

[36] The possibility that the subsidy may attract other non-eligible family members to the household is one case where the subsidy as we implemented it may yield different impacts than a general subsidy. Our subsidy was assigned to only a subset of households, creating a potential pool of ineligible persons related to an eligible person. In the case of a universal subsidy for which all individuals are eligible, or a subsidy targeted to the poor where there is high correlation in poverty among relatives, we would not expect the same household composition response. While this is a potential threat to the external validity of our study, the fact that we find that no such changes took place makes this concern less important.

[37] Further, nutrition is of course an important outcome to assess in its own right. As noted above, protecting or improving nutrition is often one of the explicit goals of subsidy programs. Further, nutrition is the outcome of interest for many domestic and international organization such as the FAO, and the first Millenium Development Goal is to halve hunger (estimated to afflict 750 million people worldwide), defined in terms of caloric intake.

measured than changes in these other outcomes, which may arise only in the long run. For example, it is well-established in the medical and public health literature that reduced calcium and vitamin D intake over long periods increases the likelihood of osteoporosis. While changes in the intake of these nutrients can easily measured with survey data, the loss of bone mineral density or an increased incidence of bone fractures would only be detectable after many years. Thus, nutrient intake provides important insight into health and long-term health risks; in the present case, the absence of any gains in nutrition suggests it is unlikely the subsidy will have any positive health impacts.[38] Similarly, while there are well-established links between nutrition and important non-health outcomes such as work productivity, school performance and cognitive development for children, we would again conclude it is unlikely the subsidy had any effect on these outcomes, since there was little to no effect on nutrition.

Ultimately, policies aimed at helping the poor should be evaluated in terms of their welfare impact. While the sign of the effect of the subsidy on nutrition is ambiguous (both theoretically and empirically), the welfare effect is not. By virtue of expanding households' budget sets, in a revealed preference framework (i.e., people are rational and make well-informed decisions) the subsidies *must* improve welfare, regardless of whether they improve nutrition.[39] According to this view, consumers' choices maximize their utility, and if they make choices that reduce their nutrition, then it must be that they gain more from the increased taste or variety than they lose in calories or long-term health status.[40] But again, the primary conclusion remains that subsidies improve welfare.

However, there are a number of other policy instruments such as cash or in-kind transfers that also improve welfare for the poor, and price subsidies or controls are generally held to have a number of disadvantages relative to these other instruments (e.g., distorting price signals;

[38] It is possible that the subsidy affects health through mechanisms other than nutrition. For example, households could use the savings from the subsidies to improve sanitation or water quality. While we cannot rule out impacts such as these, our failure to find an effect on household non-food expenditure categories is evidence against this hypothesis. It is also possible that the subsidy affects nutrient absorption while largely leaving the nutrient content of foods consumed unchanged, due to changes in food quality, storage or preparation (Schiff and Valdes 1990a,b; for example, buying more expensive meat that is less likely to be contaminated and thus less likely to result in diarrhea or dysentery that would block nutrient absorption or cause illness). However, we find no evidence the subsidy lead to increases in prices paid for foods in our sample, which is evidence against this hypothesis.

[39] If consumers are either not rational or not well-informed about the consequences of their decisions, then this may not hold. In particular, if consumers are not well-informed about the health consequences of their consumption decisions then it is possible that a subsidy program accompanied by consumer education would result in households improving nutrition in response to the combined program.

[40] This may be especially likely if consumers heavily discount the future, so they are willing to sacrifice long-term health in favor of short-term utility gains.

leading to shortages; promoting smuggling and black market activity). Although subsidies may have other advantages such as superior targeting, ease of administration, or political palatability, the primary justification for choosing subsidies over other policy instruments has been that they improve not just welfare, but nutrition as well. This argument, at least in our data, does not appear to be valid.

If consumers' simply prefer less nutritious foods, then policymakers, confronted with the reality of utility maximizing consumers, can either abandon their concerns over nutrition or take a more paternalistic approach towards nutrition, perhaps as motivated by a public good aspect of good nutrition. If the former approach is adopted, then, seen in this light, our results should not be interpreted as saying that consumer price subsidies have no value or that food price increases should be ignored. High or rising food prices have adverse welfare consequences for the poor,[41] and public policy must find ways to address these concerns. However, policymakers may have to be satisfied with knowing that giving wealth to the poor improves their welfare, and thus with assessing the gains of any efforts in terms of wealth transferred, not in terms of nutrition.

If, on the other hand, policy makers remain focused on improving nutrition, it is not clear that alternative policies will necessarily be more effective in achieving this goal.[42] Our finding of no nutritional gain from the subsidy is driven by the wealth effect of the price change. When the subsidy increases households' real wealth, they substitute toward the less-nutritious foods that wealthier households consume. Consequently, we would expect similar effects to occur with any other type of program aimed at improving nutrition that increases real wealth, including cash transfers or in-kind transfers of food.[43]

While there should always be caution in generalizing results, we believe that the conditions displayed by our sample that lead to our predictions -- namely poor households consuming a large fraction of their calories from a staple good, along with lesser quantities of a

[41] Though, again in terms of nutrition, Jensen and Miller (2008b) find that households in China were able to buffer caloric intake against at least the early phase of recent increases in world food prices.

[42] This is of course not to say that programs such as fortifying foods (for example, adding iodine to salt) are not likely to be effective in increasing the intake of specific micronutrients.

[43] Though for interpretation of our results, it is important to keep in mind that we find that the subsidy does not improve nutrition relative to a baseline in which there is no subsidy. This is not the same as saying that price subsidies are less effective than cash aid in improving nutrition. In fact, if, indeed, it is the wealth effect of the subsidy that leads consumers to reduce nutrition, then the problem could be even more severe in the case of pure cash aid (of equivalent value). Put another way, while both cash and subsidies entail a wealth effect that reduces nutrition, the subsidy program also carries a substitution effect, which, by reducing the relative price of the nutritious staple, works in the opposite direction (i.e., towards improving nutrition). Thus, when compared to a cash aid program, an equivalently-valued subsidy program may lead to better nutritional outcomes.

small number of substitute goods, some of which are taste-preferred but more expensive sources of calories -- are likely to arise elsewhere. In many developing countries, staples such as maize, sorghum, millet or cassava play a role in the traditional diet of the poor analogous to the role of rice and wheat in our Chinese sample. Indeed, our results help to substantiate the findings of no nutritional effect for food price subsidy programs found elsewhere in the literature (e.g., Kochar 2005, Tarozzi 2005 and a number of the papers surveyed in Behrman and Deolalikar 1988).

However, there are of course reasons why the effects may differ in other environments. For example, if the prices of meat and other expensive sources of calories are not as high relative to the staple, then the calories gained by increasing consumption of these luxury foods may be sufficient to offset the calories lost by reducing consumption of the staple. Similarly, differences in the availability (or attractiveness) of substitutes for the staple and/or the more expensive source of calories may also alter the pattern of substitution among commodities and consequently the effect of the subsidy. Further, our study focused on subsidizing the price of only one good per province. It is possible that subsidizing a wider range of goods would cause different patterns of substitution and, accordingly, different nutritional outcomes. Finally, differences in the income levels of the target population could also affect the results. While the households in our study represent the poorest in urban China, who live on far less than the World Bank's extreme poverty line of one dollar per person per day, it may simply be that our sample is largely beyond subsistence consumption. It may be that even poorer households would behave differently (and we note that there was some suggestive evidence of slight improvements for the very bottom of our sample). These remain empirical questions that can only be answered in other specific settings. However, our results do point out the importance of understanding the consequences of food substitution and the recognition that it will dampen the intended effects of subsidy or other programs and under certain conditions may neutralize or even reverse them.

REFERENCES

Behrman, Jere R. and Anil B. Deolalikar (1987). "Will Developing Country Nutrition Improve with Income? A Case Study for Rural South India," *Journal of Political Economy*, 95, p. 108-38.

- - and - - (1988). "Health and Nutrition," in Chenery, Hollis and T.N. Srinivasan, eds., Handbook of Development Economics, Volume 1, Amsterdam: North-Holland.

--, -- and Barbara L. Wolfe (1988). "Nutrients: Impacts and Determinants." *World Bank Economic Review*, 2(3), p. 299-320.

Benjamini, Yoav and Yosef Hochberg (1995). "Controlling the False Discovery Rate: A Practical and Powerful Approach to Multiple Testing," *Journal of the Royal Statistical Society*, Series B (Methodological), 57(1). p. 289-300.

Bouis, Howarth E. and Lawrence J. Haddad (1992). "Are Estimates of Calorie-Income Elasticities Too High? A Recalibration of the Plausible Range," *Journal of Development Economics*, 39, p. 333-64.

Dasgupta, Partha (1993). An Inquiry into Well-Being and Destitution. Oxford: Clarendon Press.

Deaton, Angus (1997). The Analysis of Household Surveys: A Microeconomic Approach to Development Policy. Baltimore, Maryland: The Johns Hopkins University Press.

Economist, (2007a). "An Expensive Dinner: Alarm is Growing About Rising Food Prices," Nov. 3.

-- (2007b). "Cheap No More," Dec. 6.

-- (2007c). "The End of Cheap Food," Dec. 6.

Food and Agricultural Organization (2006). The State of Food Insecurity in the World, 2006. Rome.

- -, and World Health Organization (1990). Expert Consultation Protein Quality Evaluation Food and Agricultural Organization of the United Nations FAO Food and Nutrition Paper 51, Rome.

- -, - -, and United Nations University (FAO, WHO, UNU) (1985). Energy and Protein Requirements. Report of a Joint FAO/WHO/UNU Expert Consultation. World Health Organization Technical Report Series, 724.

Guo, Xuguang, Barry M. Popkin, Thomas A. Mroz and Fengying Zhai (1999). "Food Price Policy Can Favorably Alter Macronutrient Intake in China," *Journal of Nutrition*. 129, p. 994-1001.

Holm, Sture (1979). "A Simple, Sequentially Rejective Bonferroni Test Procedure," *Scandinavian Journal of Statistics*, 6, p. 65-70.

Jensen, Robert T. and Nolan Miller (2008a). "Giffen Behavior and Subsistence Consumption," *American Economic Review*, 98(4), p. 1553 − 77.

-- and -- (2008b). "The Impact of the World Food Price Crisis on Nutrition in China" *Agricultural Economics*, 39, p. 465 − 76.

Kochar, Anjini (2005). "Can Targeted Food Programs Improve Nutrition? An Empirical Analysis of India's Public Distribution System," *Economic Development and Cultural Change* 54(1), p. 203-35.

Pitt, Mark M. (1983). "Food preferences and nutrition in rural Bangladesh," *Review of Economics and Statistics*, 65, p. 105-114.

-- and Mark R. Rosenzweig (1985). "Health and nutrient consumption across and within farm households," *Review of Economics and Statistics*, 67, p. 212-223.

-- and -- "Agricultural prices, food consumption and the health and productivity of farmers," in I.J. Singh, L. Squire and J. Strauss, eds., *Agricultural Household Models: Extensions, Applications and Policy*. Washington: World Bank.

-- and -- and Md. Nazmul Hassan (1990). "Productivity, Health, and Inequality in the Intrahousehold Distribution of Food in Low-Income Countries," American Economic Review, 80(5), p. 1139-56.

Popkin, Barry M., Bing Lu and Fengying Zhai (2002). "Understanding the Nutrition Transition: Measuring Changes in Transitional Countries," *Public Health Nutrition*, 5(6A), p. 947-953,

Planning Commission (2005). "Performance Evaluation of Targeted Public Distribution System (TPDS)," Planning Commission, Government of India. New Delhi.

Ravallion, Martin (2007). "Geographic Inequality in a Decentralized Anti-Poverty Program: A Case-Study of China," World Bank Policy Research Working Paper No. 4303.

Schiff, Maurice and Alberto Valdes (1990a). "Poverty, Food Intake and Malnutrition: Implications for Food Security in Developing Countries," *American Journal of Agricultural Economics*, p. 1318-1322.

-- and – (1990b). "Nutrition: Alternative Definitions and Policy Implications," *Economic Development and Cultural Change*, 38(2), p. 281-292.

Stifel, David and Harold Alderman (2006). "The "Glass of Milk" Subsidy Program and Malnutrition in Peru," *World Bank Economic Review*, 20(3), 421-448.

Strauss, John (1984) "Joint determination of food consumption and production in rural Sierra Leone: Estimates of a household-firm model," *Journal of Development Economics*, 14, 77-104.

-- and Duncan Thomas (1995). "Human Resources: Empirical Modeling of Household and Family Decisions," in Behrman, Jere R. and T.N. Srinivasan, eds., Handbook of Development Economics, Volume 3, Amsterdam: North-Holland.
-- and -- (1998). "Health, Nutrition and Economic Development," *Journal of Economic Literature*, 36(2), 766-817.
Subramanian, Shankar and Angus Deaton (1996). "The Demand for Food and Calories," *Journal of Political Economy*, 104(1), 133-162.
Tarozzi, Alessandro (2005). "The Indian Public Distribution System as a Provider of Food Security: Evidence from Child Nutrition in Andhra Pradesh," *European Economic Review*, 49, p. 1305-1330.
Thomas, Duncan and John Strauss (1997). "Health and Wages: Evidence on Men and Women in Urban Brazil," *Journal of Econometrics*, 77(1), 159-85.
Westfall, Peter H. and S. Stanley Young (1993). Resampling-Based Multiple Testing. Wiley: New York.
Williamson-Gray, C. (1982). "Food Consumption Parameters for Brazil and their Application to Food Policy," International Food Policy Research Institute, Washington, DC.
Wooldridge, Jeffrey (2003). "Cluster-Sample Methods in Applied Econometrics," *American Economic Review*, 2003(2), 133-138.
Zhai, Fengying, Xuguang Guo, Barry M. Popkin, Linmao Ma, Qing Wang, Wentao Yu, Shuigao Jin and Keyou Ge (1996). "The Evaluation of the 24-hour Individual Recall Method in China," *Food and Nutrition Bulletin*, 17, 154-161.

TABLE 1. MEANS, STANDARD DEVIATIONS AND TESTS OF BASELINE COVARIATE BALANCE

	MEANS				t-TESTS OF EQUALITY					
A. TOTAL	Control	0.1 subs.	0.2 subs.	0.3 subs.	0−0.1	0−0.2	0−0.3	0.1−0.2	0.1−0.3	0.2−0.3
Family size	2.9	2.8	2.9	2.7	0.090	0.021	0.15	-0.068	0.064	0.13
	[1.2]	[1.2]	[1.2]	[1.1]	(0.093)	(0.10)	(0.098)	(0.082)	(0.071)	(0.091)
Expend. per cap.	259	279	249	290	-19.6	10.1	-30.8	29.7	-11.2	-40.9
	[255]	[274]	[267]	[376]	(25.0)	(22.0)	(20.2)	(19.8)	(24.2)	(25.3)
Calories per cap.	1752	1758	1767	1752	-6.0	-14.7	-0.28	-8.7	5.7	14.4
	[565]	[570]	[526]	[569]	(35.6)	(24.7)	(35.4)	(24.2)	(40.1)	(29.0)
Protein per cap.	48.5	47.8	47.8	48.2	0.76	0.76	0.35	0.003	-0.40	-0.40
	[19.4]	[17.0]	[17.8]	[17.8]	(1.32)	(0.87)	(1.26)	(1.20)	(1.37)	(1.34)
Minerals	0.92	0.95	0.96	0.92	-0.03	-0.043	-0.0005	-0.01	0.032	0.042
	[0.42]	[0.44]	[0.44]	[0.43]	(0.035)	(0.025)	(0.034)	(0.039)	(0.028)	(0.040)
Vitamins	1.07	1.12	1.12	1.10	-0.048	-0.049	-0.028	-0.001	0.020	0.021
	[0.47]	[0.56]	[0.51]	[0.54]	(0.045)	(0.031)	(0.035)	(0.038)	(0.030)	(0.034)
Observations	324	324	324	321	648	648	645	648	645	645
	MEANS				t-TESTS OF EQUALITY					
B. HUNAN	Control	0.1 subs.	0.2 subs.	0.3 subs.	0−0.1	0−0.2	0−0.3	0.1−0.2	0.1−0.3	0.2−0.3
Family size	2.8	2.9	3.0	2.7	-0.056	-0.15	0.12	-0.093	0.18	0.27**
	[1.3]	[1.3]	[1.4]	[1.1]	(0.12)	(0.14)	(0.16)	(0.049)	(0.092)	(0.085)
Expend. per cap.	316	330	299	364	-13.3	16.7	-47.6	30.0	-34.3	-64.3
	[252]	[316]	[290]	[482]	(30.7)	(43.7)	(28.0)	(24.2)	(43.7)	(46.4)
Calories per cap.	1767	1783	1817	1851	-16.3	-49.6	-84.3*	-33.6	-68.0**	-34.4
	[628]	[588]	[549]	[601]	(50.4)	(39.7)	(40.8)	(27.6)	(19.8)	(25.0)
Protein per cap.	45.6	46.4	46.0	48.8	-0.76	-0.041	-3.2**	0.035	-2.43	-2.78
	[19.0]	[16.6]	[18.4]	[19.1]	(1.58)	(1.24)	(1.06)	(2.20)	(1.47)	(2.12)
Minerals	0.94	1.02	1.00	1.00	-0.072	-0.054	-0.058	0.018	0.015	-0.0032
	[0.45]	[0.46]	[0.49]	[0.47]	(0.036)	(0.045)	(0.055)	(0.060)	(0.047)	(0.071)
Vitamins	1.01	1.11	1.09	1.12	-0.10**	-0.083*	-0.11**	0.195	-0.0069	-0.026
	[0.46]	[0.57]	[0.55]	[0.58]	(0.038)	(0.038)	(0.033)	(0.045)	(0.044)	(0.041)
Observations	161	162	162	159	323	323	320	324	321	321
	MEANS				t-TESTS OF EQUALITY					
C. GANSU	Control	0.1 subs.	0.2 subs.	0.3 subs.	0−0.1	0−0.2	0−0.3	0.1−0.2	0.1−0.3	0.2−0.3
Family size	2.9	2.7	2.7	2.7	0.24	0.19	0.19	-0.043	-0.049	-0.006
	[1.1]	[1.1]	[0.95]	[1.1]	(0.12)	(0.13)	(0.12)	(0.17)	(0.095)	(0.15)
Expend. per cap.	202	228	198	216	-25.3	4.1	13.4	29.4	11.9	-17.5
	[247]	[214]	[231]	[201]	(42.4)	(13.1)	(28.1)	(34.5)	(20.4)	(20.9)
Calories per cap.	1737	1732	1716	1655	4.43	20.6	82.1**	16.2	77.6	61.4
	[4961]	[553]	[499.7]	[519.7]	(57.1)	(27.9)	(29.0)	(38.7)	(64.3)	(46.0)
Protein per cap.	51.4	49.2	49.5	47.6	2.24	1.89	3.84***	-0.35	1.61	1.96*
	[19.4]	[17.3]	[17.0]	[16.4]	(2.15)	(1.14)	(0.75)	(1.23)	(2.04)	(0.85)
Minerals	0.90	0.89	0.93	0.84	0.0082	-0.030	0.055	-0.038	0.047	0.086*
	[0.39]	[0.40]	[0.38]	[0.38]	(0.061)	(0.026)	(0.031)	(0.54)	(0.035)	(0.035)
Vitamins	1.13	1.12	1.14	1.07	0.0058	-0.030	0.053	-0.022	0.047	0.069
	[0.47]	[0.54]	[0.47]	[0.49]	(0.085)	(0.026)	(0.045)	(0.067)	(0.043)	(0.051)
Observations	163	162	162	162	325	325	325	324	324	324

Notes: Standard deviations in brackets, standard errors in parentheses. Expenditure per capita is in 2006 yuan (Rmb), protein is measured in grams, vitamins and minerals are a sufficiency index measuring the average per-person intake relative to the Daily Recommended Intake. The 0.1, 0.2 and 0.3 subs. groups received 0.1, 0.2, and 0.3 yuan per *jin* subsidies (1 *jin* = 500g). All variables as measured in the round 1 survey.

TABLE 2. BASELINE NUTRIENT INTAKES AND SUBSIDY COEFFICIENTS

	POOLED SAMPLE		HUNAN		GANSU	
	Intake	Coefficient	Intake	Coefficient	Intake	Coefficient
MINERALS						
Calcium	0.33	-0.344**	0.40	-0.506**	0.25	-0.135
	[0.27]	(0.158)	[0.30]	(0.257)	[0.22]	(0.200)
Iron	2.2	-0.079	2.3	-0.179	2.1	0.004
	[1.3]	(0.095)	[1.31]	(0.146)	[1.2]	(0.124)
Potassium	0.33	-0.073	0.33	-0.197	0.33	0.016
	[0.17]	(0.112)	[0.17]	(0.176)	[0.18]	(0.147)
Sodium	0.27	-0.028	0.31	-0.299	0.24	-0.097
	[0.44]	(0.254)	[0.41]	(0.357)	[0.46]	(0.348)
Magnesium	0.58	-0.172	0.61	-0.237	0.55	-0.141
	[0.35]	(0.112)	[0.32]	(0.153)	[0.37]	(0.157)
Phosphorus	0.56	0.068	0.60	0.078	0.51	0.027
	[0.32]	(0.117)	[0.32]	(0.185)	[0.30]	(0.154)
Zinc	0.62	-0.103	0.75	-0.112	0.48	-0.144
	[0.31]	(0.094)	[0.32]	(0.134)	[0.23]	(0.127)
Copper	1.4	-0.053	1.7	-0.117	1.1	-0.071
	[0.81]	(0.096)	[0.78]	(0.138)	[0.75]	(0.130)
Manganese	2.2	-0.160*	2.7	-0.213*	1.8	-0.129
	[0.99]	(0.088)	[1.02]	(0.119)	[0.77]	(0.122)
Selenium	1.9	0.016	1.4	-0.070	2.4	0.148
	[1.0]	(0.158)	[0.68]	(0.161)	[1.1]	(0.239)
VITAMINS						
Vitamin C	0.97	0.025	1.1	-0.214	0.84	0.190
	[0.98]	(0.194)	[1.2]	(0.325)	[0.70]	(0.243)
Thiamin	2.7	-0.019	2.5	-0.063	2.9	0.027
	[1.1]	(0.089)	[0.96]	(0.126)	[1.2]	(0.121)
Riboflavin	1.2	0.028	0.66	-0.127	1.7	0.066
	[0.81]	(0.120)	[0.39]	(0.195)	[0.76]	(0.153)
Niacin	1.5	-0.043	1.4	-0.078	1.7	0.001
	[0.62]	(0.088)	[0.51]	(0.123)	[0.67]	(0.121)
Pantotheonic Acid	0.81	-0.079	1.0	-0.130	0.59	-0.096
	[0.40]	(0.092)	[0.39]	(0.122)	[0.28]	(0.130)
Folate	2.5	-0.075	2.7	-0.223*	2.19	0.060
	[1.1]	(0.101)	[1.2]	(0.136)	[0.93]	(0.141)
Vitamin B_6	0.86	-0.033	1.0	-0.103	0.68	0.002
	[0.50]	(0.112)	[0.54]	(0.153)	[0.37]	(0.158)
Vitamin B_{12}	0.13	0.287	0.17	0.573	0.09	0.105
	[0.33]	(0.275)	[0.39]	(0.481)	[0.26]	(0.338)
Vitamin A	0.43	-0.613**	0.47	-0.829*	0.40	-0.219
	[0.64]	(0.288)	[0.72]	(0.460)	[0.53]	(0.373)

Notes: Data in the “Intake” columns represent baseline intake as a ratio of the Daily Recommended Intake; standard deviations are in brackets. The "Coefficient" columns provide the elasticity of intake with respect to the subsidy, i.e., they are coefficients from regressions for each vitamin and mineral, where the dependent variable is the arc percent change in household per capita intake, and the independent variable is the arc percent change in price due to the subsidy; standard errors, clustered at the household level, are in parentheses. *Significant at 10 percent level. **Significant at 5 percent level. ***Significant at 1 percent level.

TABLE 3. BASELINE CONSUMPTION PATTERNS

	POOLED SAMPLE	HUNAN	GANSU
% of Calories From:			
Rice	0.353	0.640	0.068
	[0.324]	[0.171]	[0.131]
Wheat	0.384	0.080	0.685
	[0.337]	[0.117]	[0.173]
Other Cereals	0.006	0.002	0.009
	[0.039]	[0.022]	[0.050]
Vegetables and fruit	0.056	0.046	0.065
	[0.045]	[0.044]	[0.045]
Meat	0.044	0.074	0.014
	[0.090]	[0.115]	[0.037]
Pulses	0.022	0.022	0.022
	[0.050]	[0.043]	[0.056]
Dairy	0.0046	0.00	0.009
	[0.028]	[0.003]	[0.039]
Fats	0.129	0.131	0.126
	[0.092]	[0.095]	[0.090]
Observations	1293	644	649

Notes: Standard deviations in brackets.

TABLE 4A. NUTRITIONAL RESPONSE TO THE PRICE SUBSIDY: FULL SAMPLE

	CALORIES			PROTEIN			MINERALS			VITAMINS		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Expt. Set-up	% Change	% Change w/controls	Expt. Set-up	% Change	% Change w/controls	Expt. Set-up	% Change	% Change w/controls	Expt. Set-up	% Change	% Change w/controls
%ΔSubsidy	-0.013	-0.027	-0.032	-0.030	-0.024	-0.027	-0.010	-0.065	-0.070	0.036	-0.049	-0.057
	(0.042)	(0.076)	(0.076)	(0.049)	(0.089)	(0.088)	(0.048)	(0.078)	(0.078)	(0.064)	(0.084)	(0.084)
Earned Income			0.024***			0.027***			0.022***			0.031***
			(0.007)			(0.009)			(0.008)			(0.008)
Unearned Income			-0.008			0.007			0.001			-0.011
			(0.012)			(0.013)			(0.011)			(0.012)
Household Size			-0.01			-0.04			0.08			0.05
			(0.05)			(0.06)			(0.07)			(0.07)
Constant	1722***	-2.4	-0.0	45.7***	-10.6	-9.1	0.96***	-19.8***	-17.4**	-0.059**	-23.7***	-20.1**
	(67.7)	(7.1)	(7.1)	(2.17)	(8.3)	(8.2)	(0.016)	(7.4)	(7.3)	(0.023)	(7.9)	(7.8)
Observations	1271	2527	2527	1271	2527	2527	1271	2527	2527	1271	2527	2527
R^2	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.02	0.02	0.00	0.02	0.03

Notes: Standard errors, clustered at the household level, in parentheses. The first column for each nutrient is a regression of the round 2 intake level on the subsidy level, i.e., the experimental set-up; the coefficient has been converted to an elasticity (and the standard error adjusted accordingly). The second two columns regress the arc percent change in household per capita nutrient intake on the subsidy, measured as a percentage of the average price in the two associated periods (%ΔSubsidy). %ΔEarned is the arc percent change in the household earnings from work; %ΔUnearned is the arc percent change in the household income from unearned sources; %ΔPeople is the arc percent change in the number of people in the household. Calories and protein are daily intakes (in kcal and grams, respectively), vitamins and minerals are sufficiency indexes measuring the average per-person intake relative to the Daily Recommended Intake. *Significant at 10 percent level. **Significant at 5 percent level. ***Significant at 1 percent level.

TABLE 4B. NUTRITIONAL RESPONSE TO THE PRICE SUBSIDY: BY PROVINCE: HUNAN

	HUNAN											
	CALORIES			PROTEIN			MINERALS			VITAMINS		
	(1) Expt. Set-up	(2) % Change	(3) % Change w/controls	(4) Expt. Set-up	(5) % Change	(6) % Change w/controls	(7) Expt. Set-up	(8) % Change	(9) % Change w/controls	(10) Expt. Set-up	(11) % Change	(12) % Change w/controls
%ΔSubsidy	0.0061	-0.214*	-0.218*	0.020	-0.001	-0.105	0.004	-0.159	-0.163	0.029**	-0.187	-0.193
	(0.0081)	(0.112)	(0.111)	(0.039)	(0.001)	(0.137)	(0.010)	(0.115)	(0.114)	(0.013)	(0.126)	(0.125)
Earned Income			0.024***			0.037***			0.036***			0.034***
			(0.010)			(0.012)			(0.011)			(0.011)
Unearned Income			-0.028			-0.014			-0.011			-0.037**
			(0.014)*			(0.016)			(0.014)			(0.015)
Household Size			-0.00			-0.03			0.03			0.02
			(0.07)			(0.07)			(0.08)			(0.08)
Constant	1861***	24.9**	27.6***	47.0***	8.7	11.6	1.02***	-17.0*	-14.3	0.022	-7.5	-3.7
	(97.3)	(10.0)	(10.0)	(1.39)	(12.2)	(12.1)	(0.024)	(10.2)	(10.2)	(0.034)	(10.7)	(10.7)
Observations	631	1258	1258	631	1258	1258	631	1258	1258	631	1258	1258
R^2	0.00	0.01	0.02	0.00	0.00	0.01	0.00	0.02	0.04	0.00	0.02	0.03

Notes: Standard errors, clustered at the household level, in parentheses. The first column for each nutrient is a regression of the round 2 intake level on the subsidy level, i.e., the experimental set-up; the coefficient has been converted to an elasticity (and the standard error adjusted accordingly). The second two columns regress the arc percent change in household per capita nutrient intake on the subsidy, measured as a percentage of the average price in the two associated periods (%ΔSubsidy). %ΔEarned is the arc percent change in the household earnings from work; %ΔUnearned is the arc percent change in the household income from unearned sources; %ΔPeople is the arc percent change in the number of people in the household. Calories and protein are daily intakes (in kcal and grams, respectively), vitamins and minerals are sufficiency indexes measuring the average per-person intake relative to the Daily Recommended Intake. *Significant at 10 percent level. **Significant at 5 percent level. ***Significant at 1 percent level.

TABLE 4C. NUTRITIONAL RESPONSE TO THE PRICE SUBSIDY: BY PROVINCE: GANSU

GANSU

	CALORIES			PROTEIN			MINERALS			VITAMINS		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Expt. Set-up	% Change	% Change w/controls	Expt. Set-up	% Change	% Change w/controls	Expt. Set-up	% Change	% Change w/controls	Expt. Set-up	% Change	% Change w/controls
%ΔSubsidy	-0.010	0.146	0.148	-0.075	0.072	0.081	-0.0072	-0.015	-0.019	-0.017	0.057	0.052
	(0.010)	(0.101)	(0.101)	(0.081)	(0.115)	(0.114)	(0.0097)	(0.106)	(0.105)	(0.012)	(0.113)	(0.112)
Earned Income			0.022**			0.015			0.011			0.025**
			(0.011)			(0.012)			(0.012)			(0.012)
Unearned Income			0.031			0.051**			0.025			0.035*
			(0.019)			(0.021)			(0.020)			(0.021)
Household Size			-0.07			-0.08			0.14			0.11
			(0.09)			(0.10)			(0.13)			(0.14)
Constant	1583.6***	-31.1***	-32.1***	44.4***	-32.5***	-35.7***	0.91***	-20.5*	-18.6	-0.14***	-39.2***	-37.1***
	(32.8)	(10.0)	(10.2)	(1.01)	(11.1)	(11.2)	(0.022)	(10.7)	(10.4)	(0.032)	(11.7)	(11.5)
Observations	640	1269	1269	640	1269	1269	640	1269	1269	640	1269	1269
R^2	0.00	0.01	0.02	0.00	0.01	0.02	0.00	0.01	0.02	0.00	0.02	0.03

Notes: Standard errors, clustered at the household level, in parentheses. The first column for each nutrient is a regression of the round 2 intake level on the subsidy level, i.e., the experimental set-up; the coefficient has been converted to an elasticity (and the standard error adjusted accordingly). The second two columns regress the arc percent change in household per capita nutrient intake on the subsidy, measured as a percentage of the average price in the two associated periods (%ΔSubsidy). %ΔEarned is the arc percent change in the household earnings from work; %ΔUnearned is the arc percent change in the household income from unearned sources; %ΔPeople is the arc percent change in the number of people in the household. Calories and protein are daily intakes (in kcal and grams, respectively), vitamins and minerals are sufficiency indexes measuring the average per-person intake relative to the Daily Recommended Intake. *Significant at 10 percent level. **Significant at 5 percent level. ***Significant at 1 percent level.

TABLE 5: NUTRITIONAL RESPONSE TO THE PRICE SUBSIDY—ROBUSTNESS

POOLED	Calories	Protein	Minerals	Vitamins
1. Non-arc	-0.072	-0.066	-0.086	-0.115
	(0.093)	(0.121)	(0.090)	(0.104)
2. County clustered SE	-0.032	-0.027	-0.070	-0.057
	(0.072)	(0.047)	(0.052)	(0.069)
3. County*Time FE	0.012	0.018	-0.064	-0.033
	(0.074)	(0.086)	(0.082)	(0.082)
4. Not per capita	-0.014	-0.012	-0.065	-0.049
	(0.081)	(0.093)	(0.078)	(0.083)
5. Individual data	0.023	0.020	-0.048	0.008
	(0.074)	(0.043)	(0.064)	(0.097)
6. Levels	-0.164	0.635	-3.45	-0.022
	(3.89)	(4.55)	(4.55)	(0.051)
7. Log-log	-0.122	-0.041	-0.065	-0.054
	(0.076)	(0.074)	(0.065)	(0.064)
HUNAN	**Calories**	**Protein**	**Minerals**	**Vitamins**
1. Non-arc	-0.228*	-0.035	-0.100	-0.193
	(0.118)	(0.157)	(0.127)	(0.146)
2. County clustered SE	-0.218**	-0.105	-0.163**	-0.193
	(0.064)	(0.103)	(0.052)	(0.129)
3. County*Time FE	-0.204*	-0.094	-0.162	-0.185
	(0.109)	(0.134)	(0.111)	(0.120)
4. Not per capita	-0.200	-0.086	-0.159	-0.187
	(0.123)	(0.147)	(0.115)	(0.126)
5. Individual data	-0.148**	-0.002	-0.088	-0.082
	(0.041)	(0.074)	(0.074)	(0.112)
6. Levels	-9.11*	-3.94	-7.96	-0.102
	(5.15)	(6.36)	(5.79)	(0.074)
7. Log-log	-0.220**	-0.022	-0.011	-0.120
	(0.100)	(0.100)	(0.088)	(0.086)
GANSU	**Calories**	**Protein**	**Minerals**	**Vitamins**
1. Non-arc	0.087	-0.028	-0.082	-0.060
	(0.126)	(0.162)	(0.119)	(0.139)
2. County clustered SE	0.148	0.081	-0.019	0.052
	(0.086)	(0.052)	(0.072)	(0.088)
3. County*Time FE	0.159	0.099	0.001	0.070
	(0.100)	(0.113)	(0.102)	(0.111)
4. Not per capita	0.185*	0.109	-0.015	0.057
	(0.106)	(0.119)	(0.106)	(0.113)
5. Individual data	0.136	0.035	-0.021	0.067
	(0.108)	(0.058)	(0.100)	(0.148)
6. Levels	9.15	5.80	1.05	-0.056
	(5.74)	(6.46)	(6.22)	(0.071)
7. Log-log	0.045	-0.008	-0.127	0.060
	(0.117)	(0.113)	(0.096)	(0.099)

Notes: Standard errors, clustered at the household level, in parentheses. This table contains robustness checks for tables 4A, 4B and 4C. The base specification for the first four rows for all panels regresses %Δ per capita intake on %Δsubsidy using household-level data and clustering standard errors at the household level, as in the previous tables. The regressions here modify one part of this basic specification. The first row for each panel uses non-arc percent changes instead of arc changes, the second row uses county-clustered standard errors instead of household-level, and the third row adds county*time fixed effects. The fourth row uses household-level %Δ intake rather than per capita percent changes. The fifth row also uses %Δ intake, but using individual-level data rather than household-level. The sixth row uses levels instead of percents, regressing Δintake on Δsubsidy and the final row regresses Δlog(intake) on Δlog(subsidy). All regressions include no other controls. Calories and protein are daily intakes (in kcal and grams, respectively), vitamins and minerals are sufficiency indexes measuring the average per-person intake relative to the Daily Recommended Intake. *Significant at 10 percent level. **Significant at 5 percent level.

TABLE 6. CONSUMPTION RESPONSE TO THE PRICE SUBSIDY

HUNAN

	Rice	Other Cereal	Fruit / Veg	Meat	Seafood	Pulses	Fats	Food Out	Non-Food	F-test joint sig [p-value]
%ΔSubsidy(rice)	-0.235*	0.397	-0.623***	0.377	0.482**	-0.791*	-0.567*	0.117	0.200	2.75
	(0.140)	(0.355)	(0.227)	(0.415)	(0.230)	(0.476)	(0.313)	(0.347)	(0.200)	[0.0037]
Multiple test adjusted *p*-values										
Holm-Bonferroni	0.374	>1.0	0.210	>1.0	0.224	0.117	0.180	0.669	>1.0	
Benjamini-Hochberg	0.135	0.392	0.090	0.718	0.126	0.117	0.068	0.669	0.621	
Observations	1258	1258	1258	1258	1258	1258	1258	1258	1258	
R^2	0.19	0.06	0.11	0.07	0.02	0.03	0.09	0.02	0.20	

GANSU

	Wheat	Other Cereal	Fruit / Veg	Meat	Seafood	Pulses	Fats	Food Out	Non-Food	F-test joint sig [p-value]
%ΔSubsidy(wheat)	0.353	-0.283	0.049	0.130	-0.017	0.240	0.507**	0.109	-0.021	0.93
	(0.258)	(0.335)	(0.190)	(0.299)	(0.017)	(0.320)	(0.251)	(0.276)	(0.180)	[0.497]
Multiple test adjusted *p*-values										
Holm-Bonferroni	>1.0	>1.0	>1.0	>1.0	>1.0	>1.0	0.252	>1.0	0.928	
Benjamini-Hochberg	0.882	0.729	>1.0	0.849	0.728	0.740	0.252	0.967	0.928	
Observations	1269	1269	1269	1269	1269	1269	1269	1269	1269	
R^2	0.08	0.06	0.07	0.05	0.03	0.06	0.07	0.05	0.17	

Notes: Standard errors, clustered at the household level, in parentheses. The dependent variables are the arc percent change in household consumption of the good listed at the top of the column. %Δsubsidy is the rice or wheat price subsidy, measured as a percentage of the average price. The last column is an *F*-test and associated *p*-value for the hypothesis that the coefficients on the subsidy variable are jointly zero across all consumption categories within each province. Holm-Bonferroni *p*-values adjust for multiple testing using Holm (1979); *p*-values across *k* tests are ranked from largest to smallest and each *p*-value is multiplied by its rank, from 1 to *k*. Benjamini-Hochberg adjusted *p*-values apply Benjamini-Hochberg (1995); *p*-values across *k* tests are ranked from largest to smallest and each *p*-value is multiplied by *k*/rank. Significance levels, unadjusted for multiple hypothesis testing: *Significant at 10 percent level. **Significant at 5 percent level. ***Significant at 1 percent level..

TABLE 7. BEHAVIORAL RESPONSE TO THE SUBSIDY

HUNAN

	(1) Hours worked	(2) Wages and Salary	(3) Unearned Income	(4) # of People
%ΔSubsidy (rice)	0.094	0.076	-0.098	0.0048
	(0.38)	(0.40)	(0.31)	(0.086)
Constant	-4.2	-11.8	9.2	-4.2
	(4.4)	(0.070)	(1.3)	(0.015)
Observations	1258	1258	1258	1258
R^2	0.05	0.05	0.06	0.10

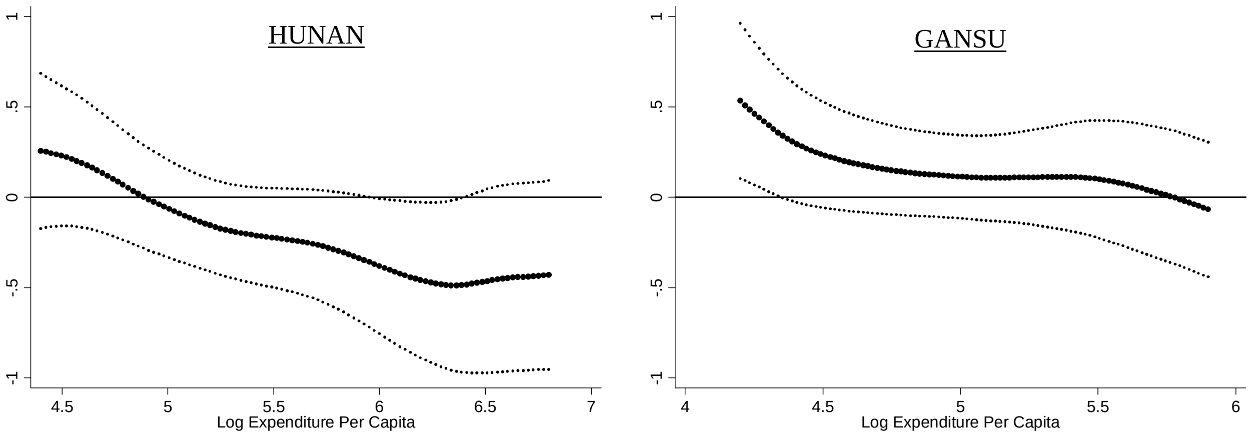
GANSU

	Hours worked	Wages and Salary	Unearned Income	# of People
%ΔSubsidy (wheat)	0.13	0.28	-0.18	0.037
	(0.29)	(0.29)	(0.16)	(0.042)
Constant	-6.9	-24.2	7.3	-1.69
	(2.4)	(2.4)	(1.4)	(0.29)
Observations	1269	1269	1269	1269
R^2	0.13	0.03	0.04	0.04

Notes: Standard errors, clustered at the household level, in parentheses. The dependent variables are the arc percent change in the variables listed at the top of each column. These variables include only %ΔSubsidy(rice/wheat) is the rice or wheat price subsidy, measured as a percentage of the average price, as independent variables.

FIGURE 1. NUTRIENT-PRICE SUBSIDY ELASTICITIES BY EXPENDITURE PER CAPITA

A. Calories



B. Protein

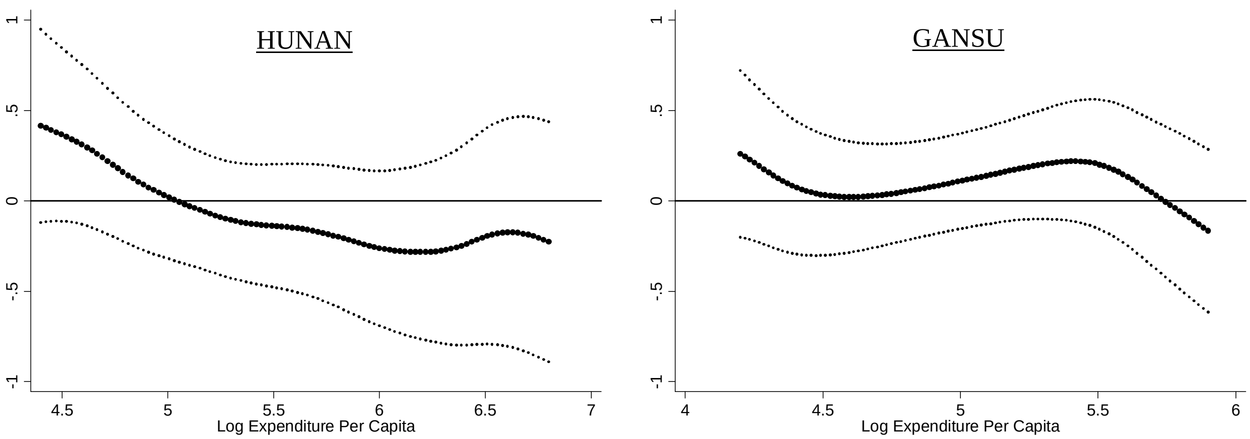
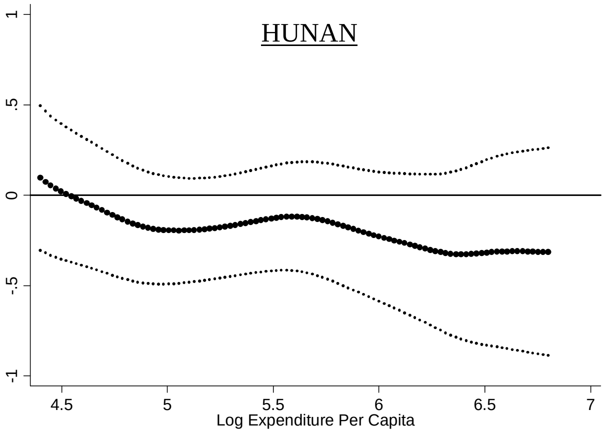
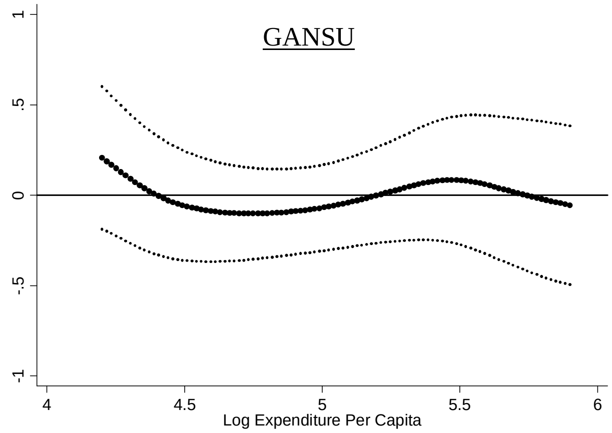


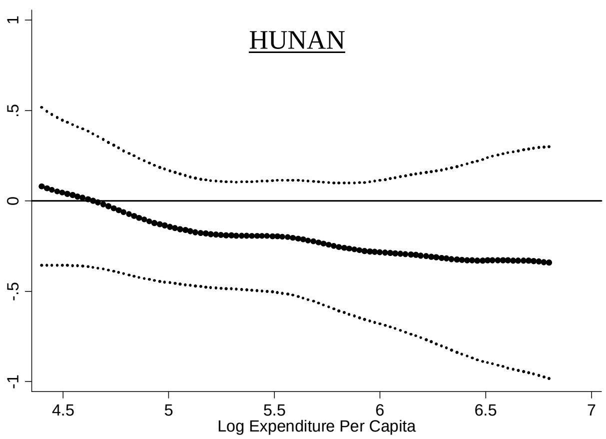
FIGURE 1. NUTRIENT-PRICE SUBSIDY ELASTICITIES BY EXPENDITURE PER CAPITA (CON'T)

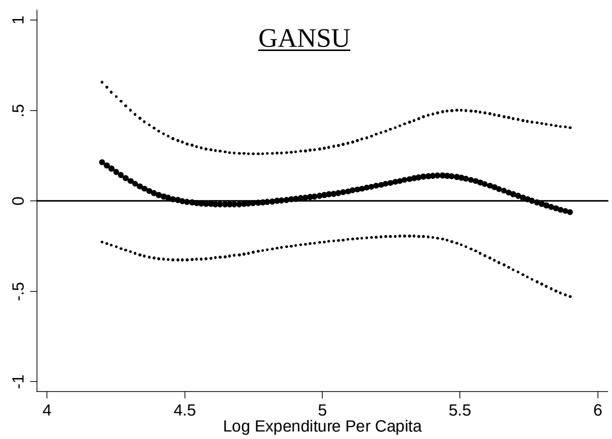
C. Minerals





D. Vitamins





APPENDIX TABLE: IMPACT OF THE SUBSIDY ON OTHER EXPENDITURES

HUNAN

	(1) Food	(2) Housing	(3) Fuel	(4) Utilities	(5) Communic	(6) Health	(7) Education	(8) Transport	(9) Clothing	(10) Entertain.	F-test joint sig [p-value]
Subsidy(rice)	-0.103	0.107	0.275	0.159	0.705**	-0.052	0.239	-0.019	-0.531	0.041	1.57
	(0.133)	(0.210)	(0.182)	(0.229)	(0.304)	(0.364)	(0.298)	(0.338)	(0.355)	(0.319)	[0.112]
Multiple test adjusted *p*-values											
Holm-Bonferroni	0.496	>1.0	0.917	>1.0	0.189	>1.0	>1.0	0.954	0.822	>0.899	
Benjamini-Hochberg	0.279	0.786	0.393	0.734	0.189	>1.0	0.765	0.954	0.308	0.899	
Observations	1258	1258	1258	1258	1258	1258	1258	1258	1258	1258	
R^2	0.05	0.02	0.13	0.05	0.02	0.06	0.14	0.10	0.18	0.17	

GANSU

	(1) Food	(2) Housing	(3) Fuel	(4) Utilities	(5) Communic	(6) Health	(7) Education	(8) Transport	(9) Clothing	(10) Entertain.	F-test joint sig [p-value]
Subsidy(wheat)	0.379***	0.258	-0.090	0.037	0.148	0.371	-0.093	-0.244	0.567	-0.215	1.65
	(0.115)	(0.220)	(0.175)	(0.176)	(0.290)	(0.291)	(0.284)	(0.301)	(0.322)	(0.258)	[0.089]
Multiple test adjusted *p*-values											
Holm-Bonferroni	0.009	>1.0	>1.0	0.833	>1.0	>1.0	>1.0	>1.0	0.711	>1.0	
Benjamini-Hochberg	0.009	0.605	0.869	0.833	0.765	0.680	0.827	0.697	0.395	0.814	
Observations	1269	1269	1269	1269	1269	1269	1269	1269	1269	1269	
R^2	0.08	0.01	0.57	0.05	0.06	0.04	0.22	0.10	0.09	0.11	

Notes: The dependent variables are the arc percent change in expenditures listed at the top of the column. Standard errors clustered at the household level. Coefficients are on the variable arc-percent change in the rice or what subsidy. No other control variables included in the regression. The last column is an F-test and associated p-value for the hypothesis that the coefficients on the subsidy variable are jointly zero across all expenditure categories within each province. Holm-Bonferroni p-values adjust for multiple testing using Holm (1979); p-values across k tests are ranked from largest to smallest and each p-value is multiplied by its rank. Benjamini-Hochberg adjusted p-values apply Benjamini-Hochberg (1995); p-values across k tests are ranked from largest to smallest and each p-value is multiplied by k/rank. Significance levels, unadjusted for multiple hypothesis testing: *Significant at 10 percent level. **Significant at 5 percent level. ***Significant at 1 percent level.